

LEARN
X DESIGN
LONDON
2017

THE
ALLURE
OF THE
DIGITAL
AND
BEYOND

PAPERS

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2. Learning to Design Together: Introducing Conditional Design as a Method for Co-Design Activities
— **Canan Akoglu, Design School Kolding**
3. Study of Co-Creation Model and Analyses of its use benefits and applicability for design teaching
— **Cristiane Bertoldi, Daniela Hanns, Sara Goldchmit, School of Architecture and Urbanism, University of Sao Paulo**
4. The Design Cognitive process using digital instruments: an enlightening design activity of secondary school pupils
— **Sophie Farsy, Blondina Pastel, Éric Tortochot, Aix-Marseille Universite**
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15. Developing Protective Body Panels for Humanoid Emergency Response Robots: How Technology Impacts Design (and vice-versa)
— **Prof. Meaghan Anne Dee, Samuel Paul Blanchard, Virginia Tech**
16. Investigating skill confidence as a concept to enhance learning development in online education
— **Lena Mayer, Karen von Schmieden, Christoph Meinel, Hasso Plattner Institute**
17. Embedding Emotions in Learning Experience for Interactive Design
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19. eCollage and FEA Model as Catalysts for Idea Generation
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21. Collaborating with External Parties in Industrial Design Education: A Review of Success Factors
— **Naz A.G.Z Brekci, Fatma Korkut, METU Department of Industrial Design**
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24. Putting yourSELF on the line, an alternative critique on digitalization
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LearnXDesign 2017: Beyond the Allure of the Digital – research in the learning and teaching of design

The DRS/CUMULUS/DESIGN-ED conference

June 27th – June 30th 2017 London UK

The Conference was held in London at Ravensbourne on the Greenwich Peninsula. It brought together researchers and practitioners with an international reach and from a wide variety of education design settings with the intention of connecting emergent models and ideas around the digital, with the scholarship of teaching and learning. We also looked to issues beyond the attraction of the digital in learning: other ways of acting, knowing and becoming in design – in the full range of educational settings from kindergarten to PhD.

Students' learning approaches demand creative solutions to a wide range of complex themes and contexts. This provoked debates on the scope of learner literacies and studies that investigate how formal and informal learning can be synergized. Dialogues that addressed new cultures of learning, issues of learner identities, tutor roles, space and their implications in the design of learning environments were also encouraged. In this context the digital imbues all such practices.

Our themes included

- Research in design education
- Hybrid models: digital/analogue
- Wearables and their pedagogy
- Remote collaboration
- Technology's impact on design
- E-learning and design
- Learning through digital methods
- Inter/ transdisciplinarity in learning and teaching
- Learning in design practice
- Teaching in design practice
- Virtual reality (VR/AR)
- Considering the local, international, and the global contexts of design education

Learning with, through and beyond the digital

In 2007 Laurillard wrote:

'Imaginative use of digital technologies could be transformational for teaching and learning, taking us well beyond the incremental value of more accessible lecture presentations. The problem is that transformation is more about the human and organisational aspects of teaching and learning than it is about the use of

technology. We have the ambition. We have the technology. What is missing is what connects the two' (Laurillard, 2007, pxvii)

Almost ten years later how much have we embraced this rally call to move beyond the allure of the digital, to fully occupying its potential? Apart from 'flipped classrooms' and MOOC modalities, how successful have we been in bridging the ambition/technology gap?

Issues to explore include online, distance and blended learning in design, from tutor, student and technological perspectives. How do students select the best digital tools from those available? What impact does the digital have on learning in design at different educational levels? Are we seduced by the digital? How do we reconcile the hand made with the digital in learning for an unknown future? Is there a digital way of knowing or digital literacy which facilitates learning in design subjects? We have lived with 'new technologies' for over 30 years, what have we learned about learning during this time? What should we be concerned about? What are the problems of learning in a post digital age?

Researching Design Learning and Teaching

What kind of approaches might be used to research the digital and non-digital aspects of learning and teaching in design? What are the opportunities and pitfalls associated with particular research approaches? How might we benefit from educational theories and what can we contribute from our disciplinary perspectives to wider debates in learning and teaching? How do educational theories play out in studio-based learning in practice?

Design Pedagogy Practices

What kinds of practices are we engaged in when students learn design subjects? Can we say that we fully understand the ways we teach and the impact these have on our students' sense of self? Can we critically evaluate our pedagogic practices and invent better ways to help students to become successful designers? What kinds of emotional, affectual and identity work is being undertaken in the learning environment and how important is this? Have pedagogies changed over time and if so why? Are we in danger of losing important aspects of our signature pedagogies? What are the implications for changing job roles on knowledge and its associated epistemologies within the university and school? How should we manage interdisciplinarity in the curriculum? What is the best way to prepare young people for working in a design industry?

Design Learning and 'third space' practices.

The 'third space' has been used to describe the emergence of roles that exist in non-traditional spaces in the university (Whitchurch 2013). These include professionals working on projects inside and outside the university, on outreach and widening participation, and on study support. There are many new roles which transcend the traditional academic roles of teaching and research. How do these roles support students learning in design? What are the issues encountered by those operating across boundaries and in the 'third space'? How do our technical support teams contribute to student learning and could technicians be described as operating in the 'third space'?

Dr Gary Pritchard, Dean of the School of Media, Ravensbourne

Room 209—210

0830 onward Registration

0900—0930 Welcome

Opening speeches — Professor Linda Drew & Professor Michael Tovey

0930—1030 Keynote

Designing teaching for post digital creative education — Professor Susan Orr

1030—1100 Coffee Break

1100—1200 paper session 1

Combining the Digital and the Analog: Exploring unfamiliar Problem Domains through video blogs and role-playing in industrial design education — Gizem Hediye Eren , Anadolu University

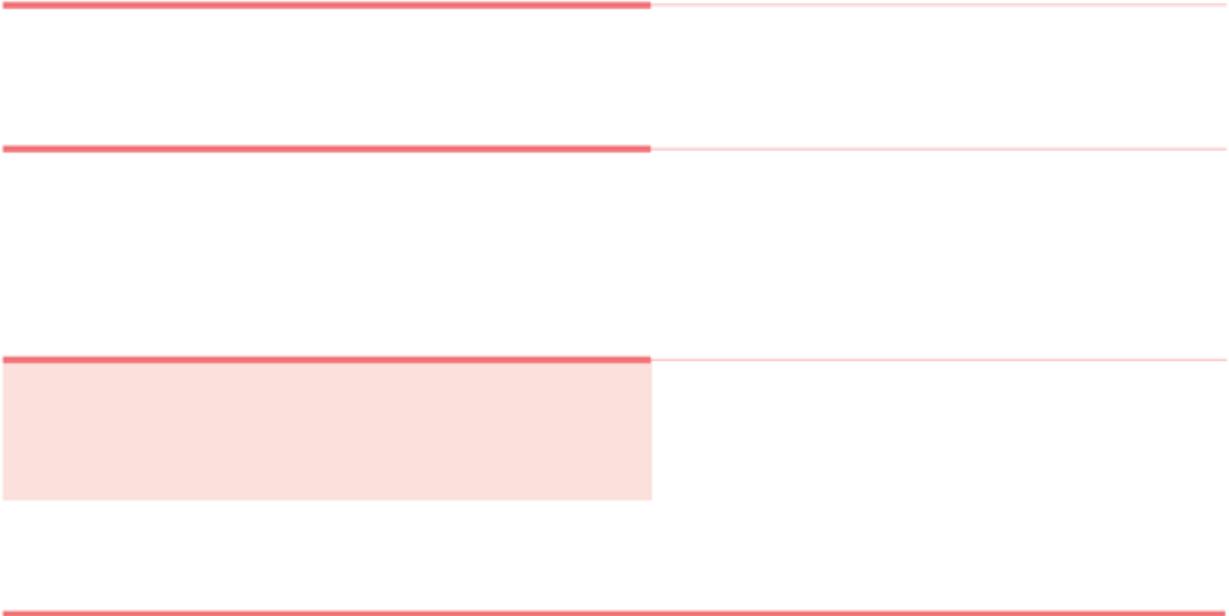
Sense making through interaction with the app Wuwu & co. The body's roll in learning in a Digital and Visual era — Lovise Søyland, University College of Southeast Norway

1200—1300 Lunch Break (Poster Sessions)

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Workshops — Ravensbourne Strand



paper session 1

Learning to Design Together: Introducing Conditional Design as a Method for Co-Design Activities — Dr Canan Akoglu, Design School Kolding

Happy Accidents: The Art (and Design) of Making Mistakes. And Learning From Them. Creativity isn't a science, but it is a process; it involves experimentation and the ability to make, embrace and learn from mistakes. — Lawrence Zeegan, Ravensbourne

"Play" as an integral part of Design Education Prof. Meaghan Anne Dee, Virginia Tech

Room

209—210

1300—1400

paper session 2

Study of Co-Creation Model and Analyses of its use benefits and applicability for design teaching — Cristiane Bertoldi, Daniela Hanns, Sara Goldchmit, School of Architecture and Urbanism / University of Sao Paulo

The Design Cognitive process using digital instruments: an enlightening design activity of secondary school pupils — Sophie Farsy, Blondina Pastel, Éric Tortochot Aix-Marseille Université

1400—1500

paper session 3

Design courses applying engineering knowledge to PjBL style - Trials in a Taiwanese design department of University — Hsiang-Tang Chang, Nien-Yun Yu, National Kaohsiung First University of Science and Technology

1500—1530

Coffee Break

1530—1630

paper session 4

Automating Design Education
— Dean Pankhurst, Subject Studio UK

Thinking across Channels: Retail Designers' Competencies in the context of Omni-Channel in retail — Stephanie Claes, Katelijn Quartier, Jan Vanrie, Hasselt University

1630

End

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paper session 2

Virtual Spatial discovery for the novice design student — Eric Dolph, SUNY Buffalo State

The Acquisition of Design Skills: A Hybrid Practice in the Digital Age — Denise Allan, Edinburgh Napier University

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Workshops — Ravensbourne Strand

Ubiquitous Wearing: Wear+Seek — Alexa Pollmann, Ravensbourne

Creative Thinking — Chantelle Morton, Ravensbourne

paper session 3

Personal Space Invasion in Collaborative Design — Julie Sille Abildgaard, Bo T Christensen, Copenhagen Business School

Design Thinking Environments: The Challenge for the Higher Education Sector — Paul Sternberg, Ravensbourne

paper session 4

Reinventing the Design (and Media) School - case study of Ravensbourne's 'Mindsets and Skillsets Manifesto — Gary Pritchard and Lawrence Zeegen, Ravensbourne

An Inclusive Pedagogical Approach within Ravensbourne — Kevin Johnson, Ravensbourne

Room 209—210

0830 onward Registration

0930—1030 paper session 5

Children deconstructing the adult mastery in the Future Design Board case study; learning how to use story-making and design as tools for life — Alexandra Antonopoulou, Greenwich University

Cultural Dimensions in Design Studio Pedagogy — Angelika Seeschaaf Veres, Maya Desai, Nancy Snow, OCAD University

1030—1045 Coffee Break

1045—1145 paper session 6

Developing a Consciousness of Influence through Aesthetic Engagement and Critical Inquiry — Kristen Collen Callahan, Lewis University

Developing Protective Body Panels for Humanoid Emergency Response Robots: How Technology Impacts Design (and vice-versa) — Prof. Meaghan Anne Dee, Samuel Paul Blanchard, Virginia Tech

1145—1245 paper session 7

Embedding Emotions in Learning Experience for Interactive Design — Dr Amic Ho, The OU of Hong Kong

1215—1315 Lunch Break (Posters)

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Workshops — Ravensbourne Strand

paper session 5

Make your move: Exploring a pedagogic toolkit for creative development in primary education — Robert Pulley, Esther Burkitt, Ashley Hall, Royal College of Art

Developing a visual voice, thinking on paper together: changing the paradigm of communicating in team settings
— Verena Natalie Paepcke-Hjeltness, Kevin Henry, Iowa State University

Desitecture of Education to Education: How Desitecture was formed, enabled, produced, practiced and feeds education as research and its outcomes
— Layton Reid, Ravensbourne

paper session 6

Investigating skill confidence as a concept to enhance learning development in online education — Lena Mayer, Karen von Schmieden, Christoph Meinel, Hasso Plattner Institute

Couture in Orbit
— Caroline Gilbey, Ravensbourne

Faking The Orchestra: Innovations in recording and mixing live and virtual orchestral instruments
— Jenna Donnelly, Ravensbourne

paper session 7

Co-created Design Tools to Transform Student Induction — Rosemary Stott, Ravensbourne

The Post-VLE Landscape: From Digitisation to Technology-Enhanced Teaching in Creative Education
— Anders Krohn, Co-founder and CEO, Aula

programme — thursday morning

Room

209—210

1315—1415

paper session 8

eCollage and FEA Model as Catalysts for Idea Generation — Sini Maarit Riihonen, Ana Nuutinen, University of Helsinki

Making distance learning visible in Virtual Design Studios — Derek Jones, Lotz Nicole, Holden Georgy, The Open University

1415—1515

Keynote

Diversity, Games and Mixed Reality
— Dr Jo Twist

1515—1530

Coffee Break

1530—1630

paper session 9

Research methods to VR Pedagogy
— Nick Lambert, Ravensbourne

Designing for the HoloPortal (including demo): 3D moving image — Carl Smith, James Edward Marks and Tristan Bruce, Ravensbourne

1645—

1900

Dinner at Intercontinental Hotel

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paper session 8

Researching Learning and Teaching
— Linda Drew and Alison Shreeve,
Ravensbourne

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Workshops — Ravensbourne Strand

Beyond Pokemon Go: How Augmented Reality can support music education
— Matthew Ramirez, JISC

Materials Alchemy: When disciplines and materials collide 3MCs — Rose Sinclair, Richard Brett, Goldsmiths, University of London

paper session 9

Putting yourSELF on the line, an alternative critique on digitalization
— Harold Koopmans, Minerva Art Academy, Hanze University of Applied Sciences

Creating a Mixed Reality Excellence Centre: Designing for Wearable Experience — Carl Smith, Ravensbourne

programme — thursday afternoon

Room

209—210

0830 onward

Registration

0930—1030

paper session 9

Collaborating with External Parties in Industrial Design Education: A Review of Success Factors — Naz A.G.Z Brekci, Fatma Korkut, METU Department of Industrial Design

Free Architecture, An ethnographic approach to architecture practice — Claudia Itzel Sanchez, UNAM

1030—1045

Coffee Break

1045—1145

Keynote

Respectful Design: how to decolonize art and design education
— Elizabeth (Dori) Tunstall

1145—1200

Closing speech
— Professor Linda Drew

1630

End

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Workshops — Ravensbourne Strand

paper session 9

**Visual Discussions as Critical Thinking
Strategies for Design Students**
— Dr Ricardo Lopez-Leon,
Aguascalientes University

Data Walking — David Hunter,
Ravensbourne

programme — friday morning

Combining the Digital and the Analog: Exploring Unfamiliar Problem Domains through Video Blogs and Role-Playing in Industrial Design Education

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When working on familiar problem domains, designers can rely on their past experience and knowledge. Unfamiliar problem domains, on the other hand, may require guided access to users and the use environment. In design education, faced with an unfamiliar problem domain, design students as novice designers usually conduct exploratory design research in order to form a sufficient background about the user group and the usage context. There are various tools and methods for conducting exploratory research. However, when direct access to users is challenging and requires advanced research skills, the students need to be provided with alternative approaches and tools. This paper introduces video blogs (VLOGs), role-playing and storyboarding as exploratory research tools that can be used in such cases.

The paper discusses the use of these tools in the case of a senior year industrial design studio project where students work on an unfamiliar problem domain for developing a walking support for people with cerebral palsy. Based on the project documentation, interviews conducted with tutors, and the focus group with the students, the paper discusses the challenges faced by the students concerning accessing the use environment and the users with cerebral palsy, and the strategies they developed to cope with these challenges. The case indicates that combining digital and analog tools – VLOGs, role-playing and storyboarding – can be used as alternative ways of conducting exploratory design research in unfamiliar problem domains for generating initial design ideas, and that this approach can play an important role in unfamiliar problem domains for substituting direct observation of, or direct contact with, hard-to-access users.

Video blogs. Role-playing. Storyboarding. Unfamiliar problem domains. Exploratory design research.

Industrial design education.

1. INTRODUCTION

The problem domain refers to the concepts, rules and principles (the “content”) which define the problem elements (Jonassen 1997). According to Arlin the domain, goal and processes implied by a problem may be well-defined or ill-defined, simple or complex, long-term or short term, and familiar or unfamiliar (as cited in Jonassen 1997). The degree of familiarity of the problem solver with the content of the problem has an impact on the problem type and problem solving process. When working on familiar problem domains, designers can rely on

their past experience and knowledge. Unfamiliar problem contexts, on the other hand, usually require guided access to users, use environment and domain knowledge.

Designers utilize a range of sources concerning the user group and the usage context. They may access to collected data about the users and use environment through the existing literature, tools and software; they may also experiment with users directly (Hasdođan 1996). They may employ ethnographic methods such as interviewing and observation to form a rich background about the

problem domain, users and the use environment. For unfamiliar problem domains, access to users may be challenging especially for special user groups such as elderly, children and people with disabilities. Privacy concerns, ethical issues, legislative barriers, or time and cost constraints may prevent designers from accessing real users (McQuaid et al. 2003; Newell et al. 2011). When direct experience with a user group or a use context is not an option, designers need to develop alternative approaches through exploratory design research in order to form a sufficient background.

2. EXPLORATORY DESIGN RESEARCH

Exploratory research is a methodological approach in social sciences concerned with the discovery and generation of theory (Davies 2006). This type of research is conducted for exploring the nature of the problem for enabling a better understanding of it and forming a basis for further studies (Dudovskiy 2016). In the context of exploratory research, exploration implies a person's perspective, state of

mind or personal orientation to the problem (Stebbins 2001, p.30). An exploratory research directs the researcher into new ways by revealing new insights (Saunders et al. 2012). Research methodology adopted in exploratory research is less strict, and small sample sizes are acceptable (Nargundkar 2008, p.41).

Exploratory design research can be characterized as research done in the early phases of design process, and it aims at forming a knowledge base of the problem domain, particularly, in cases where designers are engaged in unfamiliar domains. It is a research phase prior to a more focused research which is generative design research aiming at a deeper understanding of user needs and preferences (Figure 1). Exploratory design research methods such as surveys, questionnaires, participant observation, artifact analysis, photo and diary studies, contextual inquiry and cultural probes aim at sampling user experience and are generally ethnographic in nature (Hanington 2007, p.4).

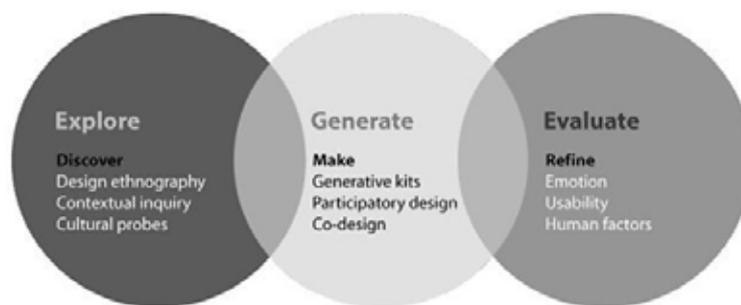


Figure 1: Model of design research (Hanington 2007)

3. THE CASE STUDY: WALKING SUPPORT FOR PEOPLE WITH CEREBRAL PALSY

The case is concerned with a senior year industrial design project conducted in a university in the fall semester of 2015. The project was about developing “walking support for people with cerebral palsy (CP)” and aimed at introducing students to an unfamiliar problem domain to encourage exploratory design research. Cerebral Palsy (CP) is a blanket term used to describe a number of neurodevelopmental disorders, beginning in early childhood as a result of brain injury or malfunction and persisting through the lifespan, which usually affects body movement and muscle coordination (Rosenbaum et al. 2007). The tutors scheduled meetings for students in a rehabilitation centre before the project started, and suggested observing and interviewing people with CP and their caretakers as the exploratory design research methods to be utilized. However, due to “unforeseen challenges” the proposed methods to be used by the students during their visits to the rehabilitation centre did not work as anticipated,

and to overcome the challenges, new methods were integrated into the process. In the following sections, we describe these new methods and the ways in which they contributed to the design process.

3.1 Methodology

The six-week project involved 45 senior year industrial design students, and the course was co-conducted by three tutors. One of the authors conducted semi-structured interviews with all the tutors separately; the interviews lasted between 30-45 minutes. Out of 45 students who took the course, 13 had prepared a presentation concerning the “troubles” they encountered during the early phases of design process; these presentations were analysed by the authors in order to get familiar with the types of problems and challenges faced by the students. Additionally, out of these 13 students who prepared these “trouble sheets,” six students volunteered to participate in a focus group session which lasted approximately one hour. The focus group session was videotaped, and the

interviews with the tutors were voice recorded by the consent of the participants. These recordings were transcribed and analysed through thematic analysis. The early findings were reported in 2016 (authors). Based on the project documentation, the interviews conducted with the tutors, and the focus group with the students, the paper analyses and discusses the strategies developed by the tutors

and the students to cope with the challenges faced by the students concerning access to users or their caretakers. The following sections discuss these strategies which involve employing alternative exploratory design research methods, VLOGs and role-playing together with storyboards.



Figure 2: Three examples from the student presentations concerning the “troubles” they encountered during the early phases of design process

3.2 Findings

During the focus group session, the students listed the methods involved in the exploratory design research phase as literature search, benchmarking, interviewing and observation, VLOG analysis, and role-playing. They indicated that they made a literature search mainly based on the keywords “cerebral palsy” and “walking support.” They stated that a product-centred literature search directed them towards products “like walkers, orthoses and prostheses,” whereas a user-centred literature search revealed that there were various levels of CP with various kinds of difficulties in walking.

Observing and interviewing the people with CP and their caretakers were the initially proposed methods by the tutors. The students experienced various challenges in relation to these methods. They stated that they simply could not interview people with CP or their caretakers. Since most of the potential participants with CP had speech disorders, it was very challenging to have a regular conversation with them. The students indicated that the caretakers were rather sensitive and reluctant to comment on the difficulties or problems they had been experiencing; they were more eager to highlight the positive experiences they had. The students also stated that they lacked appropriate skills for conducting interviews with special groups and on sensitive topics. Furthermore, since they met people with CP in a rehabilitation centre, it was not possible for them to conduct contextual observations. Additionally, they had little background knowledge and experience regarding

the specific user group. Both the tutors and the students repeatedly underlined their being unfamiliar with the project context.

In order to overcome these challenges, the tutors asked the students to prepare a presentation regarding the “troubles” they encountered during the early phases of design process. The tutors stated that they evaluated these presentations by considering the following questions:

Why don't observation and interviewing methods work in this project? What are the questions that students seek for answers? What are the alternative methods and tools that can provide answers to those questions?

After evaluating the trouble sheets prepared by the students, the tutors stated that they decided to introduce VLOG analysis and role-playing as the new research methods into the process, and suggested the students to analyse the data with a “task-centred approach” rather than a “product-centred approach.” The following sections discuss these two alternative methods, VLOG and role-playing, in order to explore the implications of their being used together in exploratory design research for unfamiliar problem domains in particular.

3.2.1. The first method: VLOG Analysis

The tutors indicated that VLOGs were integrated into the process in an improvised fashion when they discovered that the students were watching Youtube VLOGs of people with CP as a source for exploring their daily lives.

VLOG is a series of video recordings made by an individual over a period of time, focusing on his/her experiences, thoughts and feelings published on the web (Gao et al. 2010). VLOGs involve user-generated content, involving subjects in their natural settings; they are diverse, easy to access, and longitudinal. While having similarities with video ethnography which is video recording of the stream of activity of subjects in their natural settings, unlike video ethnography they are not collected as part of a systematic research.

The credibility of data “found” in VLOGs is often questioned in the literature. Credibility is evaluated based on two major factors: Trustworthiness and

expertise. Trustworthiness refers to morality of the source and can be described with terms such as well-intentioned, truthful, or unbiased, while expertise refers to the perceived knowledge of the source and can be described with terms such as knowledgeable, reputable, and competent (Tseng and Fogg, 1999). The information in the VLOGs are the blogger’s self-reported image or profile involving a username which is usually a nickname, and the content with a title and date posted in the logs (Juffinger et al. 2009). While VLOG credibility is based on truthfulness and expertise, deception, unstated bias, and incompetence or lack of authority in the source are common problems of credibility in weblogs (van House 2004).



Figure 3: Analysis of VLOGs that are uploaded by people with CP or by their caretakers as video streams on the web

VLOGs of people with CP with a focus on walking action and related actions were analysed by the students through screenshots and annotations as instructed by the tutors (Figure 3). One of the students in the focus group explained the method she adopted for analysing videos in the VLOG streams as follows:

How does the child in the video get up when he falls? Does he hold on somewhere or does someone support him? On which body part does he fall down? For this I slowed down the videos and analysed them second by second. I identified the first group of actions as walking, falling, getting up, and balance. Then I identified the sub-groups of actions under walking as crawling, slow walking, and walking while getting support from somewhere. I tried to measure the frequency of actions to understand how many times these actions were performed and how effective a particular action was in the process.”

It is important to note that the literature search conducted prior to the VLOG analysis provided the students with the background to evaluate the credibility of VLOGs they analysed.

3.2.2. The second method: Role-playing

Role-playing was also introduced into the process in an ad hoc fashion. Since the potential participants, people with CP and their caretakers, could not be interviewed or observed properly, a medical expert at the rehabilitation centre suggested the students to try the medical products on themselves. First, he acted out the task performed by the people with CP when they use a particular equipment himself, and then assisted the students’ role-playing sessions by giving instructions (Figure 4). The videos taken by the students during these sessions inspired the tutors to include role-playing as the second alternative method.



Figure 4: Left: A medical expert acting out the task performed by the people with CP when using a particular equipment. Right: A student experiencing an equipment with the assistance of a medical expert.

Role playing is defined by Simsarian (2003) as “the practice of group physical and spatial pretend where individuals deliberately assume a character role in a constructed scene.” Role-playing techniques such as play-acting and bodystorming have become popular in interaction design and experience design during the 1990s, due to the view that people’s experience is more easily accessed and understood while physically performing their tasks (Boess et al 2007). Role-playing enables the designers to leave their usual mind-sets and assumptions aside through embodied, tangible information and encourages empathy, and it “is a useful method for designers when conducting exploratory activities particularly in unfamiliar user-centered innovation” (Kumar 2012, p. 497).

There are numerous variations in which role-playing is used as well as defined in design literature. Different approaches for role-playing can be found in the literature depending on the degree of user involvement or the phases of design they are employed in. Users can be involved in role-playing sessions by acting out themselves (Binder 1999; Iacucci and Kuutti 2002), or they may watch designers / design researchers acting out and make comments (Brandt and Grunnet 2000). The design researchers may also act out in the absence of users (McQuaid et al. 2003). Role-playing can be used in different phases of design process from early phases to final implementation, and has a specific function for each phase (Burns et al. 1994; Iacucci and Kuutti 2002; Simsarian 2003). In the early phases of design, performing “walk-throughs” enables designers to explore the problem domain, uncover issues that inform the early phases, and identify the questions to ask (Simsarian 2003).

Role-playing may also involve a facilitator. The role-play facilitator’s instructions influence the participants’ experience of the reality and engagement of the role-play (Yardley-Matwiejczuk 1997). The role-play facilitator’s key roles involve identifying the objects in the role-play, making those objects familiar to the participants, and encourage them to create the role-play scene with those objects (Seland 2009).

As stated earlier, the role-playing sessions of the students were facilitated by medical experts during their visits to the rehabilitation centre.

We should also note that literature search and VLOGs coupled with the instructions of medical experts provide the background knowledge for role-playing sessions to some extent.

3.2.3. Analysis through storyboarding

The students analysed the data through storyboarding. Creating VLOG analysis boards and role-playing storyboards allowed the tutors and students to empathize with this unfamiliar user group. Besides sampling user experience, the students included their notes regarding the tasks performed and related activities on the VLOG analysis boards. The students also documented their personal experiences they gained through role-playing sessions with screenshots from video recordings and their personal notes.

Storyboards are useful tools for depicting situations, people and time in a storyline made of a sequence of images and words (van der Lugt et al. 2012). Emerged from the movie industry, storyboarding is a way of structuring a narration and its contents. Storyboard enables one to investigate the visual appearance of scenes and specify what kind of issues arise (Wikström et al 2011). Visual representations also relieve the pressure on memory and reduce processing load, and thus, one can process new information and generate new ideas (Tversky 2007). The strength of storyboards is that the viewer can experience the visualized experiences or situations for empathizing with the user, or reflect on the experience or the situation objectively by looking them outside (van der Lelie 2006).

3.2.4. Initial ideas based on exploratory research

A student’s design process exemplifies the opportunities created by the combined use of these methods (Figure 6). The new methods enabled access to users and use environment, and made it possible for the student to turn the information obtained through the literature search into the

Storyboards were used for VLOGs as a documentation technique; the students took screenshots from the videos and prepared them as storyboards enhanced by the notes they took as they watched users engaged in their most common daily tasks. Storyboarding was also used in order to document and externalize the role-playing sessions. As stated earlier, the students documented their personal experiences they gained through role-playing with screenshots from their video recordings and annotations.

4. DISCUSSION AND CONCLUSION

In the case discussed in this paper, VLOG analysis and role-playing complement each other as exploratory design research methods. VLOG analysis uses digital sources of information which provide indirect experience, while role playing uses analog sources of information which provide embodied, tangible and direct experience. In our case, VLOGs were used to access daily lives of people with CP. Their Youtube channel video streams were utilized as secondary source of data. Role-playing as primary source of data was used to have access to the experiences of people with CP. In this case, the whole process enabled the students to generate initial design ideas.

The case reveals that combining digital and analog tools, such as VLOGs and role-playing can be used as alternative ways of conducting exploratory design research in unfamiliar problem domains to generate initial design ideas. This combination can play an important role for substituting direct observation of users in unfamiliar problem domains with hard-to-access users.

The case discussed indicates that the order in which particular methods and tools are employed in exploratory design research does matter; in our case, the sequence followed was literature search, VLOG analysis and role-playing. A literature search conducted prior to VLOG analysis provides the required background knowledge to the students to evaluate the credibility of VLOGs. Role-playing experiences are based on what students have learned from the literature search and VLOGs, and instructions provided by the experts as facilitators. Literature search also provides critical information concerning the special user group (e.g. weak floor perception of people with cerebral palsy), VLOGs provide data similar in richness to ethnographic data, and instructions by experts influence the participants' experience and engagement, and provide the background knowledge and for role-playing sessions to some extent.

It is also important to note that these two methods were integrated into the process in a rather

improvised fashion; all the parties involved, the students, the tutors as well as the expert in the rehabilitation centre, combined their efforts to overcome the specific challenges presented by the problem domain. The methods discussed in this case need to be further explored in terms of the flexibility and openness they offer.

More research is necessary to further explore the potential and implications of VLOG analysis and role-playing in exploratory design research for benefiting from the best of both worlds, the digital and the analog realms.

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Learning to Design Together: Introducing Conditional Design as a Method for Co-Design Activities

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In today's world, designing include participation of users and stakeholders at different levels varying from minimum participation to co-creating with these actors. In such a context, it becomes crucial to include related educational modules to be able to prepare design students for their future professional practices. Based on this argument, this paper aims to propose conditional design as a method for co-design activities in design education by promoting the design process as a dynamic system which needs to be designed in itself. For this purpose, two workshops were conducted in Istanbul as the empirical study of this paper. The participants of the workshops were students from Communication Design and Industrial Design undergraduate programs with different seniorities in the same faculty. In terms of its content and operative flow, all the workshops were organized in a way that would enable equal contribution from each student and an active learning space was provided to the students. Based on the feedbacks, it is possible to foresee that the workshops were positive experiences especially in terms of understanding the importance of collective creativity and beyond the educational purposes, the workshops seem to be useful to create an interstice in the disciplinary atmosphere of the classes.

Co-design. Conditional Design. Generative Design Research. Co-design Activities. Design Education.

1. INTRODUCTION

Design practice is expanding its borders. Today, designers play roles not only in creating material or tangible artefacts but also in leading and facilitating design activities (Botero, 2013, Zurlo & Cautela, 2014). Moreover, the roles of designers have expanded from being a 'shaper' of industrial products to acting as a 'mediator' between the different knowledge cores in an organisation. In other words, besides its traditional realms, today design is seen as a catalyser, a process and a way of thinking for developing strategies, organisational change, business structures and for transforming the way people live in this century (Akoglu, 2014).

Rittel and Webber (1973) point out that many problems, especially the ones involving social facts cannot be accurately modelled and an engineering approach to tackle with them would fail. Today the

complexities of the challenges that design deals with are so diverse and broad that user-centred design approach has become insufficient to be used in such diverse and broad challenges (Sanders & Stappers, 2008). It is not only products only products that are designed for people, but also it is also a series of interactions and experiences as part of bigger complex systems are designed for people. In such a situation, Manzini (2011) claims that the nature of design becomes un-designable even since it supplies a background, a platform that can be changed, directed and developed by people. This characteristic is also related with the projections in societies and economies (Akoglu, 2014). The very beginning of 21st century witnessed the emergence of societies and economies based on experiences, knowledge and services (Manzini 2011, Pine & Gilmore, 2004). Especially the knowledge age has showed us new business models where stakeholders might have

multiple models and create consume value by supplying a background or basic guidance where people can contribute in many flexible ways (Brand & Rocchi, 2011). Recently designers began to build up frameworks, backgrounds for different platforms in designing services; designers serve as catalysts and facilitators. Values are created collaboratively with people, but the intensity, the extent, the timing of involving people and their roles vary widely. Moreover, “design has always been and will continue to be collaborative at its core; even if that collaboration only includes one designer and one client. Design activities are typically carried out in groups, with roles involved in complex relationships” (Nelson & Stolterman, 2012, p. 290). In such a context, key characteristics of designing together can be seen as participation, co-creation and democracy. In today’s world, designing include participation of users and stakeholders at different levels varying from minimum participation to co-creating with these actors. Such a context has a diverse nature in terms of including people with different backgrounds, mind-sets, and communication approaches. In terms of education, it becomes crucial to include educational modules to be able to prepare design students for their future professional practices. Based on this argument, this paper aims to explore conditional design as a generative method for co-design activities in design education by promoting the design process as a dynamic system which needs to be designed in itself as it directly influences the final outcome. Conditional design has been put forward as a manifesto and working method by Luna Maurer, Edo Paulus, Jonathan Puckey, Roel Wouters. The foundational idea in conditional design is based on the process rather than the products as the outputs of the process. Maurer et al (2017, p.1) emphasizes the importance of process design as such:

“The process is the product. The most important aspects of a process are time, relationship and change. The process produces formations rather than forms. We search for unexpected but correlative, emergent patterns. We search for unexpected but correlative, emergent patterns. Even though a process has the appearance of objectivity, we realize the fact that it stems from subjective intentions.”

Because of the importance of the process as stated above, the design process is proposed as a dynamic system which needs to be designed in itself in the workshops which are the empirical part of this study.

2. CHANGES IN THE DESIGN PROCESS IN TERMS OF INVOLVING USERS

Content-wise the idea of collective creativity/creating together is not new in design;

this idea roots in participatory design which started in Northern Europe, mainly in Scandinavia (Sanders&Stappers, 2008). The beginnings of participation phenomena in design can also be seen in the UK especially at a conference, of which some papers formed a book called Design Participation, held by the Design Research Society in 1971. In that book, Robert Jungk stated that participation should not only be at the time of decision making, but also be at time of idea generation as well.

Figure 1 shows how the common language about the people that designers serve for has changed; it also gives a general perspective on the level of participation of people in the design process shifting from just consumers, to users for understanding people’s needs, preferences and desires from external perspective, to participants and to co-creators who are the experts of their needs, preferences and desires and take part actively beginning from the very early design process. The collaboration with people in the design process began with the user-centred design approach that also is applied widely today as well. Starting especially from the last decade, since design has become to work with larger issues, trying to find solution for bigger complex systems, co-creation has become a critical dynamic in design.

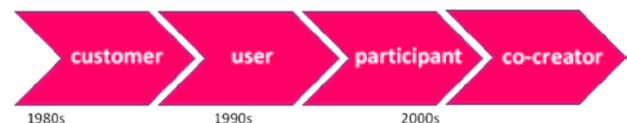


Figure 1: The change in involving people in the design process (adapted from Sanders, 2005 in Akoglu, 2015)

In a collaborative context where designers, users, stakeholders and other actors get together and work on co-creating initial design ideas especially in the early design process, it even becomes critical to find a common language within such a diverse group of people. Telling, making and enacting are the ways to co-create as shown in Figure 2 (Brandt, Binder & Sanders, 2013; Sanders, 2013; Sanders & Stappers, 2014). Visualizations are seen important tools for design practice and it might become a challenge when the design concept is co-created among all the stakeholders in the early stages (Segelström & Holmlid, 2009). In this study, visualizations and role-plays are used as tools for co-design activities. In addition to that, conditional design method is mainly focused on the ‘make’ part of ‘tell-make-enact’ trilogy.

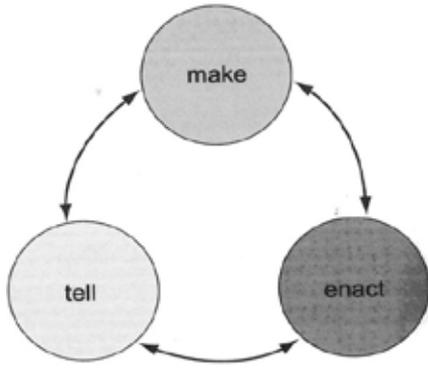


Figure 2: The telling-making-enacting circular trilogy that represents how actions are connected and are iterative on both directions within the design process (Brandt, Binder & Sanders, 2013, p. 150)

In addition, the nature of design projects have phases based on “exploratory, generative and evaluative sequences of research and design” (Hanington, 2007, p.1). Exploratory and evaluative phases are traditionally well-known in design education and practice, are applied in research and design (Hanington, 2007; Sanders, 2000). Generative phase is the one where creative tools are usually expected to be related with and has started to be used comparably during the last two decades in research and design (Martin & Hanington, 2012; Hanington, 2007; Sanders, 2000). Within this framework, conditional design is proposed as a creative generative method for co-design activities.

In exploratory research, as it’s widely known, observations, surveys, interviews or trials of a product or a service are used usually; the foundational idea of exploratory research is to discover. In generative research, the foundational idea is to make. Therefore, toolkits such as cognitive mind-mapping, images, text, collages could be used for participatory design and co-design activities as shown in Figure 3 (Hanington, 2007). Creative methods are usually expected to be related with the generative phase. Generative phase is the one where much more creative methods and tools can be used. On the other hand, the foundational idea of evaluative research is to refine to test design ideas in terms of usability, emotional values and human factors as known widespread.

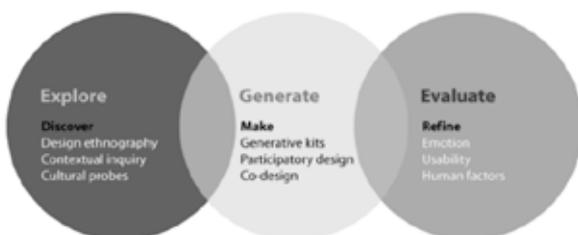


Figure 3: Models of Design Research (Hanington, 2007, p.4)

Generative phase of design research is usually related with tell and make activities that are already mentioned in ‘tell-make-enact’ trilogy. In this phase, generative kits could be created with a participatory and co-design approach.

3 THE WORKSHOPS AS HANDS-ON EXPERIENCES TO CREATE A PLATFORM FOR COLLECTIVE CREATIVITY

The idea behind co-design activities is involving all the different type of stakeholders into the design process starting from the very beginning. In this workshop, it was rather preferred to have the design students from different bachelor programs to supply them a warming-up platform for experiencing creating together based on conditional design method before involving different types of stakeholders.

The workshop, named as *Pass the Pixel*, which was hosted by Ozyegin University’s Faculty of Architecture and Design for the İstanbul group among the events of on the 2nd International İstanbul Design Biennial. Other collaborators were Michigan State University, Department of Art, Art History & Design, and San Diego State University, The School of Art & Design. *Pass the Pixel* was a workshop that aims to experiment with collaborative design processes. The design project in terms of its content and operative flow was defined collaboratively by the supervisors and organized in a way that would enable equal contribution of each student by incorporating the principles of conditional design as a method for co-design activities in generative research.

By integrating plurality, progressive flow and happenstance within the design process, conditional design has the potential to activate a thought-provoking interstice for designers. In the hope of inspiring students for new inquiries, we aim to utilize this approach for the first time with our students.

The process during the workshops and the presentations of the teams were documented by video recordings, photos and notes. Students presented their work mostly by role-playing and sketches. The process and the findings used in this paper is focused on the first workshop since the students were given very limited time and asked to create initial design ideas together and present their ideas in an effective way for the first time.

The first part of the workshop consisted of an exercise for students to get an understanding of conditional design as a method for generative research. For this purpose, during the first exercise, the students were asked to create a face on the studio’s wall by using one black dot and two red lines, connecting different dots as being the rules of

this first exercise. By this exercise, the students had a chance to experience what conditional design is and how everyone's contribution affect the next person's step and contribution in the process. By following such a method based on simple rules for each participant, it was visible that the process in itself already became much more dynamic than planned since the students' engagement level turned out to be very high. The first exercise was based on the idea that every student puts inputs according to the set of rules one by one and follows the previous inputs from the other students. In this way, students got a brief understanding of how one input has an effect on the latter's and how it becomes important to keep the big picture within the framework to create a face in the end.



Figure 4: A glance on the first exercise in the workshop

In the second exercise of the workshop, the students were asked to generate letters of the alphabet collaboratively by using small pieces of white sticky papers. Every student was asked to use only one piece of white sticky paper to make one part of the letters respectively. The rule in this exercise was to use one sticky paper to generate a part in each letter of the alphabet, only a couple of seconds were given to the students, so the whole group moved from one letter to the next letter of the alphabet at the same time. Putting the paper pieces together and moving to the next letter of the alphabet were new activities when compared to the first exercise of the workshop.



Figure 5: A glance on the second exercise in the workshop

This exercise was based on the idea that every participant makes only one input at the same time and moves to the next alphabet to make one input into the creation of the next letter. By doing so, the students got a brief understanding how creating together by only making one input at the same and proceeding to the next letter has a crucial impact for collective creation during the process.

4 TO CONCLUDE

This paper aimed to propose conditional design as a method for co-design activities in design education by promoting the design process as a dynamic system which needs to be designed in itself as it directly influences the final outcome.

In this paper, during the *Pass the Pixel Workshop*, we basically attempted provide an active learning space to students. The supervisors were there to facilitate, but it was up to the students to decide how to perform in each workshops. The workshops aimed to raise the students' awareness towards using conditional design as a method for co-design activities in the early phases of the design process. Therefore, we did not consider grading students' works in the accustomed sense; what mattered was their active participation. We aimed to communicate students that design doesn't have to be practiced within established structures, and there are many possible tools and methods that we could try and see. We inquired whether we can develop educational methods by integrating conditional design as a method for co-design activities into design education. Based on the feedbacks, it is possible to foresee that the workshops were positive experiences towards our aim. The students showed high level of engagement in the exercises of the workshop and even asked us to organize another workshop that has a similar aim and approach in the future. Students found this exercises highly engaging and even playful to get an understanding of conditional design as a generative method for co-design. Beyond the educational purposes, the workshops seem to be useful to create an interstice in the disciplinary atmosphere of the classes.

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Study of Co-Creation Model and Analyses of its Use, Benefits And Applicability for Design Teaching

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Study and analysis of the Co-Creation 6C Model (Friis 2015), created for the use in project development teams. Bearing in mind the potential for application in an environment of project learning, the approach of this article lies in the methods Knowledge & Expertise Map, Check-in and Check-out, Codex, Data Wall, Pitching and Storytelling, which belong to two of six categories, namely Collaborate and Communicate. This paper presents: a) the model and the selected methods; b) the planning and the implementation of the study context – design workshop; c) the data collection methods based on non-participatory observation, photographic documentation, testimonials, interviews and reports; d) data analysis and the results presented in tables that articulate the investigated material, its application and the perceptions of their use; e) considerations on their use and benefits that indicate applications in design classes and tutoring activities.

Design. Method. 6C Model. Co-Creation. Education.

1. INTRODUCTION

This paper is intended to study and analyse existing methods of the Co-Creation 6C Model (Friis 2015) [Figure 1]. The study addresses the discussion of design methods described by several authors and applied in different contexts, namely teaching. The aim of the study is the observation of the use of six methods of the 6C Model and to analyse them in order to detect their application potential in an environment of design teaching.

The 6C Model can be described as a set of design methods to be used in teamwork. It is organized in a kit of cards separated into six colours related to different categories of actions that take place during the design process: collaborate, collect, comprehend, conceptualize, create and communicate [Figure 2].

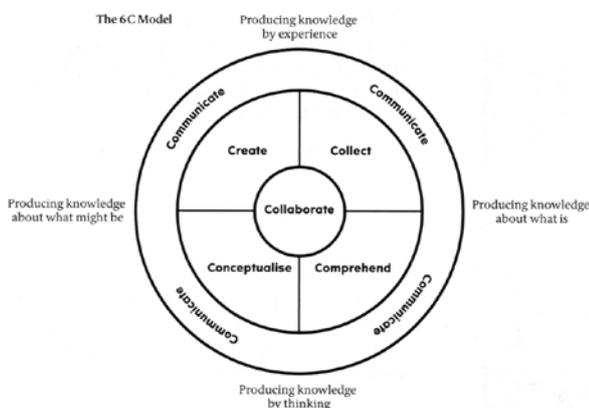


Figure 1: Diagram of the 6C Model in the folder of the kit of cards (Friis 2015).



Figure 2: Examples of cards of the 6C Model (Friis 2015) related to the categories collaborate (black), collect (green), comprehend (blue), conceptualise (purple), create (red) and communicate (orange). Photo by the authors.

The method looks at a group of actions, behaviours and protocols to be adopted in the design process. According to the folder from the kit, the model was developed to facilitate the interaction in design teams, and also stimulates the use of a common language during the design process and its

development. There are about 15 cards for each method that can be selected and used by the teamwork along the project or in specific moments. On the back of all cards there is a description of the method, the objectives, an example of the use and the benefits of its application. Some of them present, in addition, references of the origin of the method or a recommendation of different methods in other cards.

Collaborate and Communicate are actions that cover all the others. As can be observed in the diagram, Collaborate is in the centre and Communicate is in the perimetre. The focus of this paper lies in three methods of those two categories. Knowledge & Expertise Map, Check-in and Check-out and Codex are three of the methods of the Collaborate category and Data Wall, Pitching and Storytelling are three of the methods of the Communicate category analysed.

The study of the 6C Model belongs to the research on creative practices, design processes and methods performed since 2011 by members of the research group *Creative praxis: study of methods, processes and paths of creation in design* – at the School of Architecture and Urbanism of the University of São Paulo.

Proposals of application and design methods are many times shown in book format, which is organized in distinct ways whose goals are: to demonstrate the relations among the design phases; to indicate the concatenation of actions and the movements of back-and-forth of the process; to promote appropriate conditions for the divergent thinking, which is important for the generation of alternatives in search of originality; to organise and sistematise procedures and criteria for the evaluation and addressing of actions; to clarify the project process in itself. The design methods are usually catalogued according to the project phases, aiming to make their use feasible by providing examples and cases for the best comprehension of their potentials. In other formats, the best known set of method cards was idealized by Ideo in 2002 and developed for the use in business environments. When compared to the 6C Model, it is possible to note some similarities.

The principles of learning by doing and learning while doing, adopted in curricular guidelines throughout the world and also used by professors of practical disciplines consider the notion of reflection in action activity (Schön 1983). That means thinking, learning and operating reflexively about the action of designing both in educational and professional environments. In the same teaching institution there are professors who would rather teach guided by the experience of doing and therefore uncover each student's single way of

designing. Other professors prefer to teach design making use of practices, methods or sets of tools and procedures that can be replicable because they understand that structured methods are beneficial in the learning process, especially for novice students. Cross (2007) points out that the use of design methods by experts has been incorporated by the professional practice. The designer eventually traces his/ her own path during the project. According to the author, as far as novice students and designers are concerned, the clarification of the methods and their aim, as well as their systematic application are efficient ways to facilitate the design learning until the procedures have been finally introjected by practice. Lawson & Dorst (2009) remark that the design activity involves cognition, which encompasses the development of physical skills associated with ways of thinking. Thus teaching design is an arduous task and entails the teaching of both thinking and doing simultaneously. With this in mind, the teaching of structured methods proves to be profitable, because it helps with the understanding of the concatenation of actions and the awareness of its use and of the process.

The authors also present the idea of the action of designing in a reflexive way considering two interpretations: 'reflection in action' and 'reflection on action'. The first one refers to the combination of activities of understanding the problem, formulating alternatives and validating them. The second one concerns stepping out of the flow of the projective activity as an observer who evaluates whether all the process and the addressing are on the right track. This paper intends to check if structured methods presented in the 6C Model are fruitful for the teaching-learning process of design and also what works, for whom and in which context.

2. METHODOLOGY / STUDY SETUP

The workshop was planned and implemented over eighty hours distributed into two weeks. It was offered for students of different design courses from Brazil and Denmark and designed as an observation laboratory for the use and application of the methods of the 6C Model, and also for *in loco* analyses of design actions, students' production and perceptions in a design environment.

2.1 Workshop

Thirty-eight Danish undergraduate students and eleven Brazilian ones worked together at the Museum of Contemporary Art of the University of São Paulo, based on the challenge proposed by the museum's director with a view of creating ideas to deal with opportunities and problems of the

institution. The Brazilian students chosen for the study were from the design course of the School of Architecture and Urbanism of the University of São Paulo (FAU USP) and the Danish ones from Design Skolen Kolding (DSK), from industrial design, communication, fashion, textile and accessories courses.

Ten multidisciplinary teams were formed with four students from DSK and one from FAU USP mixing academic experiences and diverse cultures. The space dedicated to the workshop was prepared with furniture (tables and benches) and a wall for putting up materials for each group [Figures 3a and 3b], so that the teams could work together interacting with other teams or focusing on their work isolated from one another.



Figure 3a: The workshop space. Photo by the authors.



Figure 3b: Team working, with the wall for putting up materials and data of the working process. Photo by the authors.

There was availability of wi-fi for desktop research as well as materials such as pens of different colours, A3 and A4 offset paper, post-its, stickers of various colours and sizes, scissors, glue, and an image bank from Ibirapuera Park. Students were provided with information on print shops, stationaries and restaurants in the neighbourhood.

2.2. 6C Model in action

Two Danish lecturers, familiar with 6C Methods and their dynamics of usage all over the world with undergraduate design students, applied the methods during the workshop which was held in English. The lecturers had already selected some methods of the six categories presented on the 6c model to be used by all the teams [Table1].

Table 1: Methods pre-selected by the Danish lecturers.

Category	Methods
Collaborate	Codex
	Personal Pictures
	Check-In and Check-Out
	Knowledge & Expertise Map
Collect	Fact and Inspiration Finding
	Personal Narratives
	The Observer
	Experience Mapping
Comprehend	Personas
	Challenge Framing
	Challenge Mapping
Conceptualise	Positive Feedback
	Lotus Blossom
Create	Prototyping
Communicate	Road Map
	Data Wall
	Pitching
	Storyboard
	Storytelling

In this paper, the study of the application of the 6C model was based on three methods of two categories, namely Collaborate and Communicate [Figure 4]. Following is the description of the objectives of the methods in keeping with the cards of the kit.



Figure 4: Methods selected for the analysis of the 6C model (Friis 2015). Photo by the authors.

2.2.1 Talking about the three selected methods of the Collaborate category

On the first day of the workshop, even before the formation of groups, when the students of both institutions met for the first time, the first method of collaboration pre-selected by the teachers was used: Knowledge & Expertise Map. The objectives of this method are: quick integration, identification and visualization of knowledge and skills of group members. The second method of Collaboration was used by teachers during the ten days of the workshop: Check-in and Check-out, which aims to maintain and reaffirm a good working climate among the members of the group, through daily meetings at the beginning and end of the day, in which participants have the freedom to say what they think and feel, even if it is not related directly to the project. Another method of Collaboration, Codex, was subsequently highlighted by the students in their reports and deserved the attention of researchers because it aims to establish guidelines and protocols of conduct internally determined for and by the group.

2.2.2 Talking about the three selected methods of the Communicate category

The Datawall Communicate method is designed for the sharing of a large amount of information produced along the project, displayed simultaneously on a wall, allowing for the identification of patterns and relations among the elements. The Storytelling method is intended to capture and keep the attention and curiosity of the audience in a gripping way during a presentation. The Pitching Communicate method was used by the lecturers when all the teams were asked to present their proposals for the addressing of the project related to the problem. The aim of this method is the verbal and visual presentation of the idea or of the project as clearly and objectively as possible targeted at a specific audience: the user and/or the prospective client.

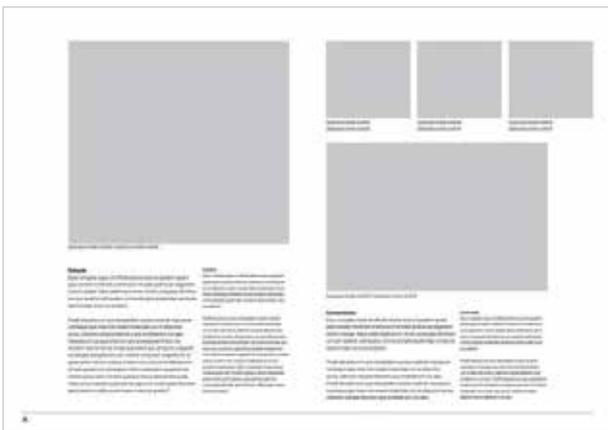
2.3 Methods of data collection and analysis

Four researchers used a non-participatory observation method following the development of the teams' works and recording perceptions of the dynamics involving the workshop. The results were also obtained through videos. A photographer took several pictures documenting the teams' processes for ten days [Figures 5a and 5b].



Figures 5a and 5b: Examples of photographic documentation. Photo by Beatriz Alcântara.

The researchers interviewed the Danish lecturers about the previous experiences of the use of the 6C Model in disciplines of design methodology in DSK and in workshops, as well as reflections upon didactic strategies in both scenarios. A template for the students' reports was created in order to speed up the gathering and the standardisation of information. The template contains the following fields: Title of the project, Team, Description of the Project, Justification, Pictures, Design Methods, Outcomes and Comments. There are also fields in grey in which to insert pictures [Figures 6a and 6b].



Figures 6a and 6b: Template for the students' reports.
 Designed by Leopoldo Leal.

At the end of the workshop a meeting with Brazilian students was held. It enabled the exchange of perceptions and criticism of the whole process, with a glimpse of the application of those methods in disciplines of the design course. This study involved the analysis of images, videos, reports, testimonials and didactic material (Model 6C), with a view to selected methods in the categories collaborate and communicate. For further content analysis four categories of information from sources collected (from the point of view of students, researchers and lecturers) were established, namely: a) perception of advantages of each of the tools during the workshop; b) identification of flaws or disadvantages of the use of the tool during the workshop; c) potential of use of each tool in the learning environment; d) suggestions of review, including methods or adaptations. Then, the triangulation of these data was performed.

3. ANALYSIS AND OUTCOMES

Tables 2 and 3 present the information obtained from the data analysis: the selected method of the categories Collaborate and Communicate; its respective description; observations and reflections performed by the researchers about how the methods were applied.

Table 2: Analysis of the Collaboration methods used during the workshop

Method	Description and Observation
Codex	Description: Establishment of a set of guiding rules of group behaviour. The method creates a working atmosphere which meets the needs and purposes of the team.
	Observation: Most of the students met for the first time during the workshop (as it might occur in a professional environment). The method enabled a behaviour of the members of the team that was mature, respectful towards their colleagues and focused on work.
Check-in and Check-out	Description: The method stimulates the expression of what is thought at the beginning and at the end of a working session. At the beginning it helps the team to engage; at the end it facilitates the reflection on what was produced with the aim of consolidating and shaping ideas for the following day.
	Observation: The Danish lecturers used this method most of the days. On arrival they would welcome the students with a friendly, relaxed attitude. That seemed to work well for the enthusiasm and engagement of the students every single day. After the welcome they would inform the students in which phase the project should be as well as the next steps to be taken.
Knowledge & Expertise Map	Description: The method helps to visualise the knowledge and the skills of the members of the team by means of notes inside the circles "all", "some", "unique". It promotes the identification of competences and differences at the very beginning of the project enriching the dialogue and assisting with the task allocation.
	Observation: This method was used on the first day so it helped the students to get to know each other. On the chart there was personal information on the students' private lives and their design skills.

Table 3: Analysis of the Communicate methods used during the workshop

Method	Description and Observation
Data Wall	Description: The method helps to share data, such as texts, images, maps, etc on a wall during the project. It provides an overview of complex information; it is dynamic and everyone can access new materials brought in by the members of the team.
	Observation: Students put up images and texts on a wall and followed up the development of the work throughout the workshop. The walls displayed a myriad of thoughts and actions of the design processes so that the students became aware of the path. The data visualisation in that environment created a ludic, focused working atmosphere.
Pitching	Description: The aim of this method is to communicate the main concept to the recipients in an attractive, persuasive way by means of visual and verbal resources. The Pitch contains the answer created to the identified problems and needs. The success of the argumentation during the pitching will validate the addressing carried out for the solution.
	Observation: The teams presented the project concept (which later on would be developed on an animated video), formulated after the students used the methods of the phases Collect, Comprehend and Conceptualise. They faced the challenge of synthesizing an idea and communicating it clearly. Pitching was the last presentation before the delivery of the final project.
Storytelling	Description: This method looks at the presentation of the work in a narrative format. It draws the attention and promotes commitment of the audience. The retention of contents on the mind is more effective when a narrative is used than when facts and data that support the argumentation are listed.
	Observation: This method went through the various programmed steps of design communication. It proved to be an important strategy of relaying a intended message in a clear, pleasant way.

3.1 Observations

The comparison between the description of the method proposed and what actually took place during the workshop enables the identification of similarities and appropriateness in relation to the existing situation and the phases of the work being

developed. Nevertheless, the information contained in the concentric structure provided by the teams during the use of the Knowledge & Expertise Map method was hardly guided upon useful skills for the project. It worked well for the interaction of the members of the team at the beginning of the activities but it did not show evidence of directing task assignment. Another fact found concerns presentation outcomes in which Storytelling method was largely applied. The ten groups used the strategy of a funny, enjoyable language, which proved to be appropriate for an audience of young design students. That did not necessarily occur for the audience of members of the Education and Management departments of the Museum. They commented on positive points of the presentation, in spite of regarding the language used by the students as childish and the ideas as naïve and focused on themselves.

As for the identification of the potential of use of the methods in curricular classes for team work, it is worth taking into account the feedback of the students of FAU USP that lent themselves to the experience of the workshop and are in different stages of the design course.

3.2. Students' feedback

In addition to the information in Tables 2 and 3 above, there are important data obtained in: a) the researchers' conclusions about the use of selected methods and b) the students' perceptions of the efficiency and the discovery of the potential of the use of the methods during the project development in class. This information was collected and organised based on the students' reports [Figures 7a and 7b] and on the discussions held at the end of the event.



Figure 7a: Report of the student Henrique Corazza.



Figure 7b: Report of the student Henrique Corazza.

As far as Collaboration tools are concerned, *Codex* forces the commitment of group members into a synchronic action. It was useful to establish specific times for breaks and the use of mobiles. This practice makes the students' behavior less dispersive and the activity more concentrated. Brazilian students realized the benefits of this phenomenon and, by contrast, understood how dispersive, counterproductive the classroom activities become when there is no ruled attitude. The Check-in and Check-out method showed the planning and control of the pace of activities by the lecturers. Students acknowledged the advantage of subdividing the design activities into smaller tasks, achievable in short periods with systematic deliveries. Such sharing gives the feeling of completeness and advancement in the process. The Knowledge & Expertise Map method provided fast rapport, and cultural diversity was perceived as one of the best points of the workshop experience.

The use of the Communication method Data Wall showed that the efficiency of textual, visual and diagrammatic communication displayed simultaneously on the wall can catalyze and communicate the process of the projective reasoning as well as induce new advancements or directions.

The students liked the positive feedbacks received after the Pitching session, because they were appropriate to the guiding of the problem. Thus, they understood how the domain of Communication can be useful to improve the project. Most of the Brazilian students knew the Storytelling method because of its use in their design course. At the workshop, the use of this tool was instrumental in the preparation of the presentation of the results on videos, which requires mastery of narrative language. However, some students reported that they had little knowledge and lack of skills in animation techniques, which consumed a lot of time for learning about the tool so they had too little

time to evaluate the quality of the message that was being generated.

4. CONCLUSIONS

The 6C Co-Creation Model is a set of method cards organised according to six categories of actions separated by colour. Each card has the definition of the method, an example of its use, why it is used, the way of using it and tips or cues for the use of other cards as well as references to the authors of the methods mentioned. The set of cards format was considered relevant to the academic setting, given that the grouping of methods in that way promotes a playful atmosphere that encourages browsing through cards to get to know them.

This format stimulates the tactile aspect and the communication of thoughts and ideas in the teamwork by means of a profusion of textual, visual and diagrammatic records produced in a relaxed, fun context. Such an environment is suitable to the generation of original thoughts and ideas without any embarrassment or fear of making mistakes. As the cards are loose, the methods can be displayed side by side according to the needs of the situation, which facilitates comparisons and allows for a better understanding of the process in a simultaneous, dynamic way. That does not occur while leafing through the pages of a book for the access to the contents and comparison among them distributed along the volume.

The selected methods analysed in this paper belonging to the Collaborate category proved to be an efficient didactic strategy for triggering the beginning of group work in the classroom once they create tools for fast rapport as well as easy flowing of the work process.

The observation during the workshop shed light on the fact that the methods improved the quality of the experience and the internal team management. Those factors deserve attention from teachers during design activities in groups. Yet considering a teaching environment, it was found that identifying skills of members of a group *a priori* can be risky in terms of a reinforcement of a specialization for task attributions, which would damage the students' education in the acquisition of multiple skills.

The methods of the Communicate category bring in themselves the core of the design activity: they synthesise the results of thinking and doing simultaneously in visual and textual languages; they calibrate compositional elements and meanings, bearing in mind both the transmission of the intended message and the record of the ideas and principles that orientate the ongoing project, which may contribute to their assimilation and guide the teams' decision-making.

In keeping with this thought, it was clear that the 6C Model contributes to strategies for conducting projects in an educational environment. Moreover, the selected methods of the Collaborate and Communicate categories are effective tools for both the management of teams and chaining of activities during the class. Those methods proved to be quite efficient at making the students understand and exercise forms of different languages for the transmission of ideas and design concepts.

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The Design Cognitive Process Using Digital Instruments: an Enlightening Design Activity of Secondary School Pupils

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The French Curriculum for Design and Applied Arts presents a subject area stretched between artistic and technology education. It offers multidisciplinary approaches and practice shifts based on design projects that engender a digital skills development process. This—O-level—syllabus does not actually train design professionals. Rather, it develops pupils' design skills and requires the use of digital instruments to visually present and defend the design projects. We observed the design activity of several pupils in three learning situations (French high schools). We analysed pupils' intentions and preparations during the assessment tasks: artefacts they designed, statements they made on those artefacts, communications they organised to enlighten what they designed, etc. We based these analyses on interviews, slideshows and 3D graphic representations. The outcomes show the complex interaction between traditional and digital practices. It unveils the way pupils develop their creativity using and uttering peculiar ideas or tampering with teachers' requirements. It also demonstrates design skill development and knowledge acquisition: how pupils adapt the required tasks to the assessment criteria the teachers enunciate; knowledge they request to complete the tasks they must do; what kind of efficient activity (exploration, necessity, obligation) is involved in the design cognitive process when using computer-aided design.

Cognitive processes. Digital skills development. Design Education. Social Constructivism. Computer-aided design.

1. INTRODUCTION

1.1 Between artistic and technology education

The French curriculum of Design and Applied Arts (DAA) presents a discipline stretched between two historical affiliations: artistic education and technology education. Both refer to a constructivist approach to knowledge, that is to say, a practical teaching-learning situation which may generate questions from which pupils will build knowledge. The specific approach in artistic education is neither that of the practitioner nor that of the historian but that of a transversality which federates a set of approaches under a common question (Gaillot 1997). What is proposed in technology education is the incorporation of 'conduct research'; given that it allows the implementation of modalities of appropriation of representation and means of communication positioned as objects and problems of a technical nature (Laisney & Brandt-Pomares 2015). At the lower secondary level, for all pupils

11–15 years old, design education is engaged in artistic and technology education. The high schools' curriculum of DAA, called 'STD2A', offers multidisciplinary approaches and practice shifts based on design projects that engender a digital skills development process.

1.2 The STD2A requirements

The STD2A requirements refer to professional design activities to stimulate teaching-learning processes and situations. Pedagogical content encourages teachers to develop digital and drawing skills.

For the penultimate year, the requirements outline an approach to digital image processing, to develop greater autonomy of the pupil in the use of digital media at the service of their creative activity. The aim of this approach is to provide tools that allow the acquisition and processing of multimedia data to, on the one hand, communicate the studies and

projects carried out in the applied arts course, and on the other hand, to incorporate these tools within the design research process (MEN 2011, p. 3).

For the final year, the requirements consider drawing skills a prerequisite to any practice because it sharpens perception and observation. More than a tool, drawing must be considered a means of understanding the problems posed, conveying concepts, giving them form, expressing ideas and implementing a project (MEN 2011, p. 4).

2. THEORETICAL FRAMEWORK: DESIGN ACTIVITY IN PEDAGOGICAL SITUATIONS

Design activity is examined in the STD2A design-learning context as a 'construction of representations' (Visser 2009). First, this perspective is based on the activity theory (Engeström 2001) and the constructivist approach to knowledge acquisition (Lebahar 2001; Vygotsky 1978). Then, this activity is also examined through the instruments in the design field within a reflective practice (Schön 1983).

2.1 The design task and design activity: representations at stake

Lebahar (2007) states that the design task consists of assembling a representation, and that this task appears more as a composition of several problems, multifaceted and having different scopes. Concerning design activity, Dorst and Cross (2001) and Lebahar (2007) suggest that it is not seen as an activity reducible to a single and permanent coding of actions and operations. They analysed design activity to learn all the features and all the components. Lebahar (2007) proposes that design activity consists of organising tasks to design an artefact model which does not proceed from an existing model. Dorst (2006, p. 10) defines it as a co-evolution, a 'constant iteration of analysis, synthesis, and evaluation processes between the two-notional design 'space'—problem space and solution space'.

Moreover, design activity is based on situations, representations and task, and closely intertwines several types of interactions and several types of representations (mental images, operative pictures) whose role varies during the task and the purpose of which, is to conduct a programmed guide.

According to the social constructivist frame of knowledge, the relationship between subjects and knowledge is mediated in part by the objects they build and by the social interactions they have with other subjects (Vygotsky 1978).

2.2 The instrumented activity of the designer

Beyond the operational design activity, the learning situation allows for the understanding of the constructivist process of design skill. In a training situation, the learner produces the conditions and the means of their future activity (Lebahar 2009). Lebahar (2007) has thoroughly analysed the design activity of designers and design students, and illustrated within the situation of complex interactions, where the designer enters a dialogue with a range of representations, tools or instruments that he uses to realise the design. Mediation by tools is at the heart of design activity, both for what it allows and by what means, what it makes possible, and what it limits (Engeström 2011; Rabardel & Béguin 2005). The tools help the subject to 'orient himself in the widening system of his connections with the world' (Leontiev 1978, p. 130). This is a necessity, the social essence of the subject.

So, to analyse data from a given context, to simulate, evaluate and communicate artefacts to the other subjects they work with, the designer establishes planned and external representations: diagrams, drawings, geometric objects, mock-ups, digital images, symbols systems, and so on. Representations are essential instruments to carry out the design activity allowing the modelling of shapes, features and achievements from an abstract design. Ochanine (1966) named these representations 'operative images'. They have two functions; first, they set a cognitive function, the designer can shape the desired data he collected, and the second is a regulating function, the designer uses the operative images as an artefact to act with the data.

Sketches made by designers during the design process play multiple roles for both designers and the design process (Purcell & Gero 1998). They serve as an external memory to augment the limitation of human cognitive abilities, as the medium that designers use to communicate with themselves and others, and as the triggers that enable designers to reason about a design problem (Schön & Wiggins 1992; Goldschmidt 1997; Gero & Mc Neill 1998; Suwa et al 1998; Bilda, Gero & Purcell 2006). They also enable the process of creativity (Bonnardel & Didier 2016, p. 84):

- A generative phase, in which mental representations, or 'preinventive' structures, are constructed;
- An exploratory phase, in which these structures are explored in ways that lead to insights and discoveries.

2.3. Digital tools: an enhancement of creativity and cognitive process?

Computer-aided design (CAD) tools as the name suggests are meant to be an aid to designers, however, professional CAD tools placed in the hands of pupils—who have a need for a tool that instructs them and that could provide instant corrective feedback—may slow down the design process and create a negative visual experience (Luh & Chen 2013).

Furthermore, if these digital technologies are taught in the STD2A curriculum, they are taught by teachers who do not have the required Technological Content Knowledge (TCK) (Tortochot 2015). As a result of not being appropriately informed on the use of digital tools, the pupil may lose sight of the objectives and requirements of the design process and focus primarily on the result of CAD representations (Tortochot 2013).

CAD tools and traditional tools, complement each other in supporting design activity (Lane, Seary & Gordon 2010). In the case of experimented students or professional designers, both digital and traditional instruments can also enhance creativity: original ideas or solutions adapted to the context (Bonnardel & Zenasni 2010). Creativity and all the appropriate instruments participate in the designer's individual cognitive process leading to the process of designing. Nevertheless, CAD tools may limit creative ability as pupils may not have the proficiency to manipulate a software program or they may be bound by the limits of the interface (Huot 2005).

This paper attempts to show the kind of cognitive processes pupils use in the design-learning field compared to experimented students.

3. INVESTIGATION

3.1. Design learning situation

The design activities of three pupils were investigated and analysed to observe how digital tools affect the design cognitive process, that is, the acquisition of design skills, design specific knowledge, and to explore how pupils decipher and handle project requirements and programme regulations. The analysis and investigation are based on the data collected as part of an on-going research, in which the goal is to observe a pedagogical situation through different theoretical objects (Lebahar 2009):

- planned organisation of the DAA teachers;

- productions the pupils made in various forms (drawings, commented drawings, photographs, texts);
- pupils' feedback on their own work.

The design-learning situation is a summative test, called 'Multidisciplinary Project in DAA', planned in the senior year for a duration of 75 hours. This test is organised in the classroom by the teaching team (a real project-based-learning). The pupils' written, graphic, oral productions are evaluated in three stages successively (Figure 1): the preparatory phase and research project (1) and its realisation (2) are assessed by their teachers and the project presentation (3) is evaluated by an external jury.

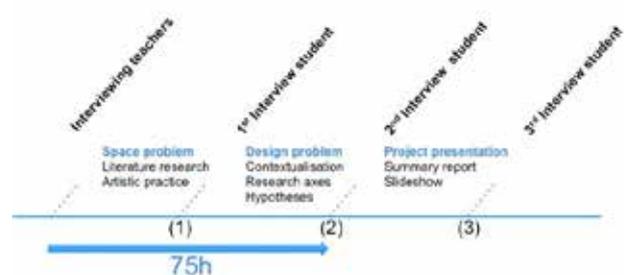


Figure 1: The multidisciplinary project and the different stages of the research

The project is always structured in five stages:

- At the beginning of the project, each teaching team proposes a topic.
- According to the teachers' requirements, pupils must engage at the same time both a literature research and an artistic practice.
- Then each pupil defines a space problem: his personal analysis of the topic allows him to point out a question.
- The space problem becomes a design problem: each pupil chooses a design field, makes clear a context and infers some requirements, as specifications and constraints induced by his design problem.
- The pupil seeks assumptions to resolve it.

3.2 Participants

Three participants from an existing corpus of nine pupils were selected for this communication. The three participants of this study are from three different schools located in south France; Diderot, Hemingway and Mistral. The topics proposed by each teaching team are 'Parade', 'Around the Time' and 'Experience of Fragility' respectively. Of the three schools that participated in this study,

Hemingway is the only school not equipped with digital material.

3.3 Materials

All the productions of the three participating pupils were documented via photography. These productions included three phases of work: phase one—exploration of the theme; phase two—development of production; phase three—presentation of the production. Only the productions from phase one and phase two were used in this communication. A pair of interview transcriptions for each of the three participating pupils were used; these included one interview at the end of phase one and a second interview at the end of phase two.

3.4 Methodology

The pupils design activity was explored using empirical methods—observation of recorded documents (photography of pupils' production) and analysis of transcriptions from interviews. The interviews were semi-structured; this is to say that each participant was asked a different set questions relative to their individual works. Additionally, each interview varied in length.

In the first instance data from the participants' productions—writings, photography, collages, weaving, sketches, design solutions and design synthesis—were used to observe and gain insight into the creative and cognitive process in design activity, choice of tools in design activity and the influence of digital methods versus traditional methods on the development of graphic design skills. Following this, the transcriptions from the interviews of the three participants were analysed. The entire interview transcriptions were not reproduced on this paper, only the sections considered to be relevant were included here. In order to synthesise and show only the essential, all the representations were not used.

4. OUTCOMES

4.1. Pupil 1 (P1), Diderot School, topic 'Parade': 'traditional tools to be better understood'

The productions of P1 in phase one, shown in Table 1, display a vigorous, cognitive process in the design activity of preparation and research. This is identified by coordinated assemblage of pictorial and textual elements, decoding of references via sketches as seen in Table 1(iii) for example, and quantity of production. With regards to the choice of tools, P1 has not used digital tools in this initial phase, favouring collage, lettering and sketching (observational drawing as grasping

perceptual skills, according to STD2A requirements).

Table 2a and 2b display the productions of P1 in phase two. Again, a vigorous, cognitive process in the design activity is displayed in this phase which includes contextualisation, exploration of axis and establishment of a hypothesis. This process is identified by the quantity of production, recorded thoughts and concepts in written form and use scenarios that are sketched ('expression drawing' [thought through form], according to STD2A guidelines), as seen in Table 2b(i). During this phase, P1 used both digital and traditional methods in their design activity.

The first interview with P1 conducted after the productions in phase one were completed, reveals that P1 sought to be understood. Their solution to this cognitive design problem was to accumulate a large amount of graphic and textual material. Excerpts from this interview are displayed in Table 3.

The interview reveals that P1 reflected on their productions and assimilated design specific knowledge; for example, they identified why a heuristic map is useful to them (to construct 'preinventive structures') and explained how sketches helped them to decode the work of other artists ('analytical drawing' as study and understanding of reality, according to STD2A requirements). P1 expresses a clear idea of what the objectives of phase one were. Concerning the choice of tools, P1 identified that they used a digital tool because they had a precise model and the representation was clearer when they used the digital tool as compared to drawing.

In the second interview, which takes place after phase two, P1 used analogue representations to describe an interactive event. P1 stated that their motivation for not using digital tools was that they felt it was what the production was requiring. P1 identified that they are most comfortable with watercolour and asserted that the choice of using watercolour is not because they felt more at ease with this method but rather because their ideas may be better understood than if they used a crayon.

4.2. Pupil 2 (P2), Hemingway School, topic 'Around the time': 'wasting the time doing small things'?

The productions in Table 4(i) and (ii) of P2 appear to have respected the requirements of phase one of the STD2A project as P2 has exploited the use of multiple artistic methods. As a result of their cognitive and design activity P2 has created clusters of information—image and text—on a collection of boards. Table 4(ii) shows the first page of a collection of boards identified as specifications.

These specification boards contain mainly textual elements with some highlighted words and a reference to colour choices. There was no use of CAD tools in this phase of preparation and research.

Table 4(iii) and (iv) display the productions of P2 in phase two. During this phase, P2 used both digital

tools and traditional methods (sketching, lettering, manual composition and fine art techniques) in their design activity. The text elements in these productions contain some highlighted words. Clusters of information—image and text—can be identified. All board titles are generated with CAD software as well as the poster propositions and the contextualisation of the artefact.

Table 1. Photographs of some productions of P1 from Phase one

	Productions	Analysis
i		<ul style="list-style-type: none"> • P1 uses words as an instrument of mediation in this initial stage of design activity. • P1 creates order on the support: a title area can be identified to the top; to the left, a handwritten text describing the theme; and to the right, a significant area of the support is used to display words that show their connection by their alignment. Some of these words are circled or highlighted with a different colour.
ii		<ul style="list-style-type: none"> • P1 has created a collage of diverse images and text. • P1 has outlined or coloured some elements of the collage in red. • P1 has used mainly figurative images in this collage. • P1 has used a majority of black and white images in this collage.
iii		<ul style="list-style-type: none"> • P1 has used sketching as a mediation instrument in this design activity. • P1 has used words as a mediating instrument in this design activity. • P1 has demonstrated an association of sketches and words by proximity. • P1 has pasted the pictorial elements onto the support and all text is composed by hand. • P1 has highlighted some words on this support. • P1 has created groups of handwritten text and image on this support.
iv		<ul style="list-style-type: none"> • P1 has created clusters of handwritten text and pasted images on this support. • P1 has created links between the groups with red lines. • P1 has made some distinctions in the handwritten text using size and colour as discriminators.

Table 2a. Photographs of some productions of P1 from Phase two

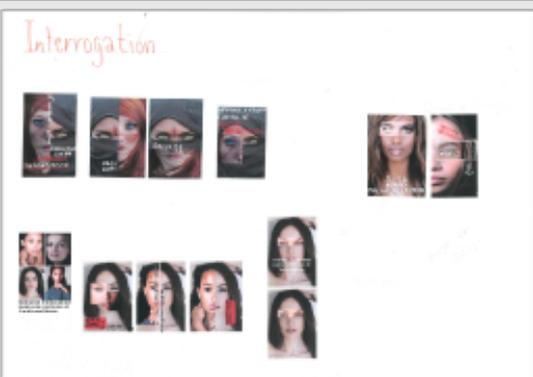
	Productions	Analysis
i		<ul style="list-style-type: none"> • On this board, P1 has constructed representations using pasted images, handwritten text and painted elements. • On this board, P1 is manipulating handwritten text, pasted images and painted elements in each instance of representation. • For the handwritten text, P1 manipulates size, colour and position. • On this board, P1 presents a contextualisation of the representation, which appears to be executed with CAD. • The board also includes an informative sketch which indicates with an arrow the mirror. • The representations on the bottom right of this board appear to have been executed with CAD.
ii		<ul style="list-style-type: none"> • On this board, P1 has constructed representations using CAD to compose the image elements and in some instances the text elements, however, they have also used handwritten elements.
iii		<ul style="list-style-type: none"> • P1 has used a mix of CAD and traditional tools on this board. For example, colour samples in the top right of the board are represented with watercolour and on the bottom right, coloured pencils. • P1 manipulates colour, images and handwritten text in the various instances of representation. Manipulation of size and position is seen here.
iv		<ul style="list-style-type: none"> • P1 has used a mix of CAD and traditional tools on this board. • P1 appears to have chosen one image from the previous board and manipulating this image by adding or subtracting from it. • The third image from the bottom right and the second image from the left on this board show that P1 continues to mix CAD and traditional tools. • P1 shows a progression of activity with directional arrows which connect the three images in the top centre of the board.

Table 2b. Photographs of some productions of P1 from Phase two

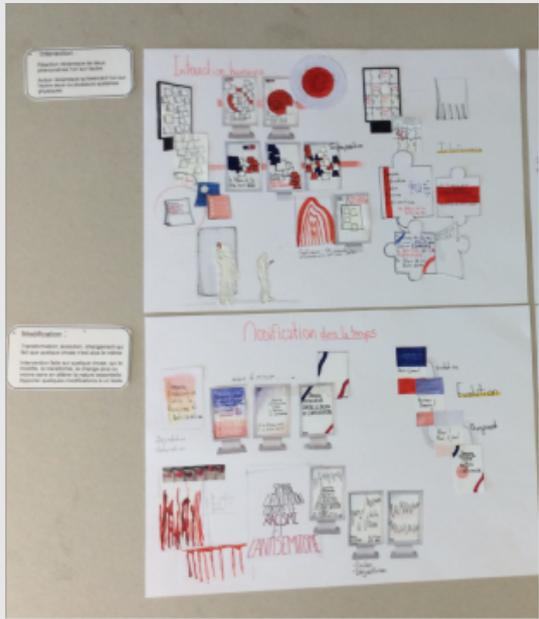
	Productions	Analysis
i		<ul style="list-style-type: none"> • P1 has executed an organisation of images, colours, words and collages to describe functionality. • P1 uses sketches, handwriting, and colouring techniques such as marker, coloured crayons and watercolour.

Table 3. Analysis of excerpts from Interview one with P1

Interviewer	P1	Analysis
<i>This choice to put a lot of photos was motivated by what?</i>	<i>I wanted it to be understandable in fact I wanted to put a lot of photos because they were plenty of direction so</i>	<ul style="list-style-type: none"> • Being understood appears to be important to P1. • P1 appears to believe that accumulation and size can accomplishing “understanding”.
<i>And these are the words you put in bold?</i>	<i>It is these notions I want to bring out</i>	<ul style="list-style-type: none"> • P1 is aware of “emphasis”
<i>The heuristic map was a request from your teachers, do you find it a useful tool?</i>	<i>Uh... yes to choose direction</i>	<ul style="list-style-type: none"> • P1 acknowledges that a heuristic map is useful.
<i>Ok and it really helped you in</i>	<i>Uh ... yes a little because otherwise I would have stayed, I would have gone everywhere</i>	<ul style="list-style-type: none"> • P1 identified why they think the heuristic map is useful.
<i>Ok and the layout, arranging the photos in this way was it also the request from your teachers?</i>	<i>No no it was I who chose</i>	<ul style="list-style-type: none"> • P1 chose how to structure their concept boards in phase one.
<i>Ok and sometimes there were images that did not show it enough or ...</i>	<i>Yeah but the teachers also said it did not show it enough</i>	<ul style="list-style-type: none"> • P1 acknowledges that some images were not correct.
<i>Ok. Did the remarks they made help you? How did it happen? Did you have any specific questions to ask them?</i>	<i>Um ... not necessarily specific but just to check if I was not going a little everywhere otherwise it is ok</i>	<ul style="list-style-type: none"> • P1 appears to be concerned mainly with staying within the boundaries or following the rules.
<i>You were able to associate them with sketches and texts. What was your purpose for the sketches?</i>	<i>To pick out the principles that emerged and to find the way in which the artists denounced something</i>	<ul style="list-style-type: none"> • P1 explained that their sketches were used to help decipher the work of other artists.
<i>What do you think were the objectives of the first phase?</i>	<i>Uh ... to find concepts and principles to find a clear context</i>	<ul style="list-style-type: none"> • P1 is aware that the goals of phase one of the project were to discover notions and principles concerning the theme in order to propose a clear context.

Table 4. Photographs of some productions of P2 from Phase one & two

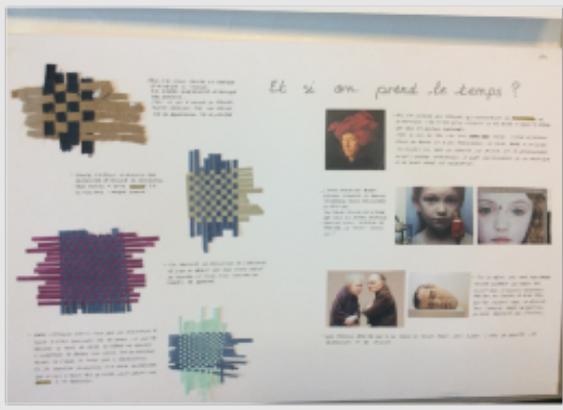
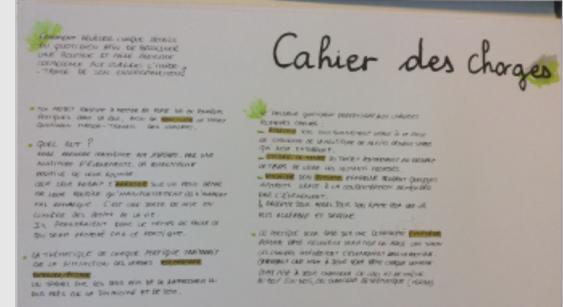
	Productions	Analysis
i		<p>Phase one</p> <ul style="list-style-type: none"> • P2 has organised this board, grouping related handwritten elements with material or pictorial elements. • Base on the text, the weaving work seen on the left was used as an instrument of mediation between P2 and themselves, as well as a mediation tool between P2 and the problematic of the project. • The organisation displays the progression of this mediation. • On the right half of the board P2 displays a selection of images—which marks a relation outside of themselves—that they have chosen to associate with the project.
ii		<p>Phase one</p> <ul style="list-style-type: none"> • P2 uses words as instruments of meditation in this stage of design activity. • P2 has composed this board in two columns of handwritten text. • P2 has some highlighted words in the text. • This first board of specifications includes; the problematic, the what, the why and the how.
iii		<p>Phase two</p> <ul style="list-style-type: none"> • P2 uses both CAD and traditional tools on this board. • The board has instances of handwritten and computer generated text, sketches and computer generated images. • P2 has created clusters of information on the board. • P2 has highlighted some of the words in red. • On the top right, there is a progression of form with regards to the booth with a corresponding handwritten text which is a realisation of internal cognitive activity.
iv		<p>Phase two</p> <ul style="list-style-type: none"> • On this board, P2 shows a contextualization of the booth and poster. This manipulation was done using CAD. The title which was pasted on the board was also formulated with CAD. • P2 has made a spelling error in the title.

Table 5. Photographs of some productions of P3 from Phase one & two

	Productions	Analysis
i		<p>Phase one</p> <ul style="list-style-type: none"> • Here on this board P3 has organised the photographs of experiments they conducted with light and plastic bags. These photographs are accompanied by text which is a realisation of their thoughts as well a mediation tool of the object. • On the bottom right of the board, P3 displays a reference image—a relation outside of themselves—they have chosen to associate with results of the experiment. • P3 has used CAD to compose the board.
ii		<p>Phase one</p> <ul style="list-style-type: none"> • This image displays the first page of P3's journal which was made after the experiments. • P3 has made a sketch with some identifying arrows, some handwritten points under a title "I Note" and a photograph which is pasted in the journal. • The sub-title on the page reads "RETAINED IDEA"
iii		<p>Phase two</p> <ul style="list-style-type: none"> • The title on this board reads "Sooth by ..." • P3 has organised a collection of options of what is identified by the text above the main image as "a 3D environment conducive to daydreaming". • P3 has used CAD to create these environments. • The text at the bottom is a realisation of their cognitive process it reads "BUT: I must add movements (birds which leave when there is noise, ..."
iv		<p>Phase two</p> <ul style="list-style-type: none"> • P3 has organised this board to show the project in context. This is done by using a sequence of images and a corresponding text which describes the key moments. • P3 has used CAD in these representations. • P3 has included a realisation of their thoughts at the bottom on the board.

The first interview conducted after phase one discloses that P2 wanted to experiment as much as possible, for example, they describe 'yes, I removed all the punctuation to observe that if one does not take the time to read the punctuation one does not really understand the text'. P2 is conscious of the choice of tools and methods they have used, for example, they identified photography as a means of accessing details, and described how one can capture different points of view with the camera that are not possible with the human eye ('... photography is not really the human eye, either we zoom, or make a wide angle, ...'). P2 also mentioned that photography was an area they want to pursue in the future. During this first interview, P2 described how process is important and demonstrated that they reflected on the method of working ('... I felt like I was wasting my time doing small things ... but perhaps the small sketch where I would have taken my time will have more value than if there were quantity, ...').

In their second interview—which was conducted after the completion of productions in phase two—P2 described how they '... don't know how to do it well by drawing ...' while referring to communicating their intentions and explained how they used the method they consider themselves best at, which is photography. They went on to say '... if I knew how to draw better, I would have done more sketches ...'. In this interview, P2 indicated that they liked working directly on Photoshop, not using any initial sketches. They also disclosed that they had already decided from the beginning what they wanted to do for phase two of the project, and this made phase one difficult.

4.3. Pupil 3 (P3), Mistral School, topic 'Experience of Fragility': 'ideas came by themselves little by little'

Table 5(i) and (ii), presents the digital documentation of the artistic research of P3 through photography and descriptive text. This documentation includes comparative references to existing works or matter as for example in Table 5(i). The productions define the context of the project using text and image. Table 5(ii) presents a page of the journal. The pages of the journal appear to recap the process that led to the results. The fifteen pages of the journal contain mainly handwritten text with two pages having images and sketches.

Table 5(iii) and (iv) displays the productions of P3 in phase two. Table 5(iii) shows a contextualization of the project executed with CAD tools. Table 5(iv) demonstrates what is described as an interactive scene (movement and sound) via 2D imagery. The journal page displayed in Table 5(ii) contains handwritten notes and pasted images.

In the first interview with P3, they revealed that the research they did themselves allowed them to remember things better. P3 stated that they did not do much sketching as they thought it was not a wise choice for this project. They also stated that putting things on paper didn't really help them progress in their research. When asked about what appeared to be conclusions of the artistic experiments, P3 described how they reflected on their work as such; 'it is advice not that I give myself, but in taking photos, I tell myself, and when I go to write well I say I must'. P3 stated that the artistic research did not have a relation to the subject. They stated that '... an important point was to move from the artistic experimentation which is just visual artistic research to something concrete ...'.

In the second interview, which took place after phase two, P3 stated that they did not have a work flow and that their ideas came by themselves little by little. They also stated that they already had an idea of what the final image would look like before they began to make the CAD representation. When asked why they had not done any sketches in phase two, P3 replied that since there were working with space, it was not wise to do sketches because that would mean sketching the space each time. They went on to say it was faster to work with the CAD program when working with spaces. When asked if they had a priority in the project, P3 replied that the results of the project were important to them, whereas for other pupils it was the process. They stated that the purpose of recording things is to have a footprint. They went on to say that if the protocol did not stipulate they had to write, they would not have written and that they realised when they would have had to talk about the work, that writing would help them to remember the important points.

5. GENERAL DISCUSSION: VIGOROUS COGNITIVE PROCESSES

The design cognitive process is conditioned by different assessment stages pupils must navigate. Table 6 provides an overview of design activities intertwined with traditional or digital tools, productions and interviews. Furthermore, the discussion underlines in what way exploration, necessity and obligation are the main activities observed in pupils' design learning.

5.1. Following the guidelines or a way to explore tools

P1 has worked mainly with traditional tools. Based on their preference for watercolour one could argue that this is perhaps why they have worked predominantly this way. However, the results imply that this use primarily of traditional tools in the second phase, was what the project dictated and it

was not a personal motivation. And in the first phase, it was motivated by the project guidelines which stipulated the use of a fine arts practice. Nevertheless, it may be constructive to suggest that the digital technique of photomontage used in the CAD representations were influenced by all the previous collage work. Was P1 trying to replicate a

traditional technique in a digital format? If the answer is yes; why?

The project of P1 has a digital counterpart which is interactive. However, P1 chose to represent this interactivity on an unanimated sheet of paper. Why did they not use another mode of representation

Table 6. Cognitive and design activity of the 3 participants in phase 1 and phase 2

Activity	P1				P2				P3			
	Phase one		Phase two		Phase one		Phase two		Phase one		Phase two	
	PRD	INT	PRD	INT	PRD	INT	PRD	INT	PRD	INT	PRD	INT
Reflexion	•	•	•	•	•	•	•	•	•	•	•	•
Writing	•	•	•	•	•	•	•	•	•	•	•	•
Lettering	•	•	•	•	•	•	•	•	•	•	•	•
Composition	•	•	•	•	•	•	•	•	•	•	•	•
Fine Arts	•	•	•	•	•	•	•	•	•	•	•	•
Sketching	•	•	•	•	•	•	•	•	•	•	•	•
Photography	•	•	•	•	•	•	•	•	•	•	•	•
CAD	•	•	•	•	•	•	•	•	•	•	•	•

PRD = Production INT = Interview CAD = Computer-aided design

that would display precisely what the results would be? Another question that comes to mind; is the choice of tools for representation accountable for quantity in production and the vigorous, cognitive design activity process?

5.2. The necessity of CAD tool against facts

The theme of P2’s project—take time—appears to have motivated the choice of techniques—mandala colouring, linocut, pointillism and so on—in phase one. A personal preference for photography and a declared inadequate skill in drawing, appear to have motivated whether they used or did not use these methods and their associated tools. The clusters of content of image and text reveal that P2 is reflecting on the project through visual and written content

As mentioned in the results of the productions of phase two, P2 has used CAD to produce the board titles. In Table 4(iv), a spelling error in the board title can be observed. This error invokes several questions: is this provoked by the use of the CAD tool? Even so, P2 has executed multiple steps of design activity that should have allowed them to revise the error—typing, printing, cutting and pasting. Is it that P2 expected the CAD tool to automatically do the right thing? Did the student’s cognitive process go into snooze mode and give automatic acceptance to the CAD tools output?

The communication of P2 is somewhat contradictory. During the interviews, they suggest that the approach and process of the project are important, yet, they declared not to have taken into account what the teacher’s instructions were as

they already knew what they wanted to do. Furthermore, in the second interview they revealed that they already knew what the outcome for phase two was going to be and therefore had to make their productions in phase one correspond; this made phase one difficult. Also, P2 talked about sketching in the first interview but there are no signs of sketching in the phase one productions.

5.3. CAD-oriented project as an obligation

The productions of P3 show that they worked mainly with CAD. The interviews reveal that they did so because they thought that the CAD tool was the appropriate choice, as they were working with space and they thought that working with CAD would help them to work faster. Is P3 equating working faster to working better? How is it then, that a CAD-oriented project does not take advantage of CAD tools to demonstrate the interactive elements of the project? P3 also mentioned in the interviews that they liked to work with Photoshop. Perhaps this preference is what motivated their choice of tools.

It can be suggested that P3 appears to have assimilated some design skills as they stated at the end of interview two, how they could see the utility of writing and recording progress.

6. CONCLUSION

The analysis shows, on the one hand, the pupils’ motivating factors and points of interest in CAD and traditional tools. P1 uses the digital tool as a tool of exploration and combines it with handmade

sketches, writing and watercolour techniques. Their activity shows an iterative and divergent design process that is nevertheless structured by a method that they have appropriated. P2 uses the CAD tool as a tool of necessity, to palliate their difficulties of representation in drawing which is an obstacle to their design activity; in this case, the 'magical' CAD tool has a regulating function that shapes their operative images (Ochanine 1966) or 'intentional drawings' (MEN 2011). Using the CAD tool is an obligation for P3 as it seems the better tool to simulate, evaluate and communicate the final state of the artefact representation (Lebahar 2007). Dialoguing with their teacher, and writing, seem to be more efficient than sketching, to reason about the design problem. On the other hand, the effectiveness of CAD in design tasks unveils exploration, necessity and obligation as main generative and constructive design cognitive process phases (Bonnardel & Didier 2016) within an obvious co-evolution of problem and solution spaces (Dorst 2006).

The observed and analysed design activity questions the role of CAD in a design cognitive process during a non-vocational training situation. The results partially explain the pupils' motives and their goals (Leontiev 1978). To further validate these findings, research must first be refined and secondly, extended to additional design learning situations (for instance, other certification levels or learning groups).

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Virtual Spatial Discovery for the Novice Design Student

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This study investigates the potential of using virtual reality technology to assist first-year architectural and interior design students in understanding spatial complexity. It is argued that virtual reality, particularly in an immersive environment, can bridge the gap of communication for students who have a low level of inherent spatial aptitude and for whom traditional modes of architectural representation have not yet been mastered. Virtual reality technology is seeing adoption in a wide variety of educational contexts and examples of these educational applications of the technology are discussed. Prior literature is also reviewed. Conclusions are presented that students with a low inherent spatial aptitude are able to see a significant benefit from the use of virtual reality in an educational context. A study is proposed during which students are administered a spatial aptitude test and subsequently invited to investigate a historic work of architecture using both traditional and virtual reality modes of representation. The hypothesis of this study as drawn from prior literature is that the students with low inherent spatial aptitude will see significant benefit in the understanding of a notable work of architecture. Results of the pilot phase of this study are discussed, including areas of further investigation.

Virtual Reality. Education. Architecture. Interior Design.

1. INTRODUCTION

Virtual reality (VR) technology is gaining significant traction in the field of education, as researchers and educators are realising novel ways of using the technology to present topics that traditionally have been difficult for students to grasp. These topics include such wide-ranging topics as immersive molecular manipulation for a chemistry class (Merchant et al. 2013), virtual frog dissection (Lee & Wong 2014), and re-creation and simulation of social situations (Ip & Li 2015) to identify but a few. Each of these examples, among many others, propose integrating virtual reality as an alternative visualisation method within a classroom environment.

One factor contributing to the value of virtual reality in an educational context is the ability of students to explore and interact with course content in an immersive virtual environment (Fowler 2015). Whereas traditional means of instruction have relied upon the extensive efforts of the instructor to relay abstract concepts, educators are finding that virtual reality environments are able to make these

former abstractions virtually tangible in a way that students find to be more accessible (Fowler 2015, de Freitas & Neumann 2009, Ip & Li 2015). This accessibility also is characterised by a greater ability for learners to personalise their learning experience and achieve greater learning autonomy (de Freitas & Neumann 2009).

Fowler (2015) notes that a required component of the success of a virtual learning environment (VLE) includes the concept of interactivity. As one notable example, Merchant et al (2013) relates that a virtual model of a molecule has allowed students to understand and interact with a virtual three-dimensional object in a way that was previously difficult for students to grasp using traditional instructional methods and means of representation.

Another contributing factor to the value of virtual reality for educators is the novelty factor. It is not uncommon for instructors using virtual reality technologies to experience a “wow” moment from their students, particularly those who have not experienced immersive virtual environments in the past. Many students, including those students that

may have experience VR as a gaming platform previously, seem open to the concept of applying this technology to a learning environment. "Novelty effect cannot be ruled out. Almost half of the samples have never heard of VR or used VR before. Thus, this new technology may create a sense of new excitement and motivation that could influence the students' performance." (Lee & Wong 2014)

Among those students who are able to particularly benefit from the use of virtual reality instruction are those students with a low inherent spatial aptitude. Prior research has identified that those students with a high level of inherent spatial awareness are likely to be successful in topics that require consideration of a three-dimensional abstraction regardless of the instructional method being used. (Merchant et al. 2013, Lee & Wong 2014). Students with a low inherent spatial aptitude, however, are able to benefit from the scaffolding offered by the intuitive interface of an immersive virtual environment and thereby receive assistance in bridging the gap between the abstract concept being presented and their understanding of that concept (Merchant et al. 2013, Lee & Wong 2014, Cohen & Hegarty 2014, de Freitas & Neumann 2009).

Mikropoulos and Natsis (2011) identify five learning affordances of virtual learning environments: "spatial knowledge representation, experiential learning, engagement, contextual learning, and collaborative learning" (Mikropoulos & Natsis 2011). Of these, spatial knowledge representation appears to maintain a particular importance. Indeed, regardless of the subject matter being studied in a virtual environment, recent research indicates that "achieving the intended learning outcomes requires spatial thinking ability either directly or indirectly" (Ip & Li 2015). "It is believed that spatial visualisation ability is the primary cognitive factor that causes the differences in performance and has an impact on comprehension of 3-D computer visualisation" (Lee & Wong 2014). This scaffolding of student learning allows the student an opportunity to self-pace and self-direct their exploration of the immersive virtual content and can therefore be an effective learning aid.

One type of learner that is uniquely able to benefit from the use of immersive virtual reality learning environments is the design student whose focus of study is the built environment. Students studying the complexities of spatial environments in allied fields such as architecture and interior design typically explore these complexities in the context of a design studio. This is an instructional environment that inherently encourages students to learn-by-doing through problem identification and experimentation under the guidance of an instructor

who provides background knowledge and supporting documentation, expertise, course-correction, a variety of viewpoints foreign to the students, and who encourages refinement of the students' work. (Ledewitz 1984, Green & Bonollo 2003, Liu & Chien 2001)

"The studio, despite the rapid developments in technology and the breadth of considerations within typical projects, remains a place where art and craft are blended in a process of intuition and reflection." (Green & Bonollo 2003)

First-year students in these design programs, however, generally have not yet been exposed to the complexities of spatial concepts (Liu & Chien 2001). Instructors of first-year design students often experience the challenge of relaying nuances of spatial complexity to students who are not yet well-versed in the drawings and diagrams that comprise the typical forms of architectural representation. This spatial complexity is difficult for instructors to describe or represent absent the tools of this typical language, yet critical for students to grasp in order to understand the significance of notable works of architecture. Conversely, as noted by Ibrahim (2010), students may not have the verbal descriptors necessary to convey complex design ideas and can benefit from the ability to reference a virtual model for further clarity (Ibrahim & Pour Rahimian 2010). Additional studies have indicated that the process of designing in conjunction with a virtual model results in improved spatial cognition (Kim & Maher 2008).

"Some of the studios that have integrated technology to assist design teaching suggest that they have observed an improvement in students' awareness of different issues, for instance environmental, spatial, and design construction knowledge of their design." (Mizban & Roberts 2006)

This focus on inhabited space places students of the built environment in a unique category to be able to benefit from virtual reality technology. If, as is proposed by this study, virtual reality environments enable students with a low inherent spatial awareness to better understand spatial complexity, there may be a variety of benefits to the student, the instructor, and the institution. Students who are able to grasp content that they find particularly difficult experience empowerment and are more likely to apply themselves to topics of increasing complexity. Instructors who are able to "short-cut" a student's understanding of complex spatial topics can move on to increasingly complex topics more rapidly. Institutions, likewise, may find a benefit to the use virtual reality technology in supporting student understanding with a goal of student recruitment and retention.

An additional challenge traditionally faced by students and instructors of the built environment is that while design students are bound by geography, notable works of architecture and novel design solutions exist the world over. As such, instructors routinely refer to works of spatial complexity that are not readily available for the student to explore in first-person. Immersive virtual reality environments allow students an opportunity to virtually inhabit notable works of architecture from the classroom. Exploration in a virtual learning environment “provides users with experiences they would otherwise not be able to experience in the physical world.” (Mikropoulos & Natsis 2011).

2. METHODS

Owing to the findings of prior research (Merchant et al. 2013, Lee & Wong 2014) this study hypothesised that those students with an inherently low spatial aptitude would see the greatest benefit from the use of a virtual reality model to investigate the spatial complexity of a work of architecture.

The following section describes the pilot phase of a study designed to test this hypothesis. This phase primarily intended to review the test methods and replicability; as such the sample size is intentionally low. The data collected was of secondary importance as a full rollout of this study is underway. The limitations inherent in this study due to these factors are presented in the Discussion section.

First-semester students in an interior design program accredited by the Council for Interior Design Accreditation in a public liberal arts college in a Mid-Atlantic U.S. state were used as a population for the pilot phase of this study. Students were anonymised and were administered the Purdue Spatial Visualisation Test: Visualisation of Rotations (PSVT:R) in an effort to quantify their inherent spatial aptitude. The PSVT:R is a standardised psychometric tool in which “the respondents’ task is to mentally rotate an object in the same direction as indicated visually in the instructions, and then to select an answer from among five possible options” (Maeda et al. 2013). It has been successfully used in the past in a variety of contexts, including to assess readiness of engineering students for higher-level study (Maeda et al. 2013).

For this pilot study, data was collected from 16 respondents. Students were given a maximum of 25 minutes to complete the 30 questions of the assessment, consistent with prior standardised uses of the tool (Maeda et al. 2013). Approximately 2 weeks prior to the study, students were asked to

complete the PSVT:R. Results were scored as a dichotomous variable (1 for correct, 0 for incorrect). Out of a possible 30 points, scores for this test ranged from a low of 3 to a high of 25.

PSVT:R scores were then sorted sequentially from low to high. Every second student was placed in one of two groups such that each group had a representative range from low score to high score. The goal of this was to attain an equivalent range of low to high scores in each of two groups. As a result, Group A was formed with an average score of 16.5 and Group B was formed with an average score of 15.4.

Participants in the control group (Group A) were provided a paper packet including a written description of a historically notable work of architecture and traditional means of architectural representation: photographs and orthographic floorplan, section, and elevation drawings. Students were provided 25 minutes in which to conduct a self-paced investigation of the building, and were informed that they would be quizzed on their understanding of the building at the conclusion of the study.

Group B was provided the opportunity to investigate the study site in virtual reality. To facilitate this process, all study participants had been provided prior instruction on downloading an application called qrVR on their personal smartphone devices. This application has been developed by Kubity, Inc. and allows digital models developed using Trimble Sketch-Up or Autodesk Revit software to be explored in an immersive virtual environment using a smartphone. Participants in Group B were provided with a Google Cardboard compatible viewer headset and were given brief instructions on the loading, setup, and navigation of the virtual model using their personal smartphone devices. Following these instructions, Group B was also provided 25 minutes to explore the study site in virtual reality.

The site selected for this study was Villa Savoye designed by LeCorbusier (1929-31). The site was determined to be suitable for the study due to a variety of factors, including building size (navigable within a short period of time), spatial complexity (elements within the building were sufficiently novel so as to require some effort in investigation), and notability (the building is a staple of architectural education and is beneficial for students to understand). The notability of the building also ensured that sufficient documented analyses of the building were readily available for inclusion in the Group A packet. The texts selected for the packets were excerpts from two texts: LeCorbusier 1910-65 by Boesiger & Girsberger (1967) and Walking through Le Corbusier by Baltanás (2006).

Following the self-paced investigation by each group, participants were asked to complete an online questionnaire. The questionnaire was designed to evaluate student understanding of the constructed space of the building quantitatively through the use of multiple choice questions. This was followed by a series of open-ended qualitative questions to evaluate the students' experience in attempting to understand the study site. This method of phenomenological research is consistent with the work of Colaizzi (1973) in the field of education and psychology. In Colaizzi's work, students were subjected to a series of tasks, including laboratory tasks and academic reading, and subsequently invited to share their experience in a questionnaire that included both closed and open response questions (Richardson 1999).

After 14 questions, students were asked to pause and await further instructions. Finally, each group was given the opportunity to explore the study site using the method assigned to the opposite group after which students were asked to return to the questionnaire, comparing the experiences and preferences of one method over the other.

3. FINDINGS

Initially, the range of scores of the PSVT:R (3-25 of a possible 30) with such a small sample size was encouraging and the attempt to equalise Group A and Group B with respect to the PSVT:R scores appeared to work. The average score of Group A (16.5) and Group B (15.4) were as equivalent as possible given the sample size. However, there were a number of student absences on the day that data was collected, causing the effective score to be unbalanced. Group A had an effective average score of 17.5 while Group B had an effective average score of 14.125. It is believed that this mismatch in the average spatial aptitude of the groups is a factor in the ambiguous results referenced later. As mentioned, this anomaly is largely the result of using such a low number of participants in this pilot test and it would likely be a non-issue with a larger dataset.

In this study, median split was used to classify participant as having high spatial visualisation aptitude or low spatial visualisation aptitude. This provides a rough way to categorise learners with different spatial abilities (Lee & Wong 2014). Six students achieved a score lower than the midpoint of possible points on the test (0-15 points) and were considered to have "low inherent spatial aptitude." Similarly, ten students with a score higher than the midpoint of possible points (16-30 points) were considered to have "high inherent spatial aptitude."

The quantitative portion of the questionnaire included multiple choice questions designed to evaluate the students' familiarity with the Villa Savoye, including such easily-recognisable items as the number of above-ground floors, the number of bedrooms on the second floor, adjacency questions, primary means of circulation, and other similar spatial concepts. The questions were specifically designed to reference reasonably easily identifiable building features. All quantitative questions included a correct answer, one or two incorrect answers, and a "don't know/not sure" neutral option. When scoring this portion of the questionnaire, the following scale was used:

Table 1: Scoring for quantitative portion of student questionnaire

Student Response	Point Value
Correct answer	+1 point
Neutral/not sure	0 points
Incorrect answer	-1 point

Following the scoring of each participant the total study average score was 2.19 of a possible 9 points. The average for Group A (paper packet) was 3.38 and the average for Group B (VR) was 1.00. The average score for all students with a low inherent spatial aptitude – disregarding group designation – was 1.17, while the average score for all students with a high inherent spatial aptitude was 2.80.

Breaking up each group into high- and low-spatial aptitude learners yielded the following results:

Table 2: Scores of quantitative post-test questions by spatial aptitude

Study Segment	Average Score
Group A – Low inherent spatial aptitude	4.00
Group A – High inherent spatial aptitude	3.17
Group B – Low inherent spatial aptitude	-0.25
Group B – High inherent spatial aptitude	2.25

According to the hypothesis, the group that was expected to benefit the most (VR investigators with a low inherent spatial aptitude) appeared to benefit the least. Additionally, the virtual reality group as a whole performed significantly less well than the control. This apparent contraindication of the study hypothesis will be reviewed in greater detail in the Discussion to follow.

After completing the quiz designed to gauge student understanding of the physical environs of the building, participants were asked to provide

responses to questions related to their impressions of virtual reality as an educational tool, some of which were open-ended.

Participants were asked how thoroughly they felt they understood the building on a four-point range including Not at all, Not very well, Somewhat well, and Very well. 62.5 per cent of Group A respondents indicated “not very well,” while 37.5 per cent of respondents selected “somewhat well.” Group B seemed to indicate greater confidence in their understanding, as 62.5 per cent of respondents indicated “somewhat well” and 37.5 per cent selected “not very well.” On average, students with a low inherent spatial aptitude in Group B felt as though they understood the building “somewhat well” while those with low inherent spatial aptitude from Group A felt as though they understood the building “not very well.”

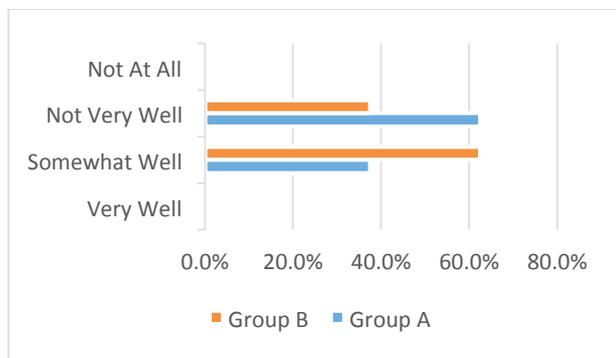


Figure 1: How thoroughly do you feel you understood the building?

Next, participants were asked how difficult it was to understand the spaces within the building. Again a four-point range was provided including Extremely difficult, Somewhat difficult, Somewhat easy, and Extremely easy. 75 per cent of respondents from Group A indicated that understanding was “somewhat difficult,” while 25 per cent selected “somewhat easy.” 62.5 per cent of Group B indicated understanding was somewhat or extremely difficult, while 37.5 per cent selected somewhat or very easy. On average, students with a low inherent spatial aptitude in Group B reported the difficulty level in understanding the spaces as “somewhat easy,” whereas the average student with low inherent spatial aptitude in Group A reported a difficulty level of “somewhat difficult.”

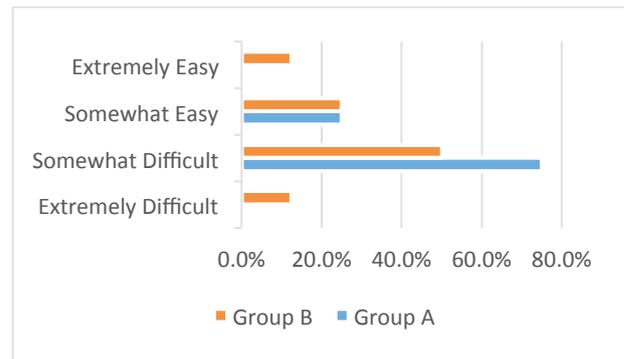


Figure 2: How difficult was it to understand the spaces within the building?

In an effort to gain understanding of the comfort level of students with each method of instruction, participants were asked how comfortable they felt with the experience of learning about this building. In Group A, students were equally comfortable as uncomfortable, as half of respondents selected extremely or somewhat comfortable, and half selected somewhat or extremely uncomfortable. On average, students with a low inherent spatial aptitude in Group B reported their comfort level as “extremely comfortable,” whereas students with low inherent spatial aptitude in Group A reported their comfort level as “somewhat comfortable.”

Following these questions, students were given an opportunity to provide open-ended responses. The first open-ended question asked students to describe the benefits of learning about buildings through the use of their assigned method. Students in Group A, learning from a paper packet including written descriptions, photos, and drawings, appreciated the ability to see spatial relationships and geometric arrangements. One student lauded the benefits of the abstracted representations as encouraging them to think more and demanding their attention to gain understanding. One student mentioned that a better understanding of architectural symbols would have aided in understanding the building.

Students in Group B appreciated the ability to “inhabit” a building they were physically unable to visit. They felt it was a good way to understand the complexities of circulation and how large a building can feel despite its low-slung outward appearance. Several students cited the ability to explore the spaces being of particular benefit, as well as the ability to self-select a point of view.

Students were then asked the challenges of learning about buildings through their respective assigned method. Students in Group A felt there wasn’t enough information to gain an understanding of the spaces they were being shown. They felt the written components were

overly verbose and didn't describe the spaces in a way that was helpful to aid their understanding. Several students mentioned they did not get a "feel" of the space, that interpreting 2D media as 3D space was particularly difficult.

A majority of students in Group B mentioned a feeling of dizziness. Several also mentioned feeling overwhelmed by the amount of information contained in the space. One student mentioned experiencing no challenges at all, while another notably mentioned feeling "very lonely."

At this point of the survey, students were asked to pause and investigate the same building using the alternative means of exploration. Briefly, participants in Group A explored the project in virtual reality while Group B participants investigated the building using traditional methods of representation.

After experiencing both methods of representation (traditional and VR) students were asked to cite specific advantages of virtual reality. Group A participants, almost unanimously, found the ability to walk through the space as the most significant advantage to virtual reality. Group B participants agreed, elaborating that the ability to change one's viewpoint is superior to being given fixed images. One student simply stated, "it is more interesting."

Students were then asked to provide the specific advantages of the traditional modes of representation seen in the paper packet. Group A participants appreciated being able to perceive the building in its entirety. One student appreciated the written description of the space. Group B participants agreed, stating that it is faster to gain an understanding of the entire building than virtually walking through each space, with the caveat that it is necessary to understand how to correctly read floorplans for this method to be of maximum benefit. One student commented that seeing the real textures and materials in the photos was helpful.

Finally, in response to whether more integration of virtual reality in their studies would be recommended, all students answered affirmatively. Some students even indicated their interest in greater use of virtual reality despite the dizziness or physical discomfort they personally experienced.

4. DISCUSSION

Although the results of the data collected during this phase of the study and presented in Table 2 appear to contraindicate the hypothesis, the variables discovered as a result of the small sample size (as outlined above) neither prove nor disprove the hypothesis at this time. As such, the hypothesis will remain intact during full rollout of the study and will be evaluated after the collection of a larger dataset.

Interestingly, however, researchers Lee and Wong (2014) considered an alternative hypothesis in which the high spatial ability learners would see more benefit of virtual reality than low spatial ability learners. While their research ultimately rejected this hypothesis (and the data collected in this study to date does not yet provide cause to alter the working hypothesis), the existence of an alternative model will be revisited as the study progresses. A summation of the competing hypotheses are provided in Table 3.

It should be noted that one outcome of this pilot study is the contradiction between the results indicated in Table 2 and the impressions of the students indicated in Figures 1 and 2. From this data it would appear that students believe they attain a greater understanding of the building through the use of VR when in fact the scores indicate that the opposite is true. This phenomenon will be monitored in the subsequent phase of this study. Should this phenomenon persist, there is a concern that the use of VR actually might be counterproductive for spatial investigation in that students may feel an unfounded confidence in their level of understanding.

At the conclusion of the pilot study, a review of the survey tool as designed has indicated that a few revisions to the wording of the open-ended questions would be appropriate. For example, the goal of 'learning about buildings' through this method is used inconsistently and requires clearer definition. Also, the term 'virtual reality' isn't used until the end of the questionnaire. While it was certainly mentioned in the instructions to the students prior to the test, it should be used more consistently to help participants refer back to the technology being studied. Aside from these minor revisions, the questionnaire appears to have attained the desired information.

Table 3: Relationship of spatial ability to virtual reality instruction under two competing hypotheses as discussed in Lee & Wong 2014.

	High spatial ability learners	Low spatial ability learners
Ability-as-compensator hypothesis	No particular benefit of VR instruction, since learners are able to reconstruct their own mental representation without the need for the scaffolding offered by VR. (Huk 2006, Mayer 2001)	Receive the most benefit from VR-based learning because they do not have an inherent ability to reconstruct spatial complexity mentally and will see particular benefit from the scaffolding offered by VR. (Mayer 2001)
Ability-as-enhancer hypothesis	Should see significant benefit from VR-based learning due to significant mental capacity remaining to facilitate mental model reconstruction (Huk 2006, Mayer 2001)	No particular benefit from VR-based learning since this environment requires "cognitive capability that exceeds the available memory resources (Mayer 2001)."

A number of limitations were identified in the study. First, the participants in this pilot phase of the study represented too few participants for the results to be generalisable. Currently, the generalisability of the results is limited to only those students included in the study. During this pilot phase, there was more emphasis placed on setting up the system by which the study could be replicated in the future than on gathering a substantial amount of data. As this project continues and more participants are engaged, a more representative and generalisable sample will be available.

Additionally, it is unknown at this time whether the self-paced methodology of the study in both the traditional and immersive virtual environments is sufficient scaffolding for students. This study does not address a comparison of a “virtual tour guide” means of exploration to the self-paced “wander” means, nor does it compare an instructor-led discussion to the self-paced discovery using traditional means of representation. Indeed it could be argued that the text description accompanying the drawings and photographs in the paper packet first investigated by Group A provided a context for that group that was unavailable to the participants in Group B. The availability of information consistently to both groups will be revisited. A comparison of open self-paced wandering and virtual tour guide or stepping stones may be fruitful areas for further study.

Finally, this study did not sufficiently address the novelty factor associated with VR as identified by researchers Lee & Wong (2014). In spite of the enthusiastic responses from students to the use of this technology in the classroom, it is unknown from this study whether repeated projects making use of virtual reality would continue the level of enthusiasm or whether the novelty of the technology would eventually dissipate.

5. CONCLUSION

Though the sample size of the limited pilot study described here prevents generalising the data, some interesting results were nonetheless received. Students expressed near-universal enthusiasm for using VR technology as part of their curriculum and a desire to use it in the future. Unfortunately, this enthusiasm was not reflected in the level of understanding attained regarding the spatial complexity of the study site. This seems to indicate the possibility that the students’ strong positive reaction to the technology was a reaction to the novelty of the technology rather than to the students’ perception of a greater degree of understanding. This will be considered and

monitored upon continuing with the next phase of the study.

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The Acquisition of Design Skills: A Hybrid Practice in the Digital Age

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Learning through doing, when learning software not only makes the skills last longer, but they also encourage design intuition, which is essential for the professional. This paper suggests ways in which design education may continue to develop and improve in an increasingly digital world.

Digital natives, digital immigrants, technological determinism, technological change

1. INTRODUCTION

Technological determinism is discredited by theorists and academics that think cultural materialism is a more compelling argument. (Williams, 1975; MacKenzie and Wajcman, 1988; Jones, 1988) Prensky (2001) introduced the terms 'digital native' and 'digital immigrant' to decipher between those born into the digital age and those born before it.

These terms are generalisations and suggest that technology alone is responsible for how these people act, think and learn. Despite the terms used, his argument that teaching methods are no longer fit for purpose is one that many agree with (Oblinger and Oblinger, 2005; Helsper, 2009). Policymakers and academics are trying to find a way to provide a more successful learning experience for students born into the digital age. However, this does not mean that what was taught before is no longer relevant, it just means that the method for doing so may need to be adapted to integrate digital skills to create a hybrid approach to teaching.

This paper will briefly discuss the debate between technological determinism and cultural materialism by reviewing relevant literature. Auto-ethnography will be used to explore the experience of the author as a digital native and her experience with design education, which will inform her PhD research. This will then be analysed to suggest ways in which design education may continue to develop and improve in an increasingly digital world where educators must ensure that heritage practices do not disappear.

2. LITERATURE REVIEW

For the following research, there exist two particularly relevant contrasting theories about the relationship between technology and society. These theories are 'technological determinism' (Toffler, 1971; Lyotard, 2001; McLuhan, 2001) and 'cultural materialism' (Williams, 1975; MacKenzie and Wajcman, 1988; Jones, 1988).

Murphie and Potts (2003) explain that technological determinism is both a theoretical position and a popular attitude. They say that technological determinism treats technology as it's own entity, which has it's own development and own set of consequences. They define it as the belief that if a successful development in technology is implemented sufficiently it will impact society.

Many argue that well implemented technology does impact society. Havelock (1963) illustrates this when he discusses the importance of technology in bringing the thoughts and ideas of Plato into the 20th century through writing. Eisenstein (1980) also explains the importance of the technology in the form of the printing press in changing the way people learned and developed. Goody (1977) concurs and thinks that technology such as print and electronic media is and will be transformative in the way people think and acquire knowledge. Levy (1997) appraised the digital networking that the Internet has facilitated which he argues will modify the intellectual ecology of society. Conversely, Jones (1988) says that the improvements and mass adoption of the motor car was not the revolutionary development that it is

often made out to be and that it was the economic and political decisions, which made it popular. Therefore it might be argued that all of the above examples, changed society because of their social, economic and political contexts which have not been referred to in the examples.

Jordan (2008) explains that technological determinism is widely discredited because it treats technologies as asocial when any technology can be shown to have been developed as a response to a societal need. He points out that although technological determinism fails as a theory its impact on the daily lives of citizens cannot be denied as it is highlighted in personal experiences of technological failures. He then says that cultural materialism never treats technology as being independent but always positions it in its social and political context.

Prensky (2001) introduces the terms, 'digital native' and 'digital immigrant'. He uses these to differentiate between those born and brought up in the digital age and those who were born before the digital age. He argues that 'digital natives' think and learn radically differently from how 'digital immigrants' do. He says that this is because they have been networked for almost their entire lives and are not receptive to lectures, step-by-step learning and the vigorous testing culture, which exists in schools today.

Controversially, Prensky poses the question, 'Should the Digital Native students learn the old ways, or should their Digital Immigrant educators learn the new?' (Prensky, 2001). The way he situates these two groups as polar opposites has attracted significant criticism, not least for the way it suggests that the situation is impermeable. Facer and Furlong (2001:467) say that not all those who Prensky may classify as a 'digital native' are comfortable or confident using digital tools and assumptions cannot be made when referring to such a large and diverse group of people. Helsper (2009) argues that this 'distinction is not helpful and could even be harmful.' Educators may assume that a child has relevant digital skills and knowledge, which depends on exposure and experience instead of when a child was born (Facer and Furlong, 2001:467; Helsper, 2009).

Additionally, Helsper's research shows that up to the age of 65, people regularly use digital technologies for a vast array of tasks. The difference between the 45-54 age group does not differ significantly from the 18-24 age group (Helsper, 2009). Therefore, to suggest that an educator is a digital immigrant could have a negative impact on their relationship with their students. Furthermore, Helsper (2009) points out that just because a 'digital native' uses the Internet

as their first port of call to find information, it does not mean that they can interpret or analyse that information well.

These statements and generalisations about the 'techy generation' can further the concept of technological determinism which over-shadows the perhaps more reasonable debate of cultural materialism. To suggest that advances in technology have changed the way students learn so dramatically that educators are no longer able to 'speak their language', Prensky (2001), furthers the perceived misconception that technology changes society independently from economic, social and political factors. Instead it would perhaps be useful to find the social developments, which create the necessary framework for new digital technologies to be widely implemented.

As Prensky suggested, a new method of teaching is necessary to engage with students who are digitally literate. Policymakers are implementing changes; education is embracing the digital to ensure that students learn skills necessary to compete on a global scale (Helsper, 2009). However, these changes in general education have impacted design education significantly.

Coorey (2016) says that design educators are torn between teaching theory alongside traditional skills and teaching the relevant technology, whether that is 3D modelling, film editing or image manipulation. Coorey identifies that if educators fail to teach the relevant technology to a high standard, 'a student will struggle to bring their concepts to fruition' (Coorey, 2016: 1).

Technologies change rapidly, which makes some of the learned knowledge obsolete very quickly (Macdonald, 2016). Valuable teaching resources are being wasted teaching students how to use technologies such as CAD software. Educators may struggle to keep up with the changes and therefore the quality of teaching may drop.

Furthermore, considering the theory of cultural materialism, the technologies are causing a shift in education. The implementation of neo-liberal policies such as individualization and the consequential economic changes has led to the commodification of education (Karpov, 2013). This has identified what skills are most valuable and learning CAD to a high level can be easily traced to high paying jobs and therefore CAD and other digital skills may be considered as being of greater value to the economy (Amiri, 2015; Macdonald, 2016).

Digital technologies change quickly. It will become increasingly important for both educators and

students to take responsibility to continually update and develop their own skills.

To instil this agency in students, the teaching of soft skills, such as learning to learn software might be deemed as more important than learning specific software. However, due to the increasing commercial need for graduates, fluent in a variety of software programmes, to meet the demands of the growing industry, educators are expected to prepare their students to fill these positions upon graduation. This means that the teaching of digital skills is being afforded more resources, at the expense of traditional skills. A solution to this might be hybridization.

The concept of hybridization of aesthetic, language and expression in design is recruiting an increasing number of academics, educators and practitioners. These include Greiman (1990), Manovich (2007) and Macdonald (2016).

This type of hybridization is the mixing of heritage practices with new digital practices. This may be thought of in its most basic form as a way of mixing images, which were created using different processes. However, Manovich (2007) explains that it is not just different forms of media, which are being mixed but also different techniques, methods and expressions. This elaboration of the possibilities of hybridization suggests that hybridization encompasses more than the mere aesthetic of a design.

Macdonald (2016: 3) explains why hybridization is important in the preservation of traditional skills. He says, "Now is the time to ensure that heritage skills do not atrophy and wither, but that their qualities and provenance are understood as potent components with digital practices in new hybrids." He observes that those born in the digital age are keen to challenge the ubiquity of the digital by using analogue practices (2012). These afford the ability to manipulate the result to create endless possibilities for mixing and remixing.

Greiman is an example of an influential practitioner, educator and academic who, through her work and writing has inspired students and professionals to embrace the hybrid approach. Her examination of typography and colour as subjects in time and space depict the way she mixes technology with graphics (Motrunecs, 1990).

It may be argued that in an increasingly mediated, digital world, there is both the expectation and the appetite to rekindle an appreciation for traditional skills and use these in new ways with the digital tools now available. In education, where the need to justify the economic value of skills is having an impact on the skills which are taught hybridization

offers a solution. Digital skills, which are perceived as being of high economic value, can be taught alongside traditional skills to form a hybrid. Students will be digitally literate and able to compete in a digital orthodoxy while preserving heritage practices. Additionally, this mix of past and future creates a unique aesthetic with limitless possibilities.

3. METHODOLOGY

The author can be defined as a 'digital native', born in the digital age and confident in using a wide range of digital tools. There is little evidence of any existing literature, which considers a digital native's experience of design education. Therefore, a mini auto-ethnography would be considered to be an appropriate method to allow her experiences to be explored in a meaningful way. Jones et al. (2013) explain that there is an absence of real stories from the perspective of the author in academia. Additionally, the experience referred to in the auto-ethnography took place between 2011 and 2014 and so the memories are relatively recent. The mini auto-ethnography presented in this paper is an edited version in order to discuss only what is directly relevant to this research.

4. A DIGITAL NATIVE'S EXPERIENCE OF DESIGN EDUCATION

I studied product design for three years. The classes were made up of both traditional design classes such as drawing, hand rendering and card or foam modelling and modules aimed at teaching software. The software taught included; Adobe Photoshop and Illustrator in first year; Solidworks and 3DS Max in second year; and Google SketchUp and Arduino in third year.

Now, a few years later, I would consider my Photoshop, Illustrator, Google SketchUp and Arduino skills to be as good as or better than they were at the end of the module. However, my Solidworks and 3DS Max skills have atrophied significantly, to the extent that I would no longer consider myself as having usable skills in either of those software programmes.

On reflection, I notice that the way that the aforementioned software was taught differed. In first year, our semester was split into two, which meant that approximately six weeks were spent learning Photoshop and the next six were spent learning Illustrator. At the first class we were given a brief demonstration of some of the most commonly used tools from each program. We were to design a visual layout for the BBC news app in

Photoshop and then a poster for a holiday destination in Illustrator. There was a PhD student teaching assistant who was there during the classes to give anyone help if they needed it. Apart from that though, we were left to explore the software.

In second year we were taught to use Solidworks first and then 3DS Max. In each of these modules we were given tasks to complete. For Solidworks, we were to copy a blender; we measured the blender, took angles and learned how to use the software to produce an exact replica of the casing of the blender. One thing that the lecturer said which I still apply to my work today is, "Don't let software limitations limit your design potential. If you can't get the software to do what you want, learn how or use a different software if it's not possible." In 3DS max we were given the task of designing a wheel, which could then be animated. In this case, as a whole class we sat on our laptops and followed the step-by-step instructions from the screen to create our own, identical wheel that appeared to turn on-screen.

In third year we learned to use Google SketchUp and Arduino. In the case of Google SketchUp, the lecturer took the same approach as we had been taught with in first year. We had to design a temporary street booth, which might sell newspapers or flowers. In this case, were left for four weeks to design and explore the software alone. However, when we were taught to use Arduino software and hardware, the lecturer spent the first lesson going through some basic coding and showing us how to wire the Arduino to use various components such as LEDs, resistors and sensors. This was similar to how 3DS Max was taught in second year. After this introduction though, the classes for the rest of the module were less structured and allowed for more creative freedom and exploration. The lecturer curated our learning by setting us the task of using a variety of predetermined components to create small interactive design projects for the following week.

5. ANALYSIS

The way that Photoshop, Illustrator and Google SketchUp were taught followed a 'just-in-time' educational model, which Gershenfeld (2007) describes as teaching what needs to be learned as and when it arises instead of the 'just-in-case' model which teaches a predetermined curriculum which educators hope will include things which may be useful later. The 'just-in-time' method has repeatedly been acknowledged as being important when learning something new. (Montessori, 1964; Schank, 1995; Macdonald, 2016) Although the setting of particular assignments might be

construed as nonconstructivist, in a formal education context it is difficult to ensure some success is achieved and therefore the assignments might be considered as the curation of learning, not the dictation.

The hybrid approach used to both learn and teach Arduino combines the more traditional teaching methods as illustrated in the learning of 3DS max, the 'just-in-case' model with the 'just-in-time' education model that Gershenfeld (2007) discusses. In a time of change where educational policy cannot always respond quickly to innovation, this hybrid approach may allow more freedom within teaching. This ensures that students learn what they need to, to satisfy policies but they also have the freedom to apply this knowledge in unique and creative ways.

Additionally, due to the freedom afforded to them, when learning these skills students were able to improve their design thinking, ideation and develop their style and intuition. Although the creation of digital files in the software did not require much traditional hand skills beyond some sketches, the ability to develop concepts and professional instinct can be argued as being part of the traditional design skillset. Therefore, this can be considered as being a form of conceptual hybridization, essential in sustaining traditional skills.

The lack of fixed learning objectives is akin to Prensky's theory of edutainment. He poses that the best way for 'digital natives' to learn is through a computer game, which he says is a natural environment for the 'natives'. (Prensky, 2006) He mentions the game Monkey Wrench, which was used to teach engineers how to use complex CAD software. Although he admits that there have been few successful examples of edutainment. (Prensky, 2001) Despite the lack of widespread success, this further reiterates the acknowledgement that the rigid learning methods of the past are no longer appropriate. However, just because learning methods are no longer appropriate, it does not mean that processes used in design practice are no longer appropriate, instead it may be more important than ever to continue using traditional processes to ensure their longevity.

Solidworks and 3DS Max were taught by different lecturers and so the impermanence of these skills cannot be attributed to the teaching style of a specific lecturer. Additionally, it may be suggested that these software are more complex than the others and therefore, to maintain the skill it might be necessary to practice it regularly. The step-by-step learning style or 'just-in-case' model, as Gershenfeld (2007) frames it, is discussed by Prensky (2001). He describes it as being unsuitable for 'digital natives' and therefore it can be argued

that this style of learning is no longer suitable, especially not for those born into the digital age no matter the complexity of the software, unless it is used as a precursor to the 'just-in-time' model to form a hybrid learning experience. Finally, the quote from the lecturer who taught Solidworks can be viewed as a being opposed to the technological determinist position. This educator was empowering the students to ensure that they did not betray their integrity as designers by succumbing to the software.

6. FINDINGS

Learning through doing, when learning software not only makes the skills last longer, but they also encourage design intuition, which is essential for the professional. Perhaps only conceptually, this too is evidence of hybridization, taking parts from the traditional skill set and using this for digital file creation. As Macdonald (2016) argues, designers can learn technical skills but they also have to develop an attitude and way of working which will allow them to solve problems and work beyond what they are comfortable with.

Presently, there is a strong hybrid aesthetic in graphic design as traditional images and footage can be digitally manipulated to create a bricolage of the traditional and the digital. However, product design has not yet been democratized to the same extent as graphic design and therefore a hybrid aesthetic of the traditional and the digital has not really made its way into product design. However, with micro-manufacturing tools such as 3D printers becoming more affordable and accessible there is now the opportunity to have this new aesthetic alongside the conceptual hybrid, which will ensure that traditional handcraft skills such as model making are not lost. The 3D printing education service, Wee Replicators is experimenting with this by using plasticine and a 3D scanner. Their 3D scanner is basic and made from an Arduino and by hacking a standard webcam and laser pen. Thus, it shows that this is a very affordable method of hybridization. The author's company, Wee Replicators works mainly with children. The children can make a model out of plasticine, 3D scan it and then 3D print their design. (Figures 1-4) All of which can be done relatively quickly allowing as many iterations of their design as they like. Though Macdonald (2016: 39) did not necessarily mean it literally when he said, "the mark of the designer is evident" when referring to digitally produced hybrids, in the example from Wee Replicators, the mark of the designers and makers is evident in the way their fingers imprinted the plasticine and are then carried forward into the well finished 3D printed object which represents a manufactured artefact. These marks show that a

human made the object and that though they may not be intentional, they convey the imperfect, but beautiful process of traditional handcraft.



Figure 1: Plasticine model (Wee Replicators, 2016)

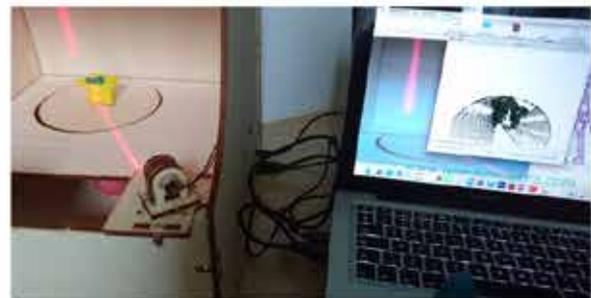


Figure 2: Plasticine model being 3D scanned (Wee Replicators, 2016)

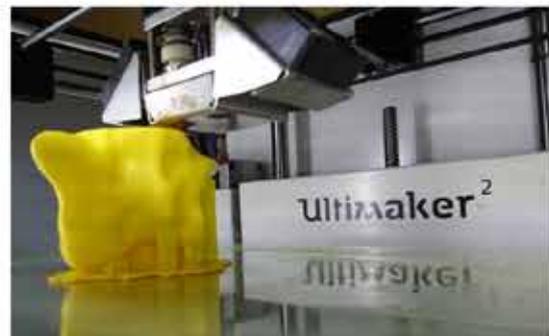


Figure 3: Digital file created from 3D scan being printed (Wee Replicators, 2016)



Figure 4: Finished artefact, with evidence of the maker in the form of indents and imperfections (Wee Replicators, 2016)

Therefore, from a pedagogic standpoint, perhaps software skills should be taught using a less structured approach to allow for more creative freedom and exploration so that students learn the software for themselves, which as has been suggested in the autoethnography, may make the skills more meaningful and therefore last longer.

Additionally, Macdonald (2016) says, those born into the digital age are curious and eager to explore traditional processes due to their tactile qualities and the time they allow for creative thought and experimentation. Therefore, perhaps model making beyond just plasticine, to include card, foam and even wood could be used as the basis for a digital file, which can then be altered using CAD software. Currently, digital fabrication tools such as 3D scanners and 3D printers are limited in their abilities. However, they will continue to improve and become easier to use with better results. When this happens, students and practitioners can be ready to exploit the technology to create beautiful and innovative designs combining both heritage practices and digital skills.

Design and design education is pushing the development of technology so that it can better serve the industry, thus further discrediting technological determinism.

7. CONCLUSION

With the economic pressures on art and design education, digital skills are being allocated more resources in place of traditional skills. Educators must ensure that their students are digitally literate and confident in using an array of software. However, it may be argued that the desire to provide students with a range of complex software skills has led to the adoption of methods, which teach students a process in a way that is not authentic. Furthermore, from the auto-ethnography and evidence from the work of others (Gershenfeld, 2007), learning software by exploration might be a way in which students can acquire authentic skills, which will not atrophy. Additionally, hybridization can bridge the design skills from the past with design skills from the present and future. This will allow design education to present itself as being valuable to the economy, which will attract funding, while maintaining its integrity and authenticity. The hybrid aesthetic has already been embraced in graphic design. However, in product design it is yet to make a significant impact. The work of some including that of Wee Replicators, propose how the hybrid aesthetic might infiltrate the industry. Macdonald (2016:38) says, "We seek to embrace a pluralistic approach that accommodates the sleek and perfected solutions but also the sublime accidents, the contaminated and the hybrid."

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Design Courses Applying Engineering Knowledge to PBL Style-Trials in a Taiwanese Design Department of University

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Engineering knowledge is the pillar of most professional industrial design, product design and interactive design of higher education. Students have to comprehend it when they would like to make their ideas become real creations. How to make the students learn more efficiently is important and also a challenge to teachers. In this paper, the authors present their teaching approaches, materials and achievements of a design course in Taiwan. They tried to develop the teaching material which can make a specific scenario with the PBL style, and built a platform for discussion and display on Facebook's private club.

Keywords: Design. Engineering Knowledge. Taiwan.

1. INTRODUCTION

Since design permeates and manifests itself in countless forms of cultural, economic, and technological activity, it is not hard to see how the explosive growth of the design industry in recent years, driven by the realization that design skills are both an essential requirement and a valuable asset for innovation and differentiation in the enterprise, in essence means that the design-oriented age has now arrived. Design college students are often partial to imagination and aesthetic matters, and the students are willing to spend much time to make their works more beautiful and amazing. For most professional industrial design, product design or even interactive design, however, engineering knowledge is necessary and that means the students have to comprehend it when they would like to make their ideas become real creations. In Taiwan, most courses of industrial design program are like PBL(Project Based Learning) style and they often involve various categories of fundamental engineering knowledge, such as mechanics, materials science, electronics, program coding, etc.; however, most of the industrial design students are afraid of the engineering learning because they consider that it always is full of mathematical equations and complicated calculations. Therefore, some of the important basic engineering courses were gradually removed and the students lost

chances to learn engineering knowledge with the lead of teacher. This change made the program easier and more friendly to the students, but it also reduced the ability of the students to resolve problems and realize their ideas.

The author's department, Innovation Design Engineering, was founded in 2012, and the first freshmen were recruited in autumn 2013. The department was in the category of industrial design of Taiwanese design academy. Different from other industrial design department in Taiwan, the program of the department of was combined aesthetics and engineering, several required and elective courses were arranged to support core design courses which are the most important in each semester. (Each semester involves one core design course generally, including Fundamental Design I/II, Product Concept Design I/II, Product Design I/II, and Monographic Product Design I/II.)

Due to the financial support of Taiwanese government, the authors and their research team have spent several years on problem-solving (Chang & Chen 2004, Chang & Ko 2006, Chang & Chang 2013) and design imagination (Chang et al., 2013, Chang & Lin 2013, Chang 2015). Furthermore, some achievements (Charlesworth 2008, Chu 2012, De Cruz & De Smedt 2010,

Donnelly 2004, Folkmann 2014, Karwowski & Soszynski 2008, Liang et al. 2012) gave the authors hints to investigate the design imagination development with creativity in higher design education. Therefore, the authors consider that the engineering knowledge is one of the pillar to design, and the design students should learn enough engineering knowledge for their design works. In this paper, the authors would like to share the recent teaching and research achievements of the PBL style design courses which applying engineering knowledge.

2. COURSE CONTENT AND IMPLEMENT

The authors' trial course is "Fundamental Design Engineering," which is a required course in the second year with 2 credits and 2 hours per week. This course is the first course which is closed to pure engineering knowledge and application for the students in their four-year learning. The purpose of the course is to introduce the general engineering knowledge and basic engineering application for the requirements to core design courses. The teacher of the course is expected to bring the knowledge such as basic structural mechanics, mechanism applications, circuit applications and program coding skills for specific corresponding product design projects. Usually, the teacher leads the students learning through one or two projects, one is elementary and the other one is advanced. In this paper, the authors would like to share two achievements, the first is a buckle design project and the second is an interactive device project; the former one is elementary and another is advanced.

2.1 Buckle design project

This project was in the last year. In this project, first, the authors would like to deliver basic buckle design guidelines, which involves criteria about geometric relationships and constraints of cantilever beams, to the students. Each the students should make their own elaborate design ideas of buckle under acceptable engineering performance through several one-by-one discussions with the author. Next, the authors also instructed the students to realize the design ideas, i.e. to fabricate it. Because all of the students took another required course, named "Computer Aided Design" in the same semester, they learned how to construct complete 3D models following their own design ideas of buckle. Furthermore, 3D printing technique is more and more popular, and it is conducive to making sample products, even finished product. The authors planned to lead the students fabricate their own buckles through the 3D printer. During the process of 3D printing, the students had to comprehend the limitation of performance of the printer, and find out the know-how to print perfect buckle product.

2.1.1 Beginning by a scenario with a PBL style

As other PBL courses, the project of the course needs a good scenario to arouse interests of the students. The scenario is: each the student were supposed a younger design student who is always love to make new product with his/her own style. One day a buckle of his/her backpack was broken, and he/she decided to design and fabricate a new one. For the purpose, he/she would survey several existent buckle products with special style or function. The students were assigned to collect at least three different buckle products and explain what their features and functions respectively are.

2.1.2 Introducing engineering design criteria

Through the information collection, the students knew that the general geometry of buckle was usually an arrow-shaped head component and a seat component; however, they often did not know how to set suitable dimension for good connect and disconnect performance. For this reason, the teacher have to introduce the students the criteria of buckle design and they also need to keep the criteria in mind when making the drafts. The students were anticipated to spend more time to comprehend on it. The students often cannot blend harmoniously and grasp thoroughly, so that their new buckle design could be fascinating in good outline but short on connecting/disconnecting performance. The authors prepared teaching materials for general design criteria instruction as shown in Figure 1 (written in Chinese Traditional). The materials were compose of simplified and easy-to-comprehend contents and they were conducive to design students.

2.1.3 Thinking, sketching, discussion/modifying, and Modeling

After introducing the design criteria by the teacher, the students thought the outline of their each new buckle and sketch it. The more sketches were encouraged and the students also need to discuss the sketches with the teacher. Most of the buckle sketches were good-looking (freely depended on the students' ideas and without any constraint) but without practicality, the common problems were:

- (i) the dimension of their buckles did not satisfy some criteria.
- (ii) their buckles could not provide convenient operation.
- (iii) the head part and the seat part of their buckles could not cause an obvious "click" sound when connecting.
- (iv) the head part could not be pushed out from the seat part when disconnecting.

The author considered that this part was the most important and spent much time because most of the students cannot completely comprehend the general criteria and apply it to buckle design.

Generally, the final sketches of the students were come out after three or four discussions. After sketching, the students were asked to create their own model through CAD and 3D printing. FDM (Fused Deposition Modeling), one of the popular modeling approaches, is mature and conducive to the students. The teacher and a teaching assistant checked the students' CAD models even though the

students has learned the CAD course. Generally, the most difficult was how to avoid or reduce support parts, which were automatically generated by the software of 3D printer. The teacher and the teaching assistant delivered their experience to the students; therefore most of the students' buckles were successfully printed. The Table 1 shows part of the students' buckle products (totally 40 students).

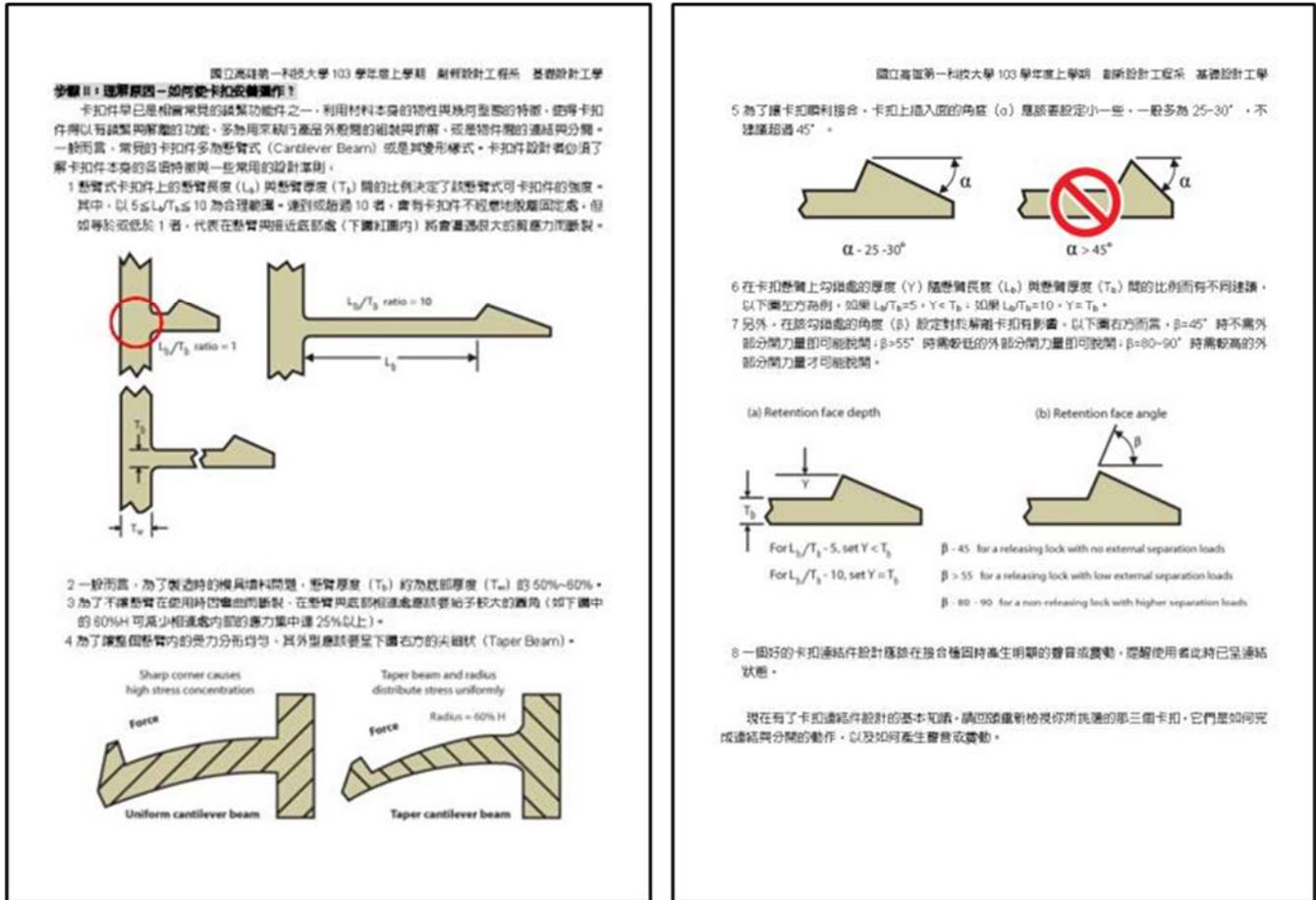


Figure 1: Teaching materials for buckle design (partly, written in Chinese Traditional)

Table 1: Students' CAD models and products in buckle design project (partly)

No	Head (CAD model)	Seat (CAD model)	Product by 3D printing	Features
1				To push the ears of the seat to act on the head for disconnecting.
2				The outline is like a shell when the head and the seat connecting.
3				The head and the seat have two-way connecting function.
4				Making obvious "click" sound when connecting.
5				Another one to push the ears of the seat to act on the head for disconnecting
6				Central guide is longer as one of the head's characteristic.
7				The ear part of head is hollow style.
8				Special triangle shape.

2.2 Interactive design project

This project was finished in this year. Through the experience of the buckle design, the authors would like to try an interactive design project which is more complicated to students. The students were asked to create a product which can make any “signal” by the “thumb up” times on their own fan page of Facebook. The students needed firstly to learn how

to communicate with the back end (server) of Facebook, and secondly make an automatic program to get the “thumb up” times for the reference to lighting signals of their products. Thirdly, the students needed to design how the lighting signals are on the Arduino system. They also asked to make their products use the chargeable battery and WiFi components, the use scenario is shown as Figure 2.

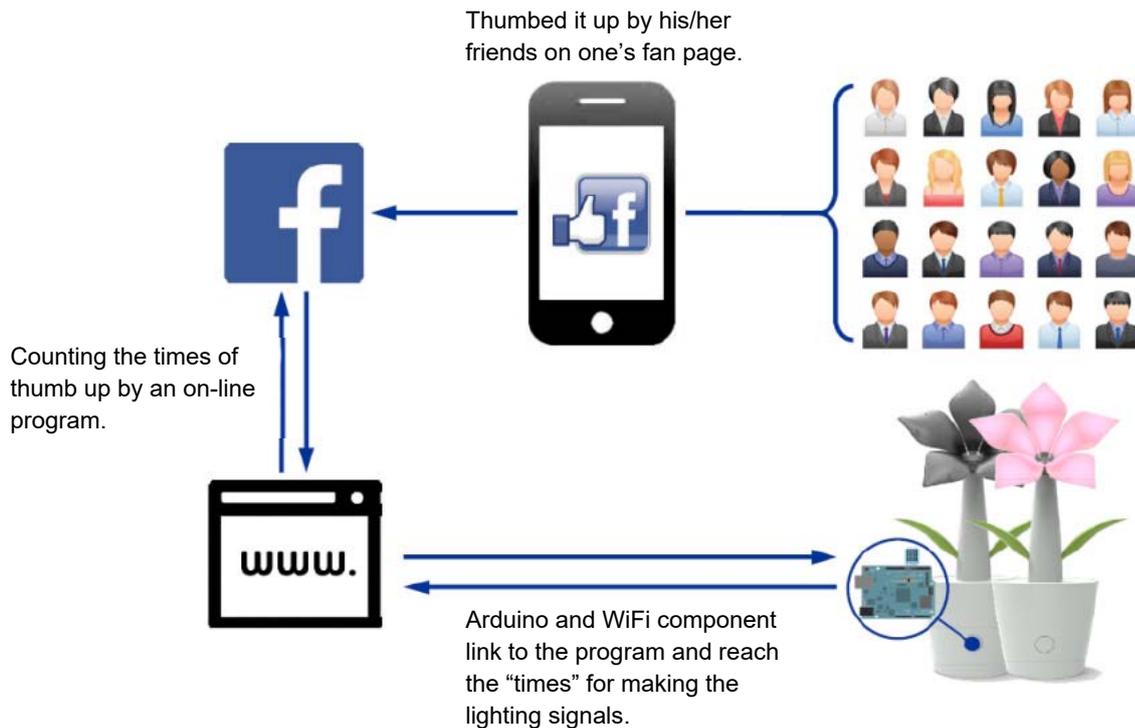


Figure 2: Scenario of the interactive project through Facebook and Arduino.

2.2.1 Introducing Facebook for learning and Discussion

Actually, this project was more complicated than the former one, therefore, the author really worried that the students could not complete all the learning activities especially in electronics and program coding. The authors tried to introduce Facebook's private club, as shown in Figure 3, as the discussion platform with all the students, and asked the 35 students organize 17 two-member groups (one

student made himself as a single-member group). All the groups displayed their own ideas, drafts, circuit layouts and movies of the products on the Facebook's private club page, as shown in Figure 4, that indeed stimulated the most students to make their own product better. Moreover, the authors invited two external experts, who were familiar with Arduino components and program coding, to help the students resolve the problem during the implement.



Figure 3: A private club of Facebook for learning the project. (written in Chinese Traditional)



Figure 4: A nice creation's video of group No.6 posted in private club of Facebook. (written in Chinese Traditional)

2.2.2 Approaches and materials to teaching, discussion, and inspiration

As the above-mention, this project was a challenge to both the students and teachers; for example, Facebook had made its security stricter and stricter, a person needs to apply the token (or permission) by several times and then he/she can reach the permanent token using the private information of Facebook. The authors and the external experts decided to make the teaching materials which involved basic template code to drive Arduino

components and communicate with Facebook's server. The teachers and the experts followed the materials and also showed couples of other applications at the mean time in class. The materials were expected to inspire the students to discover more commands for coding even the most students never touched program coding. Figure 5 shows that one expert explained the process to gather the information from Facebook, and Figure 6 shows that another expert guide the students using the Arduino components and the corresponding commands.



Figure 5: An expert explained how to gather the information from Facebook.



Figure 6: Another expert guided the how to select the Arduino component and the corresponding program coding.

2.2.3 Drafting, modeling, testing and displaying by students

The Facebook provided the project to restore all the achievements of each group, including concept drafts, circuits layout diagrams, testing video clips, etc. The experts also gave their suggestions through the email and on-line messenger communication. For example, the group No. 6 was well-performance, the two students wanted to make a faucet-like object work as the signal when their fan page was thumbed up by others. They tried to install a servo motor and

a LED strip to simulate the faucet switched on. Figure 7 shows the achievements in each step from concept draft (left), circuit and component layout (middle), and 3D printing prototype (right). Most of the group completed their own products and passed the test (16 out of 18), and all their achievements were asked to upload to Facebook club page. The achievements can be regarded as demonstrations to other students and encourage them make better products. Figure 8 shows the products of other groups.

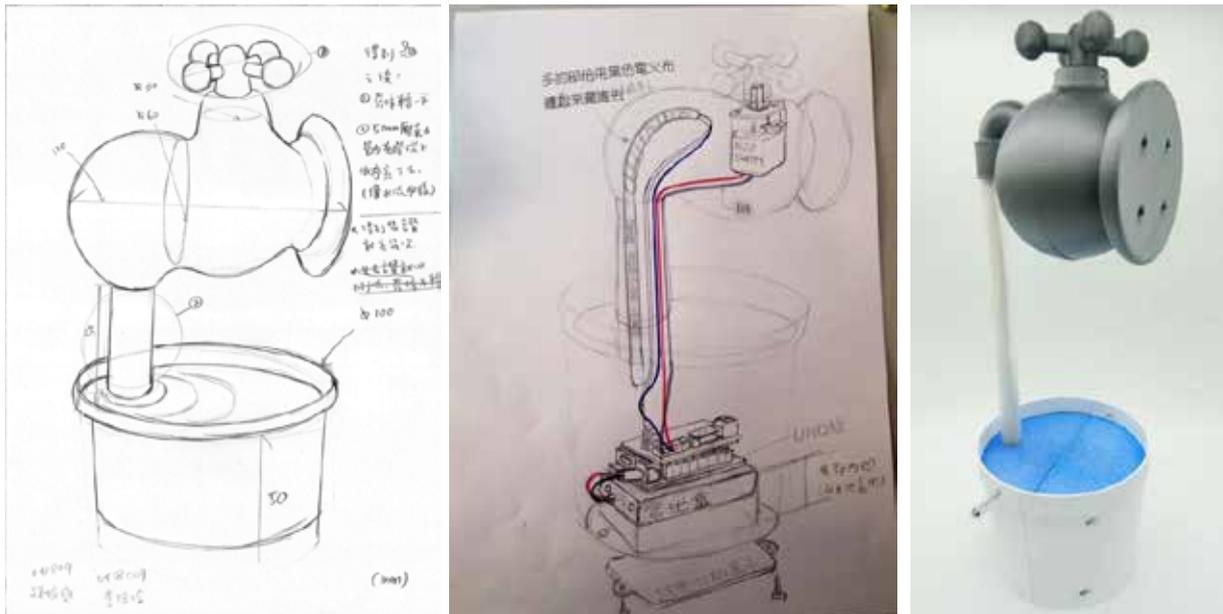


Figure 7: Achievements in each step by the group No.6.



Figure 8: Several final achievements of groups.

3. SUMMARY AND FUTURE DEVELOPMENT

The two projects were regarded as successful teaching, the authors believe that the approaches and materials were conducive to the students. The PBL style can make a practical scenario and then make the students easily immerse in their own design works. Facebook's club page can be a platform which provides the students discuss the problem with the teachers and experts, also can be a good stage where all the students display their own products on. The authors consider that the students will not be afraid to learn engineering knowledge (for engineering design) and will like to discuss their ideas (especially generated by imagination) with the teachers, the experts and their friends. Most important, the students would obtain the fulfilment and it would drive them to develop other product design by applying other engineering knowledge. Next, the authors would like to discover the influence caused to imagination and learning load by learning engineering knowledge.

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Personal Space Invasion in Collaborative Design

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We explore the dynamic process of personal space invasion in collaborative design, and the consequences thereof on team micro-conflicts, minute disagreements in behaviour. Our topic of interest is the pattern of collaboration and micro-conflicts, herein specifically the moments when the teamwork involves physical overcrossing of personal space when conducting physical co-design with LEGO bricks. To study micro-conflicts in the collaborative practice of teams, we surveyed nine high-school student teams' activity by coding captured video of their joint activities during a well-defined and an ill-defined LEGO task. Using mixed research methods, we identify the characteristics of micro-conflicts and investigate the relationship between micro-conflicts and personal space invasion. The results suggest that increased patterns of crossing personal space can provoke micro-conflicts during teamwork. But our qualitative results also demonstrate how crossing personal space can be moderated by invitations or requests during collaborative tasks. The results inform the use and design of tools and settings for co-designing for educational and professional purposes.

Personal space. Conflict. Collaboration. Creative teamwork. Co-design.

1. INTRODUCTION

The designing of artefacts is a process usually involving physical encounters between designer and design materials. As much design theory has acknowledged, doing and making often involves the designer physically touching, sketching, or constructing materials in intimate designer-object interactions, where the object taking shape 'talks back' to the designer (Schön & Wiggins, 1992).

While this intimate designer-material relationship has been acknowledged, what has been overlooked is that in collaborative designing of physical materials, the designers themselves also often end up in close physical encounters in attempts to co-shape or co-design objects. When two or more designers co-design an object (e.g. the co-shaping of a prototype, collaborative sketching, or collaborative exploration of a mock-up), the designers often occupy the same physical space.

The present paper explores how co-designing in the same physical space may affect the design process. Specifically, we explore whether intruding

on another designer's physical space may inadvertently affect team micro-conflicts in collaborative designing. We examine this in both a well-defined and ill-defined (Reitman, 1964) LEGO building design task. In addition we unfold a qualitative analysis of the potential moderating factors in team interaction, which may ensure a non-conflict-ridden response when overcrossing of personal space occurs during teamwork.

1.1 Micro-conflicts as an inherent aspect of collaboration

It is no surprise that conflicts are an integral aspect of any relationship or collaboration we engage in, whether it be personal or professional (De Dreu & Gelfand, 2008). Conflict can impair our performance and be disadvantageous for collaboration (De Dreu & Weingart, 2003). But studies also show that conflict can be beneficial for team performance (Jehn et. al., 2008), boost effectiveness, and spark the creative process in teams (Jehn, 1997, De Dreu & West, 2001), and that speech turns with greater disagreements are more closely linked with micro-creativity than turns with agreements (Chiu, 2008).

Self-reports are a common method for studying conflict. Self-reports measure how conflict is perceived, capture long-term conflicts and tensions, and include self-consistency biases, rather than measuring actual behaviour (De Dreu & Weingart, 2003, Paletz, Schunn & Kim, 2011). This calls for an approach that allows fine-grained aspects of conflicts in group interaction to be assessed. These minor aspects of conflict are conceptualized as micro-conflict; a type of expressed behaviour (e.g. facial expressions or unconscious corrections).

1.2 Measurement of micro-conflicts

In this paper we follow Paletz et. al. (2011)'s conceptualization and measurement of micro-conflict as an expressed and observable manifestation of a particular type of conflict at a low-level of granularity. Micro-conflicts are expressed disagreements at a detailed level of interaction, occurring between at least two people. Micro-conflicts are the verbalization of disagreement in the moment, but also longer-lasting disagreements from previous dialogue (e.g. A: "But we still miss the black (brick) before we can move on"). Micro-conflicts can also be simple corrections or repairs. Within the field of ethnomethodology and conversational analysis (CA), the phenomena of self-correction and other-correction is referred to as repair, which describes an important resource to adjust wrong, unclear, or ambiguous utterances (repaired in the next turns by self- or other-repair) (Schegloff, Jefferson & Sacks, 1977). From a CA approach, repairs would thus count as micro-conflicts in some situations. Following this conceptualization, we categorize micro-conflict by task, process, and relationship type (Paletz et.al. 2011, Paletz, Schunn & Kim, 2012, Paletz, Sumer & Mirron-Spektor, 2017, Jehn, Greer, Levine & Szulanski, 2008). Task micro-conflicts are disagreements concerning ideas and opinions pertaining to the task being performed. Process micro-conflicts are disagreements about who should do what in relation to the task, scheduling, and prioritization. Disagreements and incompatibilities among team members that are not task related but concern personal issues are categorized as relationship micro-conflicts.

1.3 Personal space and territories of the self

Another type of activity, which can occur during planned collaborative teamwork or in everyday interaction, is the invasion of personal space. Imagine a team collaborating on a creative task that involves designing a prototype together. In tasks where the goal is a collaboratively designed solution, behaviour involving reaching over, pointing, or touching something that is in the area

of the other person's perceived personal space may be frequent and sometimes inevitable. Despite the team sharing a mutual goal, the activity will involve personal space invasion, which can potentially lead to conflict. Within the social sciences, humanities, and geography, personal space has been defined and operationalized from concepts of privacy, crowding, immediate environment, territory and administrative regulations (e.g. Sommer, 1959; Goffman, 1971). Yet when it comes to understanding the role of personal space in collaborative (creative) settings, little is known about the effect of personal space invasions. Personal space is a challenging concept to interpret and operationalize, since it involves both verbal and non-verbal claims related to a person's immediate surroundings, and it seems interchangeably relative to situations and personal experiences. In this paper we take on the perspective from Garfinkel (1964) and Goffman's (1971, 1967) studies of everyday interaction to rope in an understanding of personal space, and what is implied in invasions of this space.

Garfinkel and Goffman studied the acts of violations and invasions to conceptualize personal space in itself. With his famous breaching experiments, Garfinkel (1964) studied how people react when commonly accepted social norms and behaviour in public are violated. The experiments involved verbal and non-verbal breaches of expected behaviour i.e. playing tic-tac-toe and disobeying the rules, or standing very close while engaging in an otherwise inoffensive conversation. Other well-known breaching experiments are the obedience studies by Stanley Milgram (1963; 1983), who also studied the unwritten rules of seating behaviour on the New York subway. These studies reveal how people experience personal space through the act of intrusion by another person, and how personal space is something that varies depending on circumstances, social norms, and personal relations. Studies of personal space invasions in public transit suggest that invasion of personal space during crowding hours is often a matter of immediate closeness of a stranger, rather than high density settings itself (Altman, 1975; Fried & DeFazio, 1974; Evans & Wener, 2007).

According to (Goffman 1971, 1967), who studied the tactic rules of everyday interaction on a micro-level of human conduct, 'the self' is a question of perceived and experienced territory that depends on the social space in which the individual is located in (Goffman, 1971). *The self* is, in this perspective, not a constant, but a changing social size constituted by, and extended to, the specific situations and interactions that we are part of. *The self* extends to words as well as objects in our surroundings, when we verbally or non-verbally claim an area. It is these individually claimed and

perceived surroundings that are 'the territories of the self', and when people/individuals enter into one another's immediate physical presence, they risk transgressing certain *territories of the self* of each other (Goffman, 1967). The *territories of the self* exist in a non-spatial, situational, and egocentric sense e.g. the personal space in our immediate surroundings (particularly in front of us); our possessional territory and conversational preserve. And violation of these can be expressed in various ways e.g. absent physical distance, touching, and inappropriate glances (Goffman, 1967, pp. 29-41).

1.4 Crossing-the-line behaviour

Most studies of personal space rely on observations and self-reports (i.e. Sommer, 1959, Goffman, 1976, Garfinkel, 1964). A study of personal space invasion in a public transit also used measurements of salivary cortisol (stress level), along with crowding density and seat proximity as measures (Evans & Wener, 2007), and a study of personal space invasion during money withdrawals from an ATM used participant observation and short interviews (Kaya & Erkip, 1999). In this study we are interested in the invasion of personal space in collaborative designing; a setting that is neither public nor alien. In teamwork with classmates or colleagues, brief overcrossing of physical space may be difficult for individuals to notice and remember, and might slip the eye of an observer. This calls for a multimodal approach, drawing on ethnomethodology and conversational analysis (CA), where speech and minute-to-minute behaviour are taken into account alongside the physical settings (Goffman, 1964, Goodwin & LeBaron, 2011, pp. 9-12, Kress, 2010, pp. 5-15). In this study we draw inspiration from Goffman's theory of territories of the self and focus on the expression of personal space invasion as it occurs between at least two people, at the same low-level of granularity as when examining micro-conflicts. A decision of whether or not personal space invasion takes place requires assessment at the micro-level of the interaction (utterance or turn), and audio-video data must be attended to alongside a detailed transcript. We operationalize personal space invasion as crossing-the-line behaviour, and define this as movement and gesture, which crosses the natural line between the participants (see figure 1).

In this study we register an act as crossing-the-line behaviour when one of the participants; (a) moves close to the other person to show/point something out about the task, (b) moves close/in front of the other person to stop/interrupt the other person's activity, (c) moves or touches the bricks on the other person's side of the table that the other person placed/used, (d) places bricks on the other person's building area, or (e) takes or touches bricks in the hands of the other person. Incidents where one person looks for a brick in the box or in the brick pile, and reaches over the other person's side, is not regarded as crossing-the-line behaviour.

2 HYPOTHESES

The primary purpose of this study is to investigate the relationship between micro-conflicts and crossing-the-line behaviour as an operationalization of personal space invasion during the assigned tasks. In alignment with the above reviewed literature, we hypothesise that:

H1: Crossing-the-line behaviour will lead to micro-conflict due to the effects of invasion of personal space, despite the fact that the team members share the same task goal.

Design tasks differ in their degree of structuredness. The second purpose of this study is to examine whether the levels of micro-conflicts differ in teamwork interaction during a task with a well-defined task goal versus a task with an ill-defined task goal. As well-defined problems allow for task de-composition (Newell & Simon, 1972) and incremental assessment of progress (Metcalf & Wiebe, 1987), it is likely that well-defined design tasks under time constraints will lead to more micro-conflicts, since the possibility of constant monitoring of progress will make designer process- and task mis-alignments more apparent.

H2: Micro-conflicts are more prevalent in well-defined tasks (Parrot) compared to ill-defined tasks (BuildToExpress).

Crossing-the-line-behaviour may interact with task type. Well-defined task types under time pressure necessitate a fixed end-goal, where it is not possible to adjust the shared goal during designing.



Figure 1: The natural line between participant, touching the other's object, and crossing-over the other's side

Conversely, in ill-defined problems it is possible to constantly re-negotiate the shared goal in order to ensure that the co-design process is completed according to the time constraint. As such, crossing-the-line behaviour in well-defined tasks may lead to disproportionately more micro-conflicts when compared to ill-defined tasks.

H3: Crossing-the-line behaviour is more likely to affect micro-conflicts in a well-defined task (vs ill-defined) with a fixed end-goal under pressure of time. Accomplishing a goal that is well-defined is more likely to increase crossing-the-line behaviour and micro-conflicts in the teams since it is not possible to re-negotiate the shared goal. Finally, we wanted to qualitatively explore some possible moderating process variables that could ensure that overstepping personal space may not always lead to a micro-conflict in co-design.

3 METHODS

3.1 Study design

The study was conducted at a Danish high-school in the Copenhagen area. The study consisted of 9 teams each undertaking two different LEGO tasks. Each team comprised of 2-3 high-school students at their senior year (17-19 years), and a total of 22 students (16 female and 6 male) participated. Each table was set up with a go-pro camera at eyelevel and a separate audio recorder (Figure 2). Written permission (informed consent) was obtained from all participants on tape. Names of the participants have been changed in the transcripts and analyses. The students seemed to quickly habituate to the cameras, at times discussing personal information or talking directly in to the camera as a comment on their task.



Figure 2: Camera and audio setup during tasks

The data collection substituted the students' regular schedule, and they worked in teams that were already established for a school project purpose. The teams began with a warm-up exercise with

time-restriction (The Lego Duck Challenge). After the warm-up exercise, the teams were given two LEGO building tasks (Figure 3). They were given 15 minutes to complete each task with a break in between. The order of the tasks was counterbalanced between teams to reduce potential ordering effects.

The well-defined task was to build a parrot from a picture of a finished parrot without further instructions. For this task (Parrot), the teams were given a 10702 LEGO® Creative Building Set, a set with 583 classic LEGO bricks. The other task was to express the values of a company using the LEGO®Education BuildToExpress (BTE) boxset. The BTE set consists of 200 pieces and affords students to 'assign personal significance and subjective metaphors to the bricks in their models' (LEGO®Education). The students were at the time working on the first stage of sustainable business model and company for an interdisciplinary school project.



Figure 3: Parrot picture and BTE boxset (Retrieved from www.lego.com & www.education.lego.com)

3.2 Transcription and coding

We only selected the parts of the video recordings where the teams were engaged in the two tasks. This resulted in 4hr and 46min of team activity. All video was transcribed following a CA-inspired multimodal transcription notation (Jefferson, 1984, Heath, Hindmarsh & Luff, 2010, pp.70-83), where both speech, gesture, and gaze was noted, which

allowed the creation of accurate and reliable transcripts as a foundation for our subsequent analysis. To ease coding, we used excel versions of the transcripts based on turn-talking in the dialogue, which resulted in 4096 segments.

Three independent coders assessed videos side by side with the transcriptions and coded for presence or absence of micro-conflicts at the turn, utterance, or other micro-level (e.g. gaze and gesture). Two of the coders were blind to the hypotheses of the study. The three dimensions of task, process, and relationship micro-conflict were coded separately, along with crossing-the-line behaviour, in two iterations of going through the transcript.

Table 1: Overview of micro-conflicts

Micro-conflicts	BTE (n = 1996)	Parrot (n = 2100)	Total (n = 4096)
Turns (%)	27,7	33,8	30,8
Types of conflict (% of conflict turns)			
Task	76,3	74,3	75,2
Process	15,6	13,8	14,6
Relationship	11,2	11,6	11,4

4 QUANTITATIVE ANALYSIS

To examine whether crossing-the-line behaviour and task type predicted micro-conflicts, we applied logistic regression analyses. These enabled us to predict the probability that crossing-the-line behaviour (coded dichotomously as present/absent), task type (well-defined vs. ill-defined), and their interaction was linked to micro-conflicts. The model versus a model with intercept only was statistically significant, $\chi^2(3, n = 4096) = 149.51, p < .001$. The model was able to classify correctly with an overall success rate of 70 percent.

Table 2: Logistic regression predicting micro-conflicts from crossing-the-line-behaviour, task type, and their interaction

	B	SE	Wald	df	Sig	Exp (B)
Crossing-the-line-behaviour	-.99	.12	72.86	1	.001	.371
Task type (well-defined – ill-defined)	.30	.15	4.20	1	.04	1.35
Crossing-the-line X Task type	0.52	0.17	0.10	1	.76	1.05
Constant	-.20	0.10	4.12	1	.05	.82

Table 2 shows the logistic regression coefficient, Wald test, and odds ratio for each of the predictors. Both crossing-the-line-behaviour and task type, but

not their interaction, predicted micro-conflicts. The odds ratio indicates that crossing-the-line-behaviour is 2.70 times more likely to lead to micro-conflicts, and well-defined tasks (as opposed to ill-defined tasks) are 1.35 times more likely to lead to micro-conflicts. Follow-up logistic regression models with the three types of conflict (task, process, relationship) revealed that the overall micro-conflict effect was almost entirely due to the prevalent task conflict sub-type.

5 QUALITATIVE ANALYSIS

5.1 Personal space invasion and micro-conflicts

With the example in figure 4, we illustrate how personal space invasion and micro-conflict occurs during teamwork.

We enter in a team with Anna, Ben, and Eva (from left to right, Figure 4). In the previous two turns, Anna and Eva have been discussing how to combine two bricks on the parrot, and Eva suggested to use some other “small bricks”, but Anna refuses Eva’s suggestion in turn 1 (i.e. task micro-conflict). The conflict continues in turn 2, when Eva says it seems “weird”. Eva supports her disagreement with a crossing-the-line behaviour; by moving her hand across the table (accompanied by a dismissive “but” marking the micro-conflict), she signals her disagreement with Anna. She then points at the picture while explaining what seems “weird”, an assumption she attempts to legitimise on the basis of the picture of the parrot. Pointing in this situation can also be seen as an attempt to establish a shared focus in the group (Goodwin, 2003). In turn 3, Anna responds to Eva’s dismissal when she reaches across the table, picks up a brick, and taps directly on to the brick that Eva holds on to. This verbal and physical response is both a task micro-conflict and a crossing-the-line act with clear markers of disagreement and intrusion. Eva reacts rapidly with a stressed “WAIT!” while pushing Anna’s hand away from her personal space (turn 4). Anna withdraws her hand and frowns as a sign of indignation (turn 5). In this episode, neither Anna nor Eva makes an explicit request to invade the other’s space, or receives an invitation prior to the overcrossing act. In the following turns we detect no micro-conflict, and the team moves on to assemble a new part of the parrot.

In this example, both Anna and Eva are proposing and rejecting each other during a series of verbal and non-verbal responses. Each time a person expresses a proposal, the person is establishing a personal space, which becomes a territory representing their ‘self’ in a social space. The proposals that Anna and Eva utter in this example

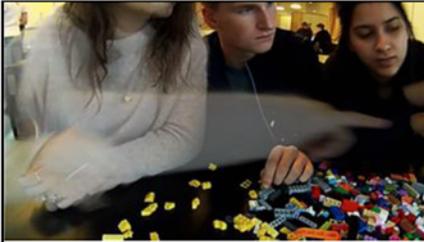
		
Turn 1 & turn 2	Turn 2 (continued) & turn 3	Turn 3(continued), turn 4 & turn 5
0:07:11.3	0:07:18.1	0:07:22.1
A: no, it can't take up all that because where does (points at picture) <u>this one</u> then attach too? (1.1 sec)	E: (connects two bricks) but eh: (looks at picture, then looks at bricks in her hands) (1.5 sec)	A: (moves hand close to E) <u>that</u> one? (taps with brick on E's bricks)
E: (looking at picture) but, it says- (moves hand toward A) it is just wierd that that thing doesn't point out there (points at picture) on the other side, I'm thinking, (withdraws hand)	A: (looks at bricks in E's hand) and how would you place (reaches after a brick) that one on ↑	E: WAIT! (pushes A's hand away)
		A: (withdraws hand, frowns)

Figure 4: Micro-conflicts in parrot task

represent their 'selves' claiming a certain area or role in the common project. Following a proposal comes either the option of acceptance or rejection, which we consciously anticipates (Davidson, 1984). Anna and Eva are both defending their own territories (and seeking acceptance through argumentation), but are also attacking the other person's territory (and rejecting their opponent's proposal).

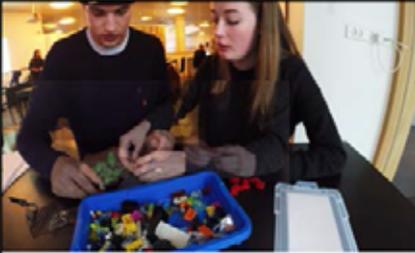
5.2 Personal space invasion in non-conflict activities

As demonstrated above, personal space invasion leads to task micro-conflict during the course of tasks. There are however sequences in the team activity where crossing-the-line behaviour does not result in immediate micro-conflict. Some moderating factors in collaborative teamwork can establish non-conflict-ridden crossing-the-line acts, which benefits the incremental progress towards the mutual goal.

The most obvious sequences where crossing-the-line behaviour does not lead to micro-conflict are in turns, where the overcrossing act is accompanied or initiated with a verbal request to cross, move, or re-place a brick on the other's side. "Have you tried

this one?" or "May I see?" are for instance requests often used by the teams that implicitly mean "may I touch" in the context of the interactional activities. Requests to cross also occur as statements of varying determination i.e. "I'm placing this one here" or "I'm just moving this one a little bit". Statements of this kind can however also incite micro-conflict. An invitation from the other person is another way to indicate permission to cross i.e. "Can you hold this" or "Help me". The following example illustrates a non-conflict crossing.

In the example below (Figure 5) we see Adam and Lea working on the BTE task. They are half-way through and are figuring out how to place some aid workers and nurses on Adam's side of the grey board (the foundation for the BTE models). Lea and Adam have previously been building on their "own" side of the board (Adam using red bricks and Lea green, as illustrated on the first picture), but now they are collaborating on Adam's side. We notice how they are very verbal in their actions, telling the other what they are building and what it represents; they are thinking aloud. In turn 1, Lea acts like a storyteller, but involves Adam in the construction of the story using an 'us' in "let's just (say)". In the next turn, Adam continues the mutual story with

		
Turn 1 & turn 2	Turn 3	Turn 4
0:07:17.5	0:07:18.1	0:07:22.1
L: .hhh let's just eh:(.) they are helping (.) (places white woman)these	L: (lifts white woman up to make room for the orange strecher)	A: we can just place her in the end(.) (grabs a red man)
A: (moves hand to make space)	exactly they- they are just lying	L: (attempts to place white man on strecher)
L: [who are lying on the ground]	(3.7 sec)	because she keeps on moving (takes white woman)
A: (looks in box) [great! >and one lies < on an orange strecher] (grabs orange flat brick from box) >it's fine like that<	A: (attaches strecher and places black man on top)	L: (withdraws hands)
		A: just put- (tosses white woman away) forget her!(.)

engagement “great”, simultaneously building on the story and the LEGO model. In turn 3, Lea approves Adam’s continuation (of both story and model) “*exactly*”, and makes space for him to modify the representation. Adam verbally excuses his

influences this type of conflict, despite the fact that the conflict in itself seemingly starts from the invasion of personal space rather than the resolution of the task.

Figure 5: Crossing-the-line behaviour without micro-conflict

crossing-the-line act (turn 4) in line with social norms of courtesy. If we zoom in on these 4 turns, we witness crossing-the-line behaviour in each turn, but no significant micro-conflicts emerge in this or the following episodes. It is worth noticing that these think-aloud acts seem to minimise micro-conflict during crossing-the-line behaviour, and create a non-conflict-ridden space in the intersection of Adam and Lea’s personal space.

6 DISCUSSION

This paper argues for conceptualising personal space invasion at a fine-grained level of interaction and behaviour. By utilizing a rich video based dataset of teams engaged in collaborative design activity, we were able to explore aspects of collaborative practice such as micro-conflicts, the role of task goals, and personal space. We find that crossing-the-line behaviour as a measure of personal space invasion leads to task micro-conflict, despite the actions per se being constructive and facilitating in relation to the solution of the task. Apparently, personal space invasion is explicitly interpreted into conflicts about solving the task i.e. *task micro-conflict*, and thus

Further, distinct design task types differ in terms of their resulting levels of micro-conflicts, with well-defined tasks leading to more micro-conflicts than ill-defined tasks, probably due to the nature of the tasks itself (fixed end-goal; possibility of task decomposition; possibility of monitoring progress). In the present study, task type did however not cohere with crossing-the-line behaviour in predicting micro-conflicts.

The results of this study pinpoint important aspects of conflict in collaborative settings, and can be useful for future design of tools, tasks, and settings for co-design and co-creation for educational purposes and professional practice. Personal space invasions do affect conflict, and thus it should be considered to design platforms, tools, and settings that allow for collaborative/inter-sectional working areas, in order to prevent individuals having to cross over and invade the space of the other during teamwork. Alternatively, task framing may moderate the effects of crossing of personal space as shown in the qualitative analysis; instructing designers to verbalize invitations or requests when crossing space may help mitigate the negative effects of intimate co-

designing. For example, studies show that people prefer to correct their own utterances as opposed to someone else correcting an unclear or wrong sentence (Schegloff, 1992). If we transfer this observation to non-verbal behaviour i.e. placing a brick wrongly, it denotes the importance of personal space in a collaborative setting. A self-repair can support the verbal work we do to avoid violation of our personal space (and thereby our *self*, which we are likely to risk, when we put forward a proposal and face potential rejection). Making a physical space for self-repairs reduces the threat of violation, and can possibly reduce micro-conflicts.

The present study has only examined the relation between personal space crossing, task type, and

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Automating Design Education

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This paper is an adaption of the contextual report which accompanies the third year major project of BA Design at Goldsmiths University of London, from which I graduated in 2016. The following report documents my methodologies and research in attempting to “automate my own degree”. The report begins with an introduction in two parts, commencing with contemporary changes to the economics of higher education, and how this may be shifting students’ attitude to academia in general, before moving onto the power dynamics of machine automation, paying particular attention to workers automating their own jobs. I propose that in applying the methodology of automation to design education, an investigation into various problem spaces and the relationship between them can be pursued. The paper examines the degree as a system, investigating linguistic analysis and algorithmic reproduction of student-tutor communications. In refocusing on the students’ input into the system, the research offers a set of tools with which a student may use to automate their own assessment submission. In doing so, those tools critically reflect on the structural nature of the “project” and if design can essentially be performed to fulfil marking criteria.

Automation. Assessment. Design. Higher Education. Research.

1. AUTOMATING DESIGN EDUCATION

Much has been written and spoken of the transformative power of technology on the body of society; in recent years there has been renewed discussion regarding the ever stretching reach of automation into territories of labour that once seemed reserved for the human hand. When looking at the history of education and the potential future of the student, teacher and institution, in an environment built upon connectedness and widely distributed knowledge, it seems likely that self-service education will evolve into an increasingly attractive option for all parties.

The climate of modern productivity escalation is causing labour relations and automation strategies to be applied in diverse areas. Of particular note is the creative industries, and by extension, institutions that provide education in creative subjects. Academic assessment at most levels of education in the UK is already dealt with in a data driven way. We have sleepwalked into a state, whereby cash-stripped schools and colleges are measured en-masse using data models, instead of tacit understandings of the best way to teach and learn. In doing so, it is an open secret that courses are constructed around the necessity of assessment, and in turn, students have positioned these data-collecting exercises to be the sum-total

of their time in education. This leads to a method of learning that works to squeeze the best numerical results, warping perceptions of the value of education. More troubling still is the way that this paradigm has begun to sweep upwards towards higher education.

The tuition fee increase which was introduced in the 2012/13 academic year for UK universities saw fees rise from a previous cap of £3,375 to £9,000 per year for undergraduate courses in England. Besides many other socio-economic implications, what this enabled was the accelerated shift of funding from the public to the private sector, [Universities UK, 2014, p. 24]. More recently, politics professors at the University of Sheffield have commented on the “Teaching Excellence Framework”

‘One of the most striking elements of the TEF discussion is the use of market language. We have heard much talk of costs, value for money, returns, investments and employment statistics. Ultimately, the student is considered a customer.’ [Blunkett and Flinders, 2015]

What is then clear, is that alongside the students’ personal perception of the role of education and the economic and productive approaches they pursue when navigating the system, there are larger forces

at work that are shaping the role and operation of higher education institutions. Although the student has little say in how these forces act, their behaviour is still distinctly shaped by them..

If recent socio-political decisions have apparently caused transformative trends regarding the attitude towards higher education in the UK [Higher Education Funding Council for England, 2013], then the understanding and reactionary strategies of various parties in the system will continue to be diverse and prototypical as the situation matures.

Running in parallel to this shift is another curious change to measures of achievement, this time in professional practice whereby workers, primarily in the administrative technology sectors, are automating their own jobs [Jumašev, 2015]. What the employee does with the time that this process frees up is variable, but often those who make accounts of this particular technique will use the time for leisure, rather than informing their employer of the optimisation: to do this may run the risk of essentially making themselves redundant. [Hello Internet, 2014] These tools therefore become secret devices, used to “game” their own act of employment.

It is in this reframing of who authors the automation here that redefines power structures often associated with the top-down nature of labour automation. We observe the use of technological literacy and inventiveness to bring agency to their own employment circumstance.

It has been an objective of mine to extract this technique and assess its potential as a methodological tool, with an understanding that its position in labour relations is potent and transformative. As a research device, it requires an innate comprehension of the task at hand, as well as articulacy regarding the process of technological or otherwise computational machine automation. Its importance is therefore two-fold: as both an investigatory methodology when applied to an unknown process, to aid understanding, and also an exercise in designing appropriate machine automation techniques. One of the functions of this exercise therefore, is to introduce this particular notion of machine automation into new spaces to test their viability, procedure and impact.

Within the context of my research, I am interested in pushing the aforementioned conflation of business and education practice, to investigate how a speculative “ultra efficient” model of education participation would behave en-situ. Automation as a methodological tool, is therefore applied to education as a critical research device. In summary, as a student at Goldsmiths BA Design at

the time, I endeavoured to “automate my own degree”.

This goal is approached by mapping the frameworks and actors that are necessary for obtaining the qualification awarded on the completion of this course. In addition, I address at various stages the importance of other goals, such as the student’s capacity to obtain and contribute to academic discourse; the institution’s role in providing education; and ultimately, for all parties, producing “good” design.

I broadly define as two angles from which to approach this task: to automate the degree as a system, where the individual student works as they would normally, surrounded and supported by automated frameworks to facilitate learning and designing. Secondly, to automate the individual’s response to the existing education system, where the student aims to design, create and respond using algorithmic production methods. This could be interpreted as a subversive or transgressive act. I will briefly explain my research into both of these pathways in turn with select case studies.

Although the presence and understanding of existing marking structures in higher education is important to my investigations, I am more interested, with regards to the context of machine automation’s role as a transformative agent in human-labour relations, in the way that current ad-hoc human interaction orientated components in the system could be in some way automated. One such interaction is the tutor-student relationship, and particularly the interface between those parties in a tutorial or a setting where feedback from a tutor is delivered in various forms.

2. TUTORING

Tutoring is traditionally a somewhat formalised process, with a delicate procedure. Its position as a very nuanced interface makes approaching the interaction in a computational sense hypothetically quite challenging. Face to face tutoring is a variable experience, with a multitude of techniques and approaches. The challenge here lies in extracting a kind of distilled pedagogic technique that is unique to each tutor, and indeed, each tutor-student experience.

Similar to many of the research methods I had undertaken at this stage, my primary focus is on language, both written and verbal, as a medium primarily used to interface between student and tutor. In dissecting the language used in this context, I can come to a better understanding of

method and intent within these observed conversations.

Alongside verbal feedback for a particular presentation at the beginning of the third year at Goldsmiths BA Design, tutors submitted a spreadsheet of written feedback which is intended to support and guide the student as they develop their project. This document becomes useful due to its pre-prepared, structured nature, similar to a spreadsheet of data. I was given permission by an individual tutor to use her contribution to this data, to construct what would become an automated incarnation of herself in a tutorial context. The methods for achieving this are as follows.

The responses from the tutor in the feedback form were decontextualised: in that the individualised responses were stripped of all specific action and advice. What would be left is the structural linguistic framework for feedback that would include generic advice, hypothetically pertinent to any student who may need it.

Interestingly, the act of decontextualising these comments highlighted a phenomenon, whereby if I was required to delete very little this meant the feedback was largely generalised and non-specific, the reverse was also observed. What this indicates is a measurable ratio of generalised to targeted advice and reference points.

In order to insert this data into what can be more broadly described as a tool, I call upon an algorithm entitled "Cobe", a modern version of a natural language processing script, created by Peter Teichman.

This program "learns" the feedback text and adopts it as its vocabulary. When a user inputs a question, or any comment, the program will respond with text of varying length, as if engaging in conversation, using the language it has learnt previously. What this constructs is a user interface that essentially allows a student to ask a robotised version of a tutor for advice.

The apparent presence of what is largely an accurate representation of the original personality of the tutor is striking. This gives a certain authenticity that enables genuine interaction with the machine on a level that approximates the original inputs and outputs, but critically, not the experience of it. Despite this alteration of experience, the effectiveness of the machine in testing, is proven.

In one case, I offered a third year student the opportunity to use the Bot for a tutorial. They submitted an extended question about their difficulties with their current project, to which the

algorithm responded with a lengthy reply. The student commented that the response made sense in the context of their submitted query, and that the questions and comments offered by the algorithm were valid as actions or things to consider, so much so that the student subsequently took further action on their project in response to the generated feedback as if it were an ordinary tutor-student conversation. This variation of a natural language processing interaction reflects the experience of one of the earliest notable examples of this technique: "ELIZA", a programming framework created by Joseph Weizenbaum between 1964 and 1966.

The findings so far suggest that it is indeed possible to distill a nuanced interaction such as this into a computationally structured device, and the key to its success relies on capturing the "essence" of the tutor's technique, maintaining a sense of humanity through language: to enable more natural interaction, and at this stage forgoing specificity.

3. FEEDBACK

I may have simply been fortunate that the tutor's feedback technique just so happened to suit this particular method of analysing and deconstructing / reconstructing language. In further conversations with her it became apparent that theoretically, what her students were searching for was simply the "right" question or suggestion that suited their needs. When the algorithm delivers a string of these, any and all of them can become applicable. Other tutors I spoke to regarding this experiment noted that they require an emotional and contextual understanding that this algorithm could not provide. The ability of the tutor to flexibly adapt to the changing needs of a student remains elusive to this iteration of the algorithm. What it does however provide, is the opportunity to explore the algorithmic combination of multiple distilled tutoring techniques, to assemble a more comprehensive experience for the student. An opportunity for further investigation in this regard, remains open.

Upon reframing my investigation on the student's contribution to the system as it currently exists, situating my research within my own third year project as a kind of "meta-project", became an alluring prospect. What I eventually devised was a set of tools that would enable the student to build a comprehensive assessment submission that would guarantee success in the institution. Upon building these tools I would test them on myself and submit the project it created in a blind-marked viva voce examination. The intention of this experiment was to use students as human surrogates inside an imagined algorithmic system, to prototype how

such a system would behave, and what methods it would employ to produce materiality.

Somewhat unconventionally, I decided to start at the end, and pick apart the degree show as a structural marker of completion, where conceptual communication is more heavily considered.

My intention at this point was to investigate whether an algorithm could use this linguistic material as a way to deconstruct and reconstruct Goldsmiths Design projects. Furthermore, to ascertain if this particular linguistic framework for design would be viable as a starting point for a machine that would produce design projects that are indistinguishable and yet sufficiently differentiated from what has come before, to stand alone as an original artefact. This would build on the spirit of "Conceptual Poetry", as a particular technique of assembling original ideas and language, from a combination of prior art and wider reference points.

Using their websites and catalogues, I compiled the titles and descriptions of every project exhibited in a Goldsmiths BA Design degree show from 2011-2015. Beginning at first with project titles alone, I collapsed the entire database into a continuous string of words in a text file. By using a simple javascript random sentence generator, this database was able to be rearranged on the fly into new titles and displayed in a web-based user interface.

What this produces is a somewhat unsettling collection of titles that seem simultaneously absurd and entirely plausible within the context of the course. Primarily because they are constructed from the course, but also because it is fairly easy to project our own imagined response to what the body of that project would look like, based on its title alone. The fact that designers in this institution are so easily able to do such a thing must signify the presence of an academic identity that I am interested in interrogating.

These thematic tropes appear most clearly here because the choice of title is the most tightly compressed summary of the territories, politics and ideologies that the project appears to be embodying. Naturally, by unpicking and reweaving the fabric of the institution's output the machine is self-perpetuating, satisfying in the most basic sense what seems to be an intangible byproduct of the particular design sensibilities that the course promotes..

4. THE DESIGN TURING TEST

If the algorithm's intention is to fool the reader, it must pass a kind of "Design Turing Test", Stevan

Harnad notes that what Turing was actually asking was, 'not whether or not machines can think, but whether or not machines can do what thinkers like us can do -- and if so, how.' [Harnad, 2004, p. 1] The distinction between thinking like a human and performing like one is important. The Automated Design Algorithm is therefore required only to be performative and is not constrained by the traditional thinking processes of the designer.

Once the title for the project is defined a further tool is employed that structures a schedule based on the start and end date, balanced by the weighting on assessment criteria that the student requests, for example, an enhanced period of project development may be proportionally favoured over contextual research. Further algorithms define research patterns by crawling the internet based on related themes, assembling dossiers that may be useful for the student. A "performative design" action generator constructs tasks that the student may undertake to produce materiality and situate their research on location. Repeated layering of these tools and selective yet rigorous use allows the student to build a body of work in a "soft" automated way, picking and choosing which tasks to undertake, guided by a reassuring structure. What this led to was a heightened state of risk-taking and lateral thinking, allowing conclusions to be drawn that built a convincing narrative for the project.

To test the process from start to end I utilised each tool in what I called the "Para-Project". This was entitled "Things Theatre Power", as defined by the Goldsmiths BA Design Project Title Generator. The nine-month third year studio practice course was compressed into four weeks of work, when blind-marked in a preliminary viva voce, it was awarded a 2:2.

Four weeks later I presented my "real" viva voce where I reflected on building an assessment submission for higher education based entirely on the framework used to assess it. I propose that the hypothetical objective, and indeed use, of the automated design education machine, as a range of tools, is to capitalise on these optimisations, firstly to acknowledge this as phenomenon, and critically, to take ownership and agency in how and when these optimisations are delivered.

Furthermore, if we are to acknowledge that it has become a strategy for many students to expect a return on their investment in higher education, this automating tool may provide them the opportunity to pursue paid work, so that they may fund their qualification, or indeed do anything else in the spare time that the machine provides.

This framework is, of course, not without issue. If design is to create the new [Marenko and Brassett, 2015, p. 21], then using the past as a basis for future insights may be reductive, in the case of the Goldsmiths BA Design Project Generator, any new production is confined, at worst to what has already been, and at best a limited scope of re-workings of the past. It is in this sense, what could be regarded as a fundamental principle of critical design, and indeed the objective of the course, is lost in the output of the machine, yet its ability to satisfy the marking criteria and achieve academic success is still present. The subsequent challenge becomes evolving the algorithms into constructive devices, as apposed to reductive ones, retaining the possibility of using prior material as a foundation or framework for production.

5. CONCLUSION

If we take a step back and view this as a meta-project that informs wider discourse, the project as a whole becomes a way of using the reductive techniques and market ideologies of automation by repurposing those problematic tools as methods of research and modern design thinking within the wider framework of design education, practice, and theory. In their use, and by constructing visions of their permeation, complex insight and critique is formed, which helps us gain a better understanding on how technology is driving the rapid evolution of design education.

The most striking element of this experiment was how familiar the automated tools I constructed are to the methods and processes engrained into the student over time and, for better or for worse, how I may have been the machine all along.

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Thinking across Channels: Retail Designers' Competencies in the context of Omni-Channel in Retail

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This contribution addresses the need to widen the discourse on retail design education, in times of major shifts in retail. Today, retailers are urged to rethink their business models into omni-channel strategies. We believe this not only affects the retail industry but consequently has repercussions on the field of retail design, the profile of the retail designer and retail design education. The central question in this contribution is: what is the impact of current developments in retail on the profile and the competencies of future retail designers? As we noticed a lack in understanding the profile of the retail designer in terms of their required competencies, we consulted 31 practitioners in the field of retail design with the objective to develop a holistic retail design competence model. The model consists out of 77 competencies divided into eight thematic competency categories. We elaborate on three competencies in the category omni-channel and digital which future retail designers need to acquire to cope with the challenges in the field of retail. Based on these findings, we reflect on the role of retail design education.

Retail design. Retail design education. Design education. Competence model. Omni-channel.

1. INTRODUCTION

Retail design emerged in 1960's as a discrete activity in the development of physical stores and from then on slowly grew into a mature discipline (Quartier, 2017). Anno 2017, the maturation of the discipline is globally reflected in the number of specialised design agencies, retail design literature/magazines and professional retail (design) fairs in different countries. Today, retail design can be considered as a transdisciplinary design discipline which concerns the design of virtual or physical spaces for selling products, services and/or brands to consumers. In this context, it is the role of the retail designer to create a sensorial interpretation of a retailer's brand values and to translate consumer needs into a spatial program (Quartier 2015).

In recent years, also academic research in retail design came to fore, which contributes to the development of the discipline's body of knowledge by means of bridging the gap between research and practice (Quartier, Lommelen and Vanrie 2016;

Petermans and Van Cleempoel 2010). Finally, along with increasing professional and academic interest, retail design education has become more prevalent during the last fifteen years at university level (Christiaans and Almendra 2012).

However, despite this growing awareness of retail design in practice, research and education, academic knowledge on retail design education seems to be lacking. Current contributions for example discuss case-studies of student projects (e.g. Christaans and Almendra 2012), the foundation of advanced courses for professionals in the field (Quartier, Lommelen and Vanrie 2016) or curricular reforms from an interior design focus to a transdisciplinary vision on retail design education (Skjulstad 2014).

Nevertheless, we want to argue that such knowledge is crucial to ensure the further development of the field and to educate competent retail designers. Since, retail is subjected to continuous change caused by technological, economic, political and socio-cultural trends (Nederstigt and Poesz 2010), global shifts in retail

influence the field of retail design and consequently touch retail design education.

Hence, we want to contribute to the discourse on retail design education, especially in the context of current shifts in the field of retail such as digitalisation and omni-channel. Central to this contribution is the question whether current developments in retail affect the competencies of future retail designers and what this implies for the conception of retail design education. We propose our retail design competence model consisting out of 77 desired competencies for future retail designers resulting from semi-structured interviews with 31 practitioners in the field of retail design. We will elaborate on three competencies relating to omni-channel and digitalisation in retail and argue that these findings have implications for retail design education. Indeed, this might create the need for new approaches in training future retail designers and/or the revision of existing retail design curricula and their desired learning outcomes.

2. A CHANGING RETAIL LANDSCAPE

During the past two decades, retailing has changed dramatically (Verhoef, Kannan and Inman 2015). In retail, as well as in other sectors, digitalisation has had a major impact on the field. This is for example evident in the blurring boundaries between traditional and Internet retailing (Brynjolfsson, Yu and Rahman 2013). The emergence of new communication and marketing channels (e.g. mobile and social media) create new ways for consumers to purchase products and to interact with retailers (Melero, Sese and Verhoef 2016). Consequently, for retailers it has become increasingly difficult to get a grip on consumers' complex shopping behaviour, which impedes them to create, manage and control the customer journey and experience across these channels (Lemon and Verhoef 2016).

Due to these shifts in retail, many retailers' business models are affected (Sorescu et al., 2011), what requires retailers to rethink their business strategies (Brynjolfsson, Yu and Rahman 2013). In this context, business and marketing experts often urge retailers to bridge the gap between online and offline to offer customers a consistent and seamless brand experience across channels (e.g. Van Ossel 2015). In academia and business this prevailing conception of retail is reflected in a myriad of popular buzzwords such as omni-channel in retail (e.g. Verhoef, Kannan and Inman 2015), phygital retail (Trendwolves 2014), onlife retail (Wijnen 2016) and seamless retail (Accenture 2015). In brief, these terminologies connote that retailers should shift towards a customer-centric approach and unify/integrate all channels to make sure that customers can use

them simultaneously and interchangeably via different devices at different moments during the buying process. From the customer's perspective, this should result in a seamless, consistent and personalised shopping experience independent of channel choice (Van Ossel 2015; Melero, Sese and Verhoef 2016).

3. THE NEED FOR A COMPETENCE MODEL IN RETAIL DESIGN

If we assume that it is the retail designer's role to translate retailers' business strategies and brand values into functional and commercial viable store concepts; one might ask whether the abovementioned developments in retail challenge designers' competencies? Hence, we want to shift the focus from the retailer to the retail designer and ask the following question: how are retail designers affected by current developments in retail and does this require new competencies?

To grasp these changing competencies, a thorough understanding of the profile of a retail designer is required. However, from the perspective of academia as well as practice, a clear defined profile and insights of their required competencies seems to be scarce. A plausible explanation is the fact that retail design is a rather young discipline (Christiaans and Almendra 2012; Quartier 2016) which is still in the process of defining its own body of knowledge.

The most comprehensive retail design job description can be found on the Creative and Cultural Skill's website (2017), Creative Choices, which is the Sector Skill Council for the creative industries in the UK. In the job profile, Marten (2013) describes the retail designer as someone who is involved in all aspects of retail design ranging from the exterior of the shop to the design of shop displays. Besides the design of appealing shop environments, retail designers aim to create positive consumer experiences. The designer's tasks include: client meetings & presentations, 2D/3D idea generation, sketching, computer assisted design (technical drawings and 3D modelling) and in some cases project management. The required competencies include skills in spatial design, graphic design, a comprehension of design aspects as well as communication skills. Furthermore, domain-specific competencies are mentioned such as understanding consumers' needs, their shopping behaviour and retail trends. To conclude, (inter-)personal abilities and attitudes are listed such as: client-centeredness, commercial ability, creativity, time-management/organisational abilities and teamwork.

In line with Quartier's definition (2015) of retail design, the profile description reflects the transdisciplinary character of the discipline as Martin considers retail design to be closely linked to the branding and marketing strategy of retailers. Furthermore, the author recognises that retail designers often work in multidisciplinary teams, a feature which also has been highlighted by Quartier (2016). However, Marten seems to consider the retail designer's role as solely involved in the design of the physical store, with barely no reference to omni-channel or digitalisation in retail. Though, the following recent academic interpretations of a retail designer's profile do address competencies in this context. Besides, these reflections seem to widen the disciplinary boundaries between 2D, 3D and the virtual space as they urge retail designers to think holistically across disciplines.

The first example comes from Teufel and Zimmerman's book on retail design (2015), in which they address the need for holistic retail design in times of multi-channel retailing. In this context, the authors call for a new generation of retail designers who understand all retail parameters and think/work on the level of communications, graphics, space and digital. In their view, working in retail design requires knowledge of the history of retail, art, market dynamics, consumers' needs as well as understanding the impact of technological developments on consumers' shopping behaviour and retailers' business.

A similar vision on the retail design profession is expressed by Christiaans (2017). Christiaans perceives the retail designer's role to create unique and emotionally touching customer experiences and who supports both the retailer and the marketer. Retail designers combine design thinking, design methodology with their understanding of human behaviour and modern technology. They need to respond to the needs of retailers and customers, while keeping a holistic overview in the process of translating retailers' brand identity into space (either online or offline).

Although these interpretations give us a first understanding of what it means to be a retail designer, they are not sufficient to grasp all the required competencies neither to translate them into a vision for retail design education. Therefore, we felt the need to develop a holistic retail design competence model that provides a detailed overview of the required future competencies of retail designers. Moreover, such a competence model can serve as a framework to reflect on the conception of retail design education.

4. TOWARDS A HOLISTIC RETAIL DESIGN COMPETENCE MODEL

4.1 The holistic view on competence

In literature, the concept of competence is considered as a 'fuzzy concept' (Van Merriënboer et al., 2002; Winterton and Le Deist 2005; Guerro and De los Rios 2012). Although the concept of competence has been widely applied in business and education (Van Merriënboer et al., 2002), a lot of confusion is surrounding the term, resulting in a myriad of conceptualisations (Winterton and Le Deist 2005).

In the years that the competence movement has come to fore, three research traditions can be distinguished namely: the behaviouristic, the generic and the holistic approach (Gonczi and Hager 2010; Wesselink 2010). In brief, these three traditions hold different views on what constitutes competent professional performance (e.g. the successful performance of tasks vs. the possession of generic knowledge/skills/attitudes) (Gonczi and Hager, 2010). Since it is beyond the scope of this paper to elaborate on all traditions, we will follow and focus on the approach which currently is the most appropriate in the context of education namely: the holistic or integrated approach (Winterton and Le Deist 2005; Mulder et al., 2008, Gonczi and Hager 2010).

In the holistic approach, competence is considered as an integrated cluster of knowledge, abilities, skills and attitudes which are conditional to perform a range of job related tasks and to function effectively in a certain profession (Mulder et al., 2008). This approach is holistic, since these different attributes of competence should be defined in the context of realistic professional key tasks and the specific profession in which they need to be performed (Gonczi and Hager 2010).

4.2 Consulting retail design practitioners

For the development of the retail design competence model we adopted a bottom-up approach and consulted practitioners in the field of retail design. Hence, the practitioners' opinion on the required profile of future retail designers, has a decisive influence on the outcome of the competence model. Moreover, the consultation of professional experts in the field, corresponds with educational approaches to develop practice-based learning programmes and competence-based curricula (van der Klink and Boon 2002; González and Wagenaar 2008, Mulder 2014).

Van der Klink and Boon (2002) provide an overview of methodologies which are often used to map the required competencies in professional domains. The overview distinguishes methodologies which centre on the identification of job related tasks (critical path analysis), expert workshops for

curricular reform (DACUM-method), identifying required future competencies in a profession (COMBI-method), determining competencies in terms of knowledge, skills and attitudes and lastly, identifying core problems in a profession. Based on this overview and with the holistic tradition in mind, we adopted a mixed approach which integrates different aspects from the methodologies mentioned. These aspects were used to define the main topics that needed to be discussed with the practitioners and guided the interview questions. We considered three main topics namely, the retail designer's opinion on:

- the **current** practice of retail design and the profile of the retail designer;
 - retail designer's required competencies in terms of knowledge skills and attitudes;
 - job related tasks;
 - the retail design process;
 - core problems in the profession;
 - the influence of digitalisation and omni-channel on the profession and the practitioner;
- retail design **education**;
 - curricular requirements;
 - format;
- the **future** of retail design and the profile of a retail designer (10-15 years).

4.3 Data collection

We conducted semi-structured interviews to be able to have a dialogue with the respondents and to understand their underlying experiences, beliefs and values (Mortelmans 2013).

The choice and selection of retail design agencies was based on the following three criteria:

- the agencies' core business is design for commercial purposes;
- the online portfolio contains reference projects in the sector of retail;
- the agency is involved in concept development and design.

The agencies were searched online by using Google search engine, exhibitor lists of retails (design) fairs (Euroshop, Retail Expo London, Globalshop), Dexigner.com and Linkedin.com. To see whether the agencies met our criteria, the firms' websites were reviewed. Geographically, the scope included Belgium and neighbouring countries namely: the Netherlands, the United Kingdom, Germany and France. This resulted in a list of 83 agencies.

In May 2016, all agencies were contacted via e-mail with an invitation to participate in the research. We asked every agency to interview one junior and

one senior retail designer, preferably involved in the spatial design of the store. A total number of 17 agencies agreed to take part in the research. The participating agencies are located in Belgium (5), the Netherlands (8), and Germany (4) and range from 11 to more than hundred employees. Unfortunately, we did not manage to convince agencies in France and the United Kingdom to participate.

Between June and September 2016, we interviewed 31 respondents with different disciplinary backgrounds (Table 1). We preferred face-to-face interviews, but due practical reasons we also conducted four online interviews (Skype). Since some agencies were limited in time, interviewing both the senior and junior designer was not always possible.

All interviews were voice recorded and had an average duration of 30 to 90 minutes.

Table 1: The number of respondents and their disciplinary background

Respondents (31)	
senior retail designers (18)*	junior retail designers (11)
<i>interior design (7)</i>	<i>interior design (8)</i>
<i>product design (5)</i>	<i>product design (1)</i>
<i>architecture (3)</i>	<i>architecture (1)</i>
<i>graphic design (2)</i>	<i>exhibition design + communication design (1)</i>
<i>trained in practice (1)</i>	
Non-designers (2)	
<i>brand director (1)</i>	
<i>account manager (1)</i>	

* More than 10 years of experience

4.4 Analysis procedure

All the interviews were transcribed and analysed using qualitative data analysis software (NVIVO) following Mortelmans' (2013) methodological interpretation of Grounded Theory (Glaser and Strauss 1967). In this approach, the objective is to develop theoretical insights from the data through continuous comparison (Mortelmans, 2013).

The interview transcripts were gradually broken down into fragments which contained respondents' view on the required retail designer's competencies. We selected fragments that included job related tasks, required knowledge, skills and attitudes as well as future-oriented competencies. All fragments were coded, reviewed and cross-referenced in order to arrive at thematic competency categories. Competencies that were only mentioned once were left out. This resulted in a list of 77 competencies divided into eight thematic competency categories.

4.5 The holistic model of professional competence

We selected Cheetham and Chivers' holistic model of professional competence (1996), to further categorise the competencies and thematic categories. The goal was to arrive at a competence model that would reflect both the competency themes and the competencies related to knowledge, skills/tasks and attitudes. Although in theory this distinction can be easily made, in practice competencies are described in a multi-dimensional way. Besides, the different attributes are mutually interdependent and interrelated (Winterton and Le Deist 2005).

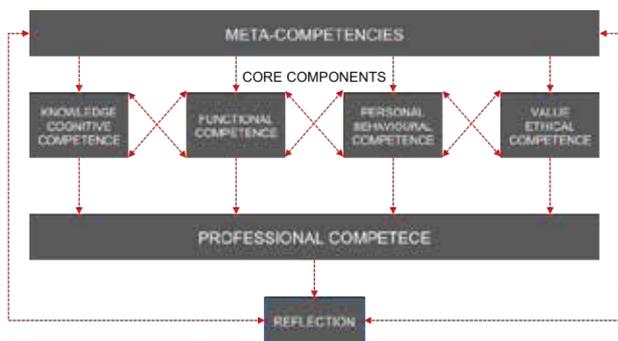


Figure 1: The holistic model of professional competence (simplified), adopted from Cheetham and Chivers (1996)

Cheetham and Chivers' holistic model provides an overview of the different types of competencies and components that contribute to professional competence (Figure 1). These components are mutually interrelated, which is reflected with the red dotted lines.

The four core-components distinguish **knowledge/cognitive competence** ('the possession of appropriate work related knowledge and the ability to put this to effective use'), **functional competence** ('the ability to effectively perform a range of work-based tasks to produce specific outcomes, what requires the possession of discrete skills'), **personal/behavioural competence** ('the ability to adopt appropriate observable behaviours in work-related situations') and **values/ethical competence** ('the possession of appropriate personal and professional values and the ability to make sound judgments based upon these in work-related situations').

The overarching group is called '**meta-competencies**'. These competencies are more generic in nature and facilitate the development of the four core competencies. Both the meta-competencies and the four core competencies contribute to the production of observable professional outcomes which mirror a practitioner's **professional competence**.

The last component '**reflection**', is based on Donald Schön's theory of the professional as a reflective practitioner (1983). Herewith, Cheetham

and Chivers (1996) argue that practitioners reflect on their professional outcomes what leads to self-reflection on their performance and core competencies or meta-competencies. This aspect of reflection gives the model a dynamic character and suggests a continuous cycle of a practitioner's personal improvement. In our view, the dynamics in the model and the idea of continuous personal improvement are assets as we wish to use this model in the context of retail design education.

4.6 The retail design competence model

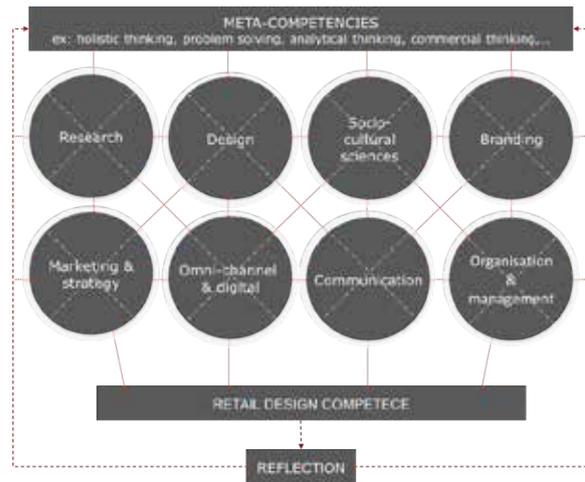


Figure 2: The retail design competence model (simplified)

The final retail design competence model consists of 77 competencies. 69 Competencies are divided over eight thematic categories (research, design, socio-cultural sciences, branding, marketing/strategy, omni-channel/digital and organisation/ management) and 8 competencies belong to the group of meta-competencies. The thematic categories are clusters of competencies relating to knowledge, skills/tasks, attitudes and values/ethics. However, it should be mentioned that not all categories cover the four types of competencies, since respondents did not mention all of them.

In analogy with the model of Cheetham and Chivers (1996), the meta-competencies together with the competencies in the thematic categories interact to produce specific retail design related outcomes (e.g. an innovative store concept which corresponds the retailer's brand values). These outcomes are observable by the retail designers or by others (e.g. retailer, colleagues, etc.), what leads to designers' self-reflection on their professional performance or their retail design competencies.

5. RETAIL DESIGNERS' DESIRED COMPETENCIES IN THE CONTEXT OF OMNI-CHANNEL AND DIGITALISATION IN RETAIL

Since we now have a deeper understanding of the required competencies of future retail designers, our initial research question can be answered. As it is not possible to discuss every category in depth, we will focus on one category which explicitly relates to the topic of omni-channel and digital. In the following paragraphs, we briefly explain respondents' vision on three main competencies we could discern (Figure 3).

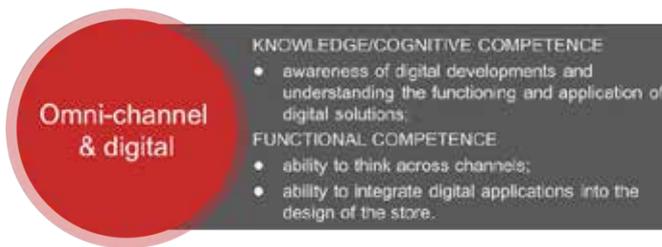


Figure 3: Competencies related to omni-channel and digitalisation in retail

5.1 Awareness of digital developments and understanding the functioning and application of digital solutions

In the first competency, respondents address the need that retail designers should be aware of digital developments in the field of retail. A few examples of such developments are: holograms, augmented reality, mobile applications, data technology, etc. Apart from being aware of these developments, respondents value the fact that retail designers have a basic understanding of how these digital solutions function and how they can be integrated in the store environment. The following reasons were mentioned why this competency is valuable for retail designers:

- to be able to think or design differently and to come up with creative ideas during the concept development and design process;
- to be able to communicate with others (e.g. external agencies or experts);
- to be able to advise the retailer.

The underlying basis for these arguments should be seen in the context of how the participating agencies work in their daily practice: four agencies have in-house digital designers, whereas others claimed to work with external partners or agencies to develop digital solutions (e.g. websites, mobile applications, etc.). Though, the respondents of the last group stated to come up with the creative ideas themselves and then continue to develop these ideas with external partners. Hence, to be able to come up with these ideas, a basic understanding of digital developments in the field is necessary.

5.2 The ability to think across channels

The second competency stresses that during the creative process retail designers should not solely think/work on the level of the physical store, but also need to consider the other channels and consumer touchpoints. Several respondents explained how they try to do this in practice.

A first manner is to integrate online and offline channels to bridge the gap between both. In most cases, respondents mentioned the integration of the online world into the physical store as most participating agencies' focus is on the design of physical environments. An example is the creation of meaningful instore service and brand experiences and the extension of the experience outside the store by means of providing convenient mobile applications to easily buy products.

A second manner is creating consistency between channels. This means that designers for example try to create a brand experience, brand story or visual identity which evokes the same feeling online as well as in the store.

The last aspect involves rethinking the role of the physical store. In this context, respondents for example question how the concept of the physical store should differ from the online experience. Answers to this question lead to the reconsideration of the function of the store (e.g. the store as a pick-up point vs. the store as an experience centre).

According to the respondents, thinking across channels should already take place at the beginning of the process. This to make sure that everything is fully integrated in the concept since certain decisions to integrate digital solutions might for example influence the lay-out of the store.

In these early stages of the retail design process, respondents often mentioned the use customer journey mapping with personas as a tool to map all touchpoints customers encounter or use during the decision-making process. Based on the outcomes of the customer journey map, the retailer and the designer can discuss which touchpoints and channels are the most relevant for the brand or which ones need to be further developed.

5.3 The ability to integrate digital applications into the design of the store

The last competency refers to the actual design of the store and the integration of digital applications. Respondents mentioned several aspects which designers should take into consideration if they consider the integration of technology:

- the routing and the lay-out of the store;
- the role of the staff (e.g. supporting vs. minimizing the staff's role);

- the changing role or function of in-store elements (e.g. check-out);
- the integration of technical aspects (e.g. cables or electrical conduits);
- the added value of the technological solutions (e.g. commercial tool vs. gadget);
- digital content;
- aesthetics;
- consumers' needs and their shopping behaviour;
- the retail brand and values.

In brief, every decision to integrate technology in the store influences at least one of the abovementioned aspects.

In this context, several respondents also criticised the way in which technology is often used or integrated in the store. Most respondents refer to the rashly use of in-store screens without considering the commercial value, the required digital content or the added value for the customer. According to some respondents, this results in the typical black screen phenomenon or turns these applications into unnecessary gimmicks.

5.4 Constraints and conditions

During the interviews, respondents mentioned several **constraints** which hinder them to put these competencies into practice (Table 2). These constraints can be divided into external and internal factors. The external factors relate to aspects outside the reach of designers/agencies. For example, it might be difficult to convince the retailer to invest in an omni-channel strategy. Another external factor is the speed at which these technologies develop. Consequently, it becomes too difficult for designers to stay up-to-date of the latest developments.

The internal factors relate to the retail designer or to the operational side of the retail design agency. Respondents for example mention that the store is still often considered as the default starting point at the beginning of the process. Consequently, the other channels are only considered at the end of the process what does not result into a fully integrated concept.

Besides, several respondents experienced a lack of digital or omni-channel knowledge and stated it to be difficult to find best-practice examples. However, some respondents also acknowledged that the degree of knowledge and awareness for these developments depend on the designer's personal interest.

To conclude, the last constraint refers to designers' ability to think in a holistic way. A few respondents stated that designers tend to limit their thinking to their own discipline, whereas in this context it is required to think across disciplines.

Table 2: Constraints and conditions

CONSTRAINTS	CONDITIONS
External factors	<ul style="list-style-type: none"> • the briefing of the client • type of store • type of brand • type of retail sector • customers' needs • customers' shopping behaviour
<ul style="list-style-type: none"> • the retailer • speed of technological developments 	
Internal factors	
<ul style="list-style-type: none"> • the physical store as the default starting point • lack of knowledge and experience • lack in holistic thinking 	

Besides constraints, the respondents mentioned several **conditions** which determine whether the online aspect will be taken into consideration or not. For most respondents the type of store, the brand and the specific retail sector are the most depending factors.

6. CONCLUSION: SOME CONSIDERATIONS FOR RETAIL DESIGN EDUCATION

From the perspective of education, half of the respondents explicitly mentioned that the topic of omni-channel and digitalisation should be integrated into the retail design curriculum. Based on our findings, we notice a theoretical and a practical component which can be integrated. The theoretical component relates to the awareness of digital developments, understanding how they can be applied or integrated as well as an understanding of how they function. The practical aspects relate more to skills such as the ability to generate creative ideas, the ability to think across channels starting from the customer journey as well as the ability to integrate these technologies while considering the different variables and conditional factors.

Our findings show there is an opportunity, but also a need for retail design education to respond to the developments in the field of retail. Retail design education should strive to educate students to become collaborative holistic thinkers who are able to create immersive consumer experiences in a seamless world of retail. In our view, this calls for a transdisciplinary approach to retail design education which is not limited to the physical design of the store. It should stimulate design efforts which transcend the disciplinary boundaries of 2D, 3D and the virtual world. Besides design competencies, retail design education should provide the opportunity to acquire knowledge and skills in the fields of design research, socio-cultural sciences, branding, marketing & strategy, communication, organisation & management as well as omni-channel & digital.

In this context, our model can serve as a reference point to understand these required competencies

on a deeper level since it reveals what a certain competency entails, how practitioners perform these competencies in practice and which type of attributes they address. We therefore believe that the model will be a useful tool to further reflect on the conception of retail design education, the content of the curriculum and didactic methodologies. Besides, it can serve as a benchmark tool to study existing retail design programmes and best-practice endeavours. Hence, the objective of our further research is to use the model as a tool to map different scenarios to integrate the abovementioned competencies into a curriculum for the future of seamless retail design education.

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Children deconstructing the adult mastery; story-making and design as tools for life

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This paper examines a partnership between adult designers and ten-year-old children working together on a future-orientated design brief called the 'Future Design Board'. The study was part of the author's Ph.D. thesis and used a fusion of design and story-making processes as tools for critical thinking and everyday exploration. During the study, the children were positioned in the role of the imagination expert while the adults were positioned in the role of the learner. This paper focuses on the impact that the partnership had on the adult participants; in particular, it reviews how the workshops allowed them to experience the power of children's imagination and recognise what elements of this may have been lost in the process of growing up. At the same time, the paper reviews the different qualities that the adults began to reconsider; these include the value of sharing and allowing time to have fun, using all their senses to experience the world, taking risks and making mistakes. The paper also analyses how the methods of the workshop had impacted on the adults' identities as designers and researchers. However, most importantly the paper discusses the importance of experiencing what children are capable of and the adults' commitment to valuing their ideas.

Story-making, design, collaboration, child, adult, power dynamics, play, methods, future

1. INTRODUCTION

This paper commences with a story from Rudyard Kipling that had been used as an example in Warner's (2013) chapter called 'Contradictory Curiosity'. It is a "story of a child – "an elephant's child" – who was full of satiable curiosity" and an inquisitive nature towards all he sees, hears, touches and smells. However, the adult elephants became annoyed by his endless questions and begin to punish the curious elephant child. This story is an analogy of how growing into an adult often means being pushed into a place that differs from the curious, magical place of the childhood.

In the context of exploring if parts of the magical 'child-expertise' can be restored in adulthood, this paper examines a child-adult partnership that questions how far it is possible for adults to be "carried away" by children's fantasies and to challenge their established adult thinking structures. This paper builds on a previous paper (Antonopoulou, 2011), which positioned and analysed "the Future Design Board" child-adult workshop series that took place between January

and June 2011¹. This child-adult partnership model had evolved after observing that despite the theoretical discourses that envision design, play and story-making as an integrated creation tool (Warner, 2011; Brake, 2008; Baynes, 1992) there is an apparent lack of practical examples that combine them into a "hands-on" method for all. Potential parameters that were identified as causes for this were the ways that child-play is generally devalued and obscured in adult life, in addition to how design is mainly considered as a professional designers' activity.

2. TASK AND METHOD

The workshops consisted of three six-hour sessions that involved several teams of two 10-years-old children and one adult. The adult participants were really diverse in terms of age, nationality and skills, however, they all viewed themselves as designers. Nevertheless, with the belief that everyone is a designer in their everyday capacity to problem-solve and create, the

¹ these comprised the final case study of my Ph.D. research at Goldsmiths – University of London.

workshops also included participants that did not come from a professional design background. During the study, the children were positioned in the role of the imagination expert while the adults were positioned in the role of the learner. Pre-session training was devised in order to facilitate the adult and children participants to be able to work in these terms (Antonopoulou, 2012).



Figure 1: Adults and children working together

The overarching task of the partnership was to design objects for the future and as part of this, an imaginary “Future Design Board” (FDB) sent a fictional brief to the child-adult groups. This concept and its tasks directly immersed the participants in story-making. The workshop started with a warm-up activity asking the teams to think about how they imagine the designers of the future, design their accessories-technologies and dress up with these. In the role of the future designer, the participants would then talk about how they envisage design and its role. The children immediately immersed in making without giving any explanation of what they were planning to do. “Not knowing what children were doing made me feel scared”, said Jill, one of the adult participants. Adults reacted in different ways to the loss of their power. This ranged from Jill’s passive attitude which led to her being initially ignored by the children she was working with to Lena’s “teacherly” approach stemming from a fear of losing control, which resulted in attempts to discipline children’s actions and behaviour). By and large, however, the adults at this stage were mostly helpers in the making process as many found it difficult to follow the fast pace of children fast pace of fiction-making.



Figure 2: Jill trying to figure out what children were doing during the first stage of the workshop

During the main activity, later on, the teams were asked to design future objects and help the “Future Design Board” committee that had run out of ideas. As part of this, they used the “story-making tool for design”; a tool I had created in 2009 that helps participants develop new objects while imagining them as personified living characters (Antonopoulou, 2009). The participants used the tool to write and illustrate the objects’ life adventures and used these stories as an inspiration to model their objects. Once more, the children were faster in story-making. Jill referred to this as a phase during which the adult participants were “pushed on roller skates” into the children’s world of play and not knowing how to balance they were “trying not to fall”. By the end of the day, some of the adults have started to add their own fictions and they were even attempting to “compete” the children’s fantasies, by expressing what they thought as being “crazy ideas”. Nevertheless, the children would, in turn, propose something more “extreme”, and often reject the adult ideas.



Figure 3: Children being really fast in co-creating stories during the first day

The teams’ proposals were posted to the imaginary Future Design Board and a week later they received responses that helped them discuss, progress and finalize their ideas. During the second day, the adults were clumsily rolling holding hands with the children admiring the “places” that children took them. The children’s leadership gradually diminished as adults were becoming more ready to immerse themselves in fictional thinking and the children were engaging in design thinking. During the third day, the teams had to create their final models. By that time adults and children were confidently rolling together in playfulness, while the nature of the activities allowed the adults to share secrets from their design world.



Figure 4: Adults and children working together during the third day

However, the aim of the workshop was not the development of new products but the use the creative process as a way to test personal ideas and ideals. In this context, the process triggered discussions on the ethics and the rhetoric of public voice, the limits of the designers' power and responsibility, discourses on sustainability, wellbeing, empathy and friendship as well as highly philosophical issues such as ethics of punishment, freedom of choice and the elusive idea of perfection.



Figure 5: Discussing ideas and ideals

The data collection process was part of the main "Future Design Board" fictional scenario and involved a personified PDA device² called the "little computer" and personified "Dictaphones assistants" that the groups have to dress up and name. All these were acting as agents transferring information (videos, pictures, conversations, writings) between the participants and the imaginary "Future Design Board". The participants responded via imaginary finger personas that they had drawn in their fingers. The data that were analysed with NVivo included final objects, recordings (audio, video, photographs) of the process, questionnaires and interviews with the participants. The task of the data collection process was essentially in the hands of the participants.

² a compact mobile devise that you can use to write, take photos, videos and voice recordings



Figure 6: Data recording: The little computers and the finger characters

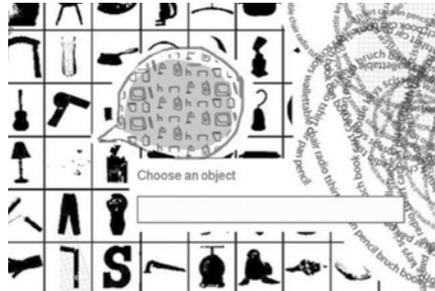


Figure 7: Screens from the "story-making tool for design"



Figure 8: Dressing up and personifying a Dictaphone



Figure 9: Child participant collecting research data



Figure 10: The tasks and stages of the workshop

3. THE IMAGINATION OF THE CHILD: RECOGNISING WHAT WE HAVE LOST AND EXPANDING ADULT CAPACITY TO IMAGINE

To start with, adults were fascinated to experience that in the child's world everything is possible. As Zahret, one of the adult participants, put it, "with adults you can say that is wrong but with a kid, you cannot say "no we can't do it"; everything is logical; magic makes sense". And, indeed, the children considered a living sweet as something normal. "He is just a normal sweet, that he is alive... he is a living sweet that's all he is," they said. Magic, is as simple as that for children. According to Harry, it is this "alternative possible" that adults were not able to consider themselves one of the major learning.

It is important to observe that all the adults recognised that their interaction with the children generated new ideas that would not have occurred without them. While many of the adults expressed a sense of shock at having lost this type of unadulterated playfulness, nonetheless, after the workshops they also expressed pleasure and exhilaration. As Jill put it, it was as if the children had entered into a "Peter Pan" role, putting them back in touch with their childhoods.

Adults came to the conclusion that becoming an adult meant to forget how to see things anew. They realised that they had been somehow educated out of their creative capability "to continue to be" or constantly "become" (Horton and Freire, 1990, p. xi). As Zahret said "I was interrogating myself. Everybody needs that shock, why did I stop learning?" Horton has also talked about the danger of this process suggesting that "one of the most tragic illnesses of our societies is the bureaucratization of the mind" (Horton and Freire, 1990, p.37); and it is actually one that is very difficult to diagnose ourselves. The children seemed to be the catalysts in making adults diagnose themselves and become motivated.

It was clear that adults also valued the power of story-making as an ideation process and in particular the method of the personifying objects. Even if the adult participants had clearly suggested that the "story-making tool for design" was way more than a professional practice tool, most of them considered ways of using it professionally in the future. As adults said: "Even though story-making felt to be a hard task at first, the impulse questions, the atmosphere of the workshop and openness of interpretation of stories became a medium to have fun, unwind and let it go". However, everyone suggested that an integral part of the tool's success is that is used in collaboration with the children. Jill outlined that "the disagreements", meaning the times that children rejected her ideas, were the moments that made

her think differently, cultivate and develop new ideas. Harry said that while he is able to make the best of the world around him, he found complimentary that the children could help him create something out of nothing; a new world to escape to. Lena also felt that the collaboration allowed her to become more playful.



Figure 11: A robot as part of the group

4. SHARING, COLLABORATING AND VALUING TOGETHERNESS

In addition to the uses of story-making the adults realised that play, fun and thinking is best when shared with others. The workshops not only motivated adults to value collaboration but also cultivated the importance of friendship and togetherness within a community. The concept of love, friendship and companionship were evident in many of the personified objects and stories produced and allowed adult participants to reflect on it. For example, Betty thought that their "dream for a wish" hat could be worn if you have a bad dream and one may wish to instantly have someone next to you to console you. With this enhanced value of co-existence, the adults were enabled to respect and consider the full value that makes us humans. Zarhet, for example, said that their "incredible robot" has taught them that "it wouldn't be very nice to change people" and she elaborated on how we should respect and accept others, "just how they are".



Figure 12: Hat that consoles you after having a bad dream

5. “JUST IS”: DISMISSING THE CONSTANT SEARCH FOR UNDERLYING MEANING

Another important finding was that the adults were moved by the unpretentious simplicity of the children’s perspective. Lena pointed out that while adults search for meaning in the moral or the purpose of a story for the children a story is just a story. Jill had also observed that the children, “just do something”, “just make something because it is just play for them”, they don’t need to think about it beforehand; they don’t like to overanalyse their thoughts. This is also evidenced in their dialogues with the adults.

P (child): He does not have eyes, no!
J (adult): Why?
P (child): Because he is a Dictaphone...
J (adult): What about ears?
P (child): He doesn’t have ears either
J (adult): Why not?
P (child): Because he doesn’t

Adults were able to reflect on this stance of unpretentiousness to critique professional Art and Design discourses. They talked about how the “trend” to justify actions by intellectualising and academically legitimizing them often leaves no space for the honest, “just because...why not”.

Adults understood the value of these “just is” moments when pleasure comes out of the practice of doing; and indeed, according to Dijksterhuis, and Van Olden (2006), it is these unconscious moments that people do not have time to analyse what they do, that they are actually more able to be happy with the outcome. It is this “just is” approach that underpins doing things just because they are fun.

6. CHOOSING FUN OVER PROFIT

Harry suggested that he had learned that fun is not “a waste of time” but it should be an important objective. As he said, even if it would not make sense to a client to charge per hour just to have fun, it is crucial to be able to afford the time to explore and “just do” for the pleasure of doing. When I met him for the interview sometime after the workshop he had transferred this experience into his practice and he was creating journals just for “his own fun”. “I am going to hang it on the wall” he continued, “the whole idea is letting go of what this would be (...) I am not doing it because [it] is going to be a masterpiece; it might be, but I didn’t care at that time”. This realization is important as it shifts the perception of what is valuable. Value is not dependent on acknowledgment but on enjoyment and self-expression.

The adults came to the conclusion that it is also the professional ways that we have learned to operate that refrain us from being able to obtain a fresh view where everything can go. For example, Zahret said that it would be boring without children since the adults would follow the familiar to them methods (research, discussions, brainstorming, creating a long story, and ending up with a product), but they would never be able to have a robot amongst them to tell them what to do.

Harry also suggested that Arts and Design, in their attempt to seem “serious” and worth investing, often compromise their innate creative nature and adopt business processes. However, adults realised that play and fun involves passion and emotion, and they were hopefully inspired to be what Jenkinson calls “free-range players” and grow into “free-range thinkers” (2001, p.51).



Figure 13: Group photo; the team is just having fun

7. OVERCOMING SELF-CONSCIOUSNESS, TAKING RISKS, MAKING MISTAKES

Being with the children and evidencing how they express whatever comes to their mind without filtering it, the adults realised that another barrier is their self-consciousness. As the adult participants said, our ego controls and filters a lot of what we say, fearing not to be perceived as silly or not “normal”. For example, in contrast to children’s spontaneity “we might think of something, but then immediately our subconscious says, ‘oh, no, no, that is a silly idea’, and then you wait until you get something better”. Harry outlined that even in cases that adults try to be childish, they are still self-aware: “even if you pretend to be a child you pretend to be a smart child, you never pretend to be a stupid child”.

In addition to decreasing their self-awareness and learning through fun, adults stated that the children have taught them how one should not take themselves too seriously and take risks. While the children agreed that there is no recipe for “perfect” life, the adults were inspired to see that life is liquid

and hunting perfectionism does not guarantee control; instead, a culture of experimentation, no matter the outcome, and continual readjustment to new experiences was needed.

Inspired by the children the adult participants were prepared to take any chance and try out things that they did not know how to deal with. It became apparent to them that “the bigger the risk the bigger the value” (Warner, 2013, p.34). In accordance to Becket’s (1983;1999) “fail better” philosophy, Harry outlined the importance of failure as valuable as part of life learning. In his words, “you make mistakes and eventually one mistake you would like”.

8. USING ALL THE SENSES

The adults at the same time observed how the children were able to recognise, understand and articulate the most complex issues in a very truthful and precise manner without sugar-coating them. “If they thought something is ugly, if they don’t like something, if they feel moody, they would say it with a sharp honesty”, said Lena.

Jill illustrated the deep and truthful connection between the children and their environment by saying that children were more sensitive about things. Sensitive according to her means, “to be able to use all your senses to observe and absorb things”. They are according to Jenkinson “in tune maintaining a connection with the invisible, with unseen forces behind nature, and the metaphysical world” (2004, p.67). Not only did Jill notice how children managed to be more sensitive but she believes that by observing them she learned how to follow the same process and look at things from a different perspective. As Jill said, when they had designed the living sweet that saved Japan from starvation, she felt confused and thought “what on earth?”. Despite that the children were rejecting her ideas, she was amazed to observe how they combined and interwove their ideas without having a plan. During the group presentations, she further absorbed how one would say something and the other would continue even if they had never talked about it before. They would say “oh yeah and (...) they would carry that on, they would pass it to each other and continue back and forth, in a malleable and flowing in a way,” Jill said. Zahret also found that this process of interchanging fictions and inhabiting fictional worlds made her more open-minded and able to look at things from a different perspective than the singular reality of your own world.

9. AGENCY AS DESIGNERS AND RESEARCHERS

With this new perception of what it means to be creative, that resulted from the collaborative story and physical making, the group discussions and the meta-reflections helped the adults reconsider what it means to be a designer and a researcher, and feel more confident about their “designer” identities. While Harry had talked about design as a “creative and as fun as possible process”, Zahret had come to consider design as a personal experience through which the designer constantly seeks inspiration for their own personal growth and satisfaction. And like many of the adult participants, she had come to consider design capability as a life skill and as a mode through which one could develop and express their knowledge, values and opinions: “If you are a real designer you have to create for yourself, for your beliefs”, “you need to have your own projects”, the “designer’s job does not end at 5 pm”, it is “your life long decision”.

Zahret, also came to think that design is not fragmented in different disciplines; it is a skill-set logic. However, according to Zahret If someone is “just hungry and eats” it does not mean that they design their food, they just consume”, Zarhet said that a designer is someone who “wants to make the best rice” and “tries to get the best olive oil from the city market”. Everyone phrased their views about design in different ways but they all outlined that design is about commitment, idealism, passion and inspiration.

10. ADULTS RECOGNISING WHAT CHILDREN CAN OFFER THEM AND BECOMING MORE RESPONSIVE TO CHILDREN

The partnership allowed adults to value children as coherent-self entities, with advanced capabilities, interests and unique voices. Jill suggested that the conversations changed the grown-ups preconception of children as less critical and knowledgeable compared to adults. Moreover, the adults realised that children can hold these complex “pragmatic” concepts in parallel with their “beyond-adult” capability to inhabit fiction.

Adults may not able to permanently return to this “child” state, however understanding the ways that children use the world held adults in awe and motivated them to respect “childhood in its own right as a place to be and become a human” (Drummond, 2004, p.xi). The messages that the adults left for the children was a massive thanks for what they had learned from them and wished for the best in their lives. It is hoped that these adults will remember that what is “best” is something that the children should choose.

11. THE ADULTS’ LIVES AFTER THE WORKSHOP



Figure 14: Adults, during the interviews, talking about their lives after the workshops

It is interesting to recount the impact that the partnerships had on the adults' lives sometime after the end of the workshops. Jill was the first to contact me a few months later asking eagerly to meet me, tell me that she had found her place as a designer and that her MA project has been highly influenced by the workshops. She enthusiastically said that story-making had become her tool to engage people with "obscure" issues. Betty also had a professional revelation; she said that she had finally found the confidence to draw and feel that she is a designer.

For Zahret and Harry, the workshops had broader life-changing effects. Zahret said that children were the "motivators to find direction in life" and she signed herself up for a life of staying fresh. She started studying new areas in her free time and she was so enthusiastic about her new life that she was getting in touch with me very often to share the new things she had learned. Harry decided to free himself too and left engineering for what he always wanted to do, enjoy art. In our first interview a couple of months later he brought me his drawing and showed it to me with pride. He had tried to paint in a very free way just for his own fun.

Almost a year later, during our second interview, we spend many hours talking about all the things he had learned about the power of collaboration and how he has applied these in his new collaborations as a photographer, filmmaker and artist. I felt very proud to see one of his photographs in Tate Britain. Lena left her job too and moved to France where shortly after met her other half, became a mum and started a career as an illustrator for children's clothes.

Someone would argue that these changes might have happened anyways in these people's lives. It is interesting however that they happened simultaneously shortly after the workshops and that every single adult thought that the workshop experiences were the catalyst for their change.

The teachers in school that I ran the "Future Design Board" were also interested to run further workshops engaging their 16-year-olds "Design and Technology" GCSE students with the 10-year-old children and possibly engage the teachers to be in partnership with the children. Subsequent to my workshops the school also continued to engage with very interesting projects along the same concept of capability being connected to a broader life skill (Stables, 2013). Even if the school has always been proactive I hope that my research somehow enforced the teachers to see the benefit of such projects for the children. Simultaneously the parents of the children in every single workshop were fascinated by their children's motivation and they emailed me back to express interest for future activities and ask me advice on how to keep their children motivated. No matter how awkward I felt with such questions that have no singular answer, it was obvious that all these adults had noticed that something has changed and were eager to follow this through.

It is hoped that at least some of these adults will form a new generation of adults that in their multiple roles as designers, researchers citizens, parents, teachers, learners will have a clarity about who they are and what they believe in; they will be prepared to think outside the social conventions, they will be open to test things otherwise and discover through the combination of their design intelligence and the power of play. Even if they will never be able to become as spontaneous as children are in every aspect of their lives, at least, they will be adults that value the child's expertise and know what children, as adults of the future, really need.

11. REFLECTIONS

During my Ph.D. research, I focused on a broader idea of learning without directly analysing how that model impacts on certain school or academic curriculum. However, one would wonder if and how such learning methods could have a place in formal education; how could we achieve such equal power dynamics in a formal education setting and whether children can be part of this. Wearing my academic hat I have evidenced that the universities I work for, identify the need to teach people how to be able to change and be capable of deconstructing their own processes. Being part of this process, three years ago I created the 'Creativity and Innovative thinking' short course, at Chelsea College of Arts –

University of the Arts London. This course aims and has indeed helped many people of really diverse professional backgrounds to reconsider their strengths and gain the confidence to change or better frame their direction.

However every single time I witness such transformation I cannot stop being self-reflective thinking whether academic knowledge and research are enough for one to teach such a course. To my mind, in order to teach such a course you have to stick to its principles and constantly challenge your own processes. I feel fearful that in all my roles as educator, designer, researcher and storyteller, I am part of a system or institution that propagates a set of principles and imposes them through its "expertise". Nonetheless, while being self-critical, "challenging", "political" and "experimental" might appear to offer an escape from being institutionalised, given that this is an ethos in itself (that is promoted by academia), perhaps we are inevitably bound to a system; we are perhaps part of a production line.

But how do we (academics and institutions) break away from our own foundations and what can we learn from children? Perhaps the least we can do is seek continuous "diffraction" in our individual approach by having a holistic polyphonic view of different systems and "immigrate" (Bezaitis and Robinson, 2011) in new disciplines. I try my best to stay as a "discipline wanderer-wonderer" or even as a stranger, who is expected to find ways to adjust, go with the flow, allow time for relationships to develop, learn the distinct languages used in other domains and in the meanwhile accept some degree of uncertainty, tension, friction and confusion. Leaving one's comfort zone may be difficult, nevertheless, I value that I have been forced to survive the destructive but also creative chaos of becoming disorientated and required to continually problem-solve in a "messy" way. Being willing to be both wanderer and a wonderer, like a child I am richly compensated by the magic of new discoveries. I have learned that the moment that I speak the language with a perfect accent is about time to look for new wonderlands of learning. We have many homes to come back anyways.

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Cultural Dimensions in Design Studio Pedagogy

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The increased interaction between people of diverse cultural, social, and economic backgrounds presents a complex orchestration of needs for the designer, the design, and the act of designing itself. As design educators, the authors set out to better understand this complexity in order to purposefully support the development of culturally sensitive design processes within the first-year student body. The authors speculated that current teaching methods attempted to honour the complex reality of ‘cultural diversity’ and sought to identify and document actions and uncover gaps in pedagogical approaches through data collected from interviews with educators across three design disciplines at OCAD University. The data collection was framed around the five educational aspects of studio-based learning: the setting of the learning space, the assignment structure, the design process, peer/mentor critique, and the assignment outcomes. The study identified current efforts and pedagogical approaches that connect to ‘cultural diversity’ in design studio classrooms under three main themes: lived experience, language, and discipline-specific dominant practice. Future work looks to expand the study to include more faculties and student perspectives.

Multicultural education. Diversity. Cultural Awareness. Cultural Sensitivity. Inclusivity. Design Curriculum. Design Pedagogy. Design Studio Practice. Environmental Architecture. Product Design. Graphic Design.

Diversity has become a code word for ‘all those other folks’. The problem with code words is that they’re lazy: They’re broad rather than specific, and can provide cover for inaction - the ‘I don’t know how to do this or what it means, so can someone else please do the work for me?’ manoeuvre. (Chang 2015)

1. INTRODUCTION

The authors of this paper hold the belief that design—no matter it’s specific discipline—works simultaneously in cultural contexts and produces culture. This preliminary study set out to identify what current efforts and design-specific pedagogical approaches—that connect to ‘cultural diversity’ in studio-based classrooms—were being used at OCAD University, a Canadian-urban art and design university. In order to consider broad questions—What is ‘culture diversity’? How does ‘cultural diversity’ manifest (or not manifest) itself within educational aspects of design education?—the authors sought out to identify and critique current phenomena in the studio classrooms of three of the six design disciplines at OCAD

University: environmental design (ED), graphic design (GD), and industrial/product design (ID).

2. METHODS

Semi-structured interviews were conducted with a small sample of participants, self-identified as working with beginning design students and who engage with notions of ‘cultural diversity,’ inclusion, and/or accessibility in their studio-based classrooms. Using approaches from grounded theory (Strauss and Corbin, 1990) interview transcripts were analysed to identify categories and subcategories found within the phenomena.

3. STARTING WITH ASSUMPTIONS: ‘CULTURAL DIVERSITY’

In the OCAD University classroom half of learners identify as non-white and from a range of different ethnicities. This, however, is not currently reflected in the faculty complement nor in established design education teaching practices. This study questions design culture on two fronts: one of ethics—what

value does the succession of a dominant design culture have to a contemporary learner—and one of enhancing design practice—learners enact that which they learn, therefore perpetuating a design culture that is no longer reflective of contemporary Canadian society, hinders the advancement of design practice, and limits the opportunity to create new knowledge.

Therefore, the authors wished to assess and critique current classroom practices of studio-based learning— assignment structure, design process, the setting of the learning space, critique, and the assignment outcomes—considered through a lens of ‘cultural diversity.’

In order to establish a common starting point for each participant's interview, the UNESCO definition of ‘cultural diversity’ was provided specifically because it emphasized ‘cultural diversity’ as ‘opportunities for dialogue’. The authors found this meaningful to the design education context where design should be permeable and provide fluidity between art, technology, and society.

Cultural diversity is a dynamic process whereby cultures change while remaining themselves, in a state of permanent openness to one another. At the individual level, this is reflected in multiple and changing cultural identities, which are not easily reducible to definite categories and which represent opportunities for dialogue. (Matsuura 2009)

The participants responded to various aspects of the definition of ‘cultural diversity’ in context to their experiences as educators in the classroom, design practitioners, and individuals. What emerged was a very rich contextual landscape of individual definitions on what cultural diversity could mean in the context of first-year design studios:

GD 2 spoke from the perspective of positionality and analysis of power structures:

My issue with ‘cultural diversity’ and multiculturalism’ [I tend not to use terms like cultural diversity, and I definitely don’t use terms like multiculturalism] is that it assumes an exchange void of power, and so my acceptance as a person of colour, of white-dominant culture is...first of all it’s not consensual...that’s the nature of colonialism, but the lack of acceptance for my culture is political violence. (GD2)

GD 1 spoke from the perspective of design in context to its origins,

[Design] comes from a very culturally located place. I think that there’s an impossibility towards creating a completely diverse and inclusive classroom in these fields in the same way that I think that diversity in something like English [literature] isn’t necessarily entirely a possibility...permanent openness to one

another: I think that’s a very accurate utopian vision of diversity. (GD1)

ED 1 spoke in context to the complexities of culture and heritage,

I have observed that often culture and heritage are intertwined and confused and/or separated. There are many people who have strong ties to their heritage, but don’t practice its cultural norms. So, the question of culture, heritage, practice, I think it’s always in flux...There’s a culture within a given workplace or within an institution, there’s a peer culture when, for instance, our students come together. There is a private culture at home that may be at varying odds with say the work culture. (ED1)

ID 1 also argues definitions of culture as heritage and asks students the question: what is your history?

Maybe you need to be going and interviewing your grandma about those histories that they’ve lived, so [students] get an understanding of their histories and then [students] can start to pass that information along ...[and] blend this knowledge [about heritage] into their design process. I tell my students not to be afraid of doing that. (ID1)

ED 2 spoke from a perspective that favoured embodying cultural behaviour, habits and perspectives in environmental design over cultural pastiche,

I do think that the idea of cultural diversity ... [is] necessarily a direct representation of a cultural identity imposed on say a project. But there may be ways of discussing space [and] the use of space. (ED2)

ID 2 frames industrial design as

a highly universal practice. Because it’s dealing with issues to cut across the globe that every culture faces’ ... ‘each body is different, but they’re different relative to certain similarities [a human body]. (ID2)

While UNESCO’s definition of cultural diversity could serve as a bridge to individual interpretations of the concepts of ‘cultural diversity’ offered by the study participants, it has become apparent that ‘cultural diversity’ cannot be absolute in its definition. Its contextual nuances need to be explicitly stated for it to be rendered actionable in a given environment. Across the disciplines, multiple meanings of ‘diversity’ were revealed during the analysis of participant discussions and predominant areas of focus emerged:

A. Lived experience: Valuing lived experience as expertise and honouring individual learning processes.

- B. **Language:** Opportunities and limitations of language as a tool for understanding and articulating design intent.
- C. **Discipline-specific dominant design practices:** Addressing the challenges of embedded disciplinary practices that limit the inclusion of varied cultural perspectives and practices.

4. LEVELS OF ENGAGEMENT

As showcased in the variety of perspectives on 'cultural diversity' offered by participants at the onset of their interviews, analysis of discussions on educational aspects of studio-based classrooms—assignment structure, design process, the setting of the learning space, critique, and the assignment outcome(s)—led to the consideration of the means by which 'cultural diversity' is made tangible in the studio classroom.

Anything that moves the individual towards a more inclusive, differentiated permeable (open to other points of view), and integrated meaning perspective, the validity of which has been established through rational discourse, aids an adult's development. (Mezirow 1991)

The following radial column chart (figure 1, page 4) plots levels of engagement as offered by each study participant. In order to expand on the matrix, the following sections offer detailed insights into the tools and pedagogies used across the three most prevalent areas of focus: (A) lived experience, (B) language and (C) discipline-specific dominant practices.

4.1 Lived Experience

Value of lived experience and individual learning processes of students was mentioned at multiple points in most participant study discussions within each educational aspect of studio-based classrooms.

This included actions such as attempts to channel students' interests outside their field of study (i.e. creative writing, mathematics) into their design methods/ process/practices, uncovering heritage through peer-to-peer interviews, disruption of dominant design practices through positionality, analysis of power structures, and coping skills for anxiety.

The following two examples provide specific details of lived experiences being made actionable in the studio classroom through the sharing of heritage and accommodation for public speaking.

A 4.1.1 Sharing Heritage

ID 1 provides an example of an information gathering method that they use in the 'Metaphor chair' assignment which has a student create a physical chair that represents a fellow student. Through the use of interviews, students—as part of their inquiry and discovery within the research phase—learn about particular behaviours, habits, and cultural practices which is then embodied in form of a chair.

ID 1 explains the process as follows:

The way the assignment is set up is to have the student interview another student in order to learn, interpret, and synthesize key points about their peer. So for example, you might have a student that's from Peru and a student that's from Canada, and the student from Canada is trying to understand key points about the Peruvian student and vice versa. Then they try to synthesize, interpret, and embody these findings into a "metaphor chair". What the student intends to do is to fill in the gaps because you only have a set amount of time to interview the other student, so it forces them to do a little bit of research on their own and understand what more do they need to know about their peer's culture that can only be found out through the interview. Through this process the student has to actually try to interpret the culture of this person and that forces them to learn about each other. (ID1)

Through a facilitated intercultural dialogue, students are challenged to confront and overcome cultural stereotypes and understand cultural practices on a personal level through peer interviews.

A 4.1.2 Accommodation through Critique

ED 1 uses group presentations as a tool to support those who are not confident in public speaking. They state in group settings the individual student feels supported by their peers—when each member has to cover some aspect of the presentation—and they can practice their particular component and present it in context to the group instead of being singled out to deliver the presentation on their own. When critiquing an individual project, ED 1 offers students the option to present publicly or individually during office hours, as well as provide the possibility of gaining feedback inside or outside the classroom from the instructor. In the case where a student is really challenged by the idea of presenting to the class, the instructor offers to present on the student's behalf,

I will present the work, I'll put the work up and so the students can see it and gain feedback from their peers without the individual having to actually present their work. That seems to work well for individuals that have problems with presenting. (ED1)

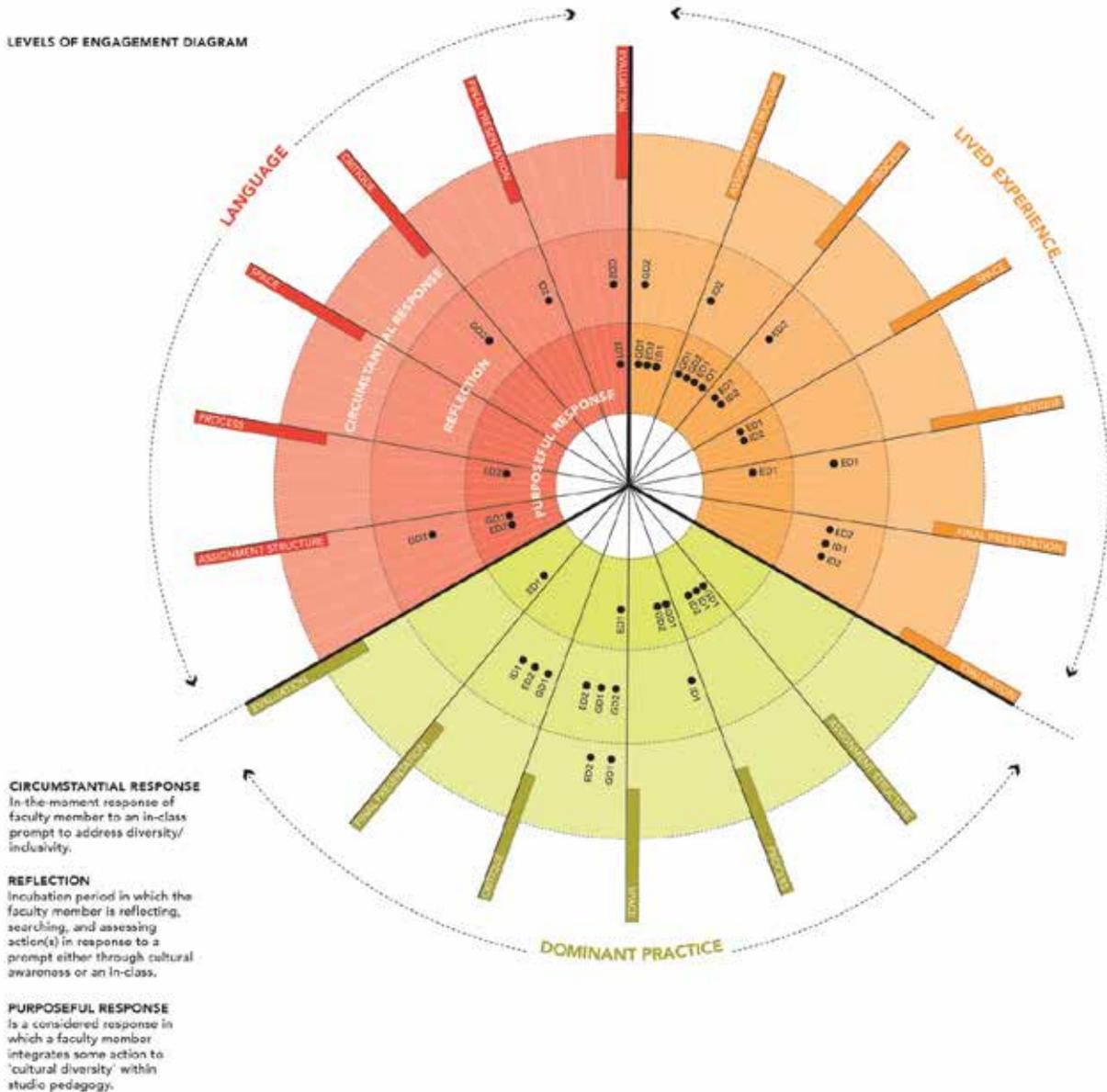


Figure 1: Levels of Engagement radial column chart.

By gradually integrating students into the critique environment, ED 1 creates a safe space for students to improve their public speaking skills and slowly gain confidence when speaking in front of a class.

B 4.2 Language

Many of our participants identified language as critical to design but also a challenge in the classroom. Language (oral and acquisition) as opportunity and/or limitation in reference to understanding of assignment intent, articulation of a concept or idea, and discussion in a critique setting was a predominant occurring area of focus with most study participants. This included actions such as peer translation of oral presentations, faculty presentation of student work, clearly written

assignments further augmented in class for clarity, encouragement of process work developed in native languages, providing support through group presentations and on-on-one meetings to target specific areas of skill development (public speaking) and written transcripts of class proceedings for clarity and accommodation.

The following two examples provide specific details of how supports for language comprehension, articulation and deconstruction are being made actionable in the studio classroom.

B 4.2.1 Modes of Communication

GD 2, states that they emphasize the value of clearly written assignment instructions to support understanding,

[I use] clear written instructions, going through those [written instructions] really thoughtfully in

class, explaining them, using different types of words. I might communicate it in academic language, or in professional terms, but also in conversational terms to make sure that different kinds of people can understand the instructions. And also just being available to answer questions, showing [visual] examples. (GD2)

Struggles with language are not limited to the language learner and language is cannot be reduced to simply understanding words. GD 2 acknowledges that students have various experiences with the use of language and therefore consciously uses multiple modes of communication to ensure their intent for an assignment is clear for a variety of learners. In doing so, they facilitate a student's understanding and learning of design.

B 4.2.2 Deconstructing Typologies through Language

ED 2 encourages students 'to use language in a much more sensitive way.' When presented with a project brief, students are asked to deconstruct and reconstruct the intent of the project through the conscious use of language (oral and written). Students are encouraged to question established typologies, and culturally and contextually examine

Defined and definable key words so that we understand if we are talking about something like a market, what is a market, what does that actually mean? I think that opens the opportunity to bring cultural diversity certainly into the conversation and it puts the studio and the brief on a level playing field. (ED2)

For ED2, language not only serves to communicate intent or idea, but is a means to discuss and explore the significance, use, meaning, and behaviour within a given space across many cultures. In this studio classroom practice, language becomes a creative driver.

C 4.3 Discipline-specific Dominant Practice

The analysis of the participant discussions revealed the challenges and limitations of embedded disciplinary practices within a 'culturally diverse' classroom context. Discussions with study participants exposed that embedded practices have become naturalized and being critical of those practices creates a paradox between an academic mandate (critical engagement with embedded practice) and being prepared for current professional design practice and culture.

This included a limited range of actions from study participants such as the investigation and challenging of established typologies, recognition of risk-taking that challenges the prioritization of exquisite form-making in evaluation, and shifting critique from a master-apprentice model to one of dialogue in a safe space.

The following three examples provide insights into how the discipline-specific dominant culture is being challenged through actions in the studio classroom.

C 4.3.1 Creating Consensual Spaces

GD 2 informs their approach to in-class critique by first unpacking the dominant critique practice and questioning how and if it should be part of the learning environment. They create a consensual agreement among students and themselves in the classroom and asks students to explicitly express the ways in which they would like to be critiqued and motivated.

I think that critiques are just something that we do because we do them, and so being really clear about what you want from it and then in terms of those presentations I often ask students ... because what I'm trying to do is build collaborative classroom environments as opposed to competitive classroom environments. In terms of the structure for critiques—it tends to be informed by conversation. So yesterday, as an example, we came up with a respect agreement...'I need to be challenged in my critiques, I want you to tell me what's not working' ... 'if that's your first and last sentence—this isn't working—that actually doesn't motivate me, it just shuts me down" So as a class we came up with a rule for, critique as a place of support, and also give suggestions and next steps for how to move forward. [For example] if you tear someone down in that class it is okay. They all seem to want that, surprisingly, which is going to be a challenge for me because that's not my style. But after you tear someone down, here's how you can reassemble those pieces. (GD2)

In building a consensual space, the unexpected challenge that GD 2 faced was that some students requested the dominant form of critique, a form of critique that is not congruent with their practice of creating a safe space in the classroom. However, the student's intent is respected by providing ways in which the practice of critique can be beneficial to all participants.

C 4.3.2 Dominant Voices in Critique

GD 1 is very aware of certain dynamics—often gendered—in the critique environment, in which a limited number of students dominate the space of discussion and feedback.

In the following example they explain how these power dynamics presents itself in the classroom:

What do I [as the instructor] is not talk too much, [and] I'm trying to figure out how to neutralize the voice of eager men. I've noticed there's a dynamic in my classroom, which are 80% percent female usually, that there are male students who are good students, intelligent people, but who start to dominate the conversation in the classroom...I am trying

to find ways to, not shut that down, and not make them feel like their voices are unheard, but to make sure that this is a classroom environment where everyone should feel comfortable to be able to respond and talk and dialogue and the other thing is that, and sometimes this isn't even gendered. Like sometimes this archetype can be female as well. (GD1)

Although challenged to experiment with ways in which this dynamic can be changed systematically, they do respond circumstantially in the classroom when the situation presents itself.

C 4.3.3 Collaborative Knowledge-building Practices

ID 2 created the following assignment practice:

three-part assignment in which the first part they [students] come in with their ideas, then in the second part we cluster them [ideas] on the wall and everybody does a model of the diversity of their ideas, it's like periodic table. [This is called an infinity map]. And it's important for them to understand how to make a [conceptual] model. The great thing about a model or a periodic table is that the gaps are just as important as the parts that are identified ... it helps you figure out what that element might be. And so, this process, it's called infinity mapping, it leads to each student then producing a model of how they think the ideas fit together in the class, that's the second part, and then the third part, they design teams. This allows students to come up with ideas that they're passionate about, it also allows them to come up with ideas that are meaningful to them. And by that I mean

in a technical way where if you imagine that

Figure 2: Conceptual Model: Levels of Engagement.

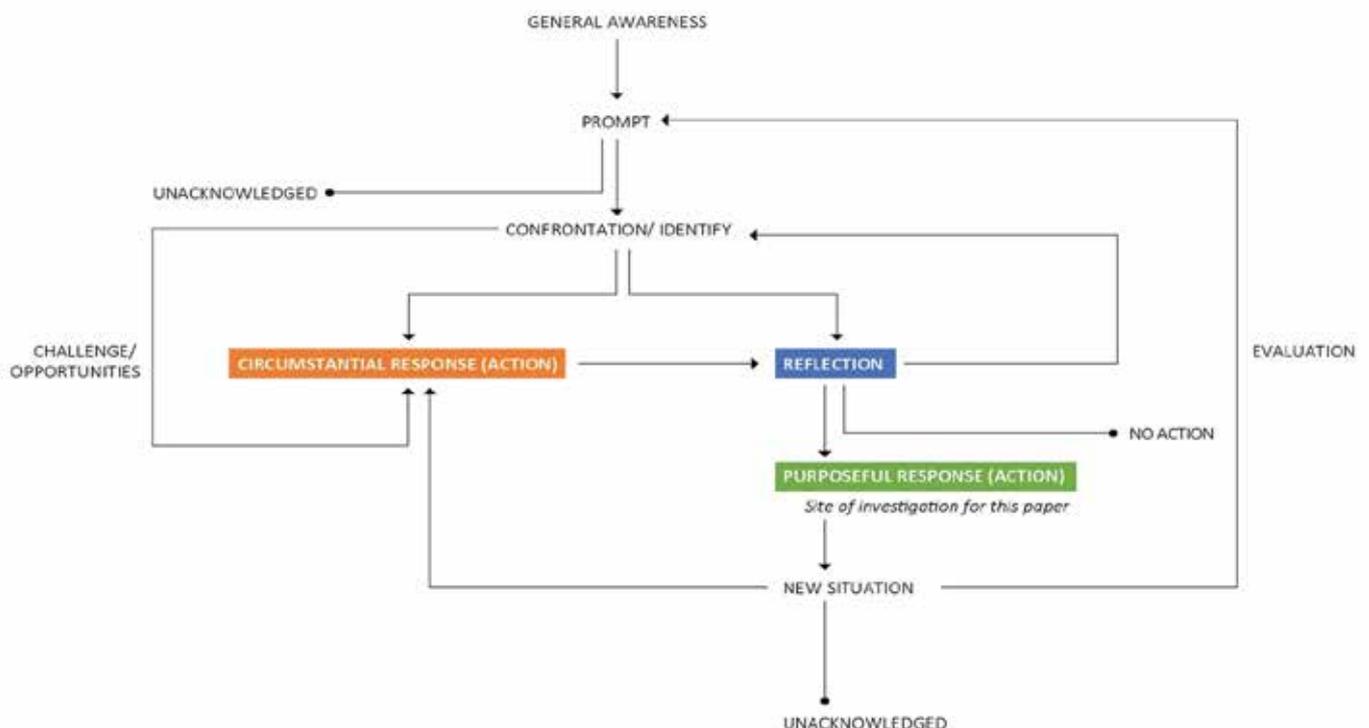
knowledge is like a tree, the more it [learning] interconnects with the tree that's emerging from someone's background and experience, I think the more the knowledge is retained, the more it interconnects. (ID2)

Through the practice of infinity mapping, the master/apprentice model is challenged with the intent of creating new knowledge through the integration of diverse student ideas and expertise.

5. CONCEPTUAL MODELS: LEVELS OF ENGAGEMENT

In reviewing the interview analysis, the authors observed the levels of engagement to be cyclical in nature (see fig. 2 below). Often the focus of the answer to a question included a prompt (e.g. some students dominating in-class discussion), with faculty identifying a type of confrontation (e.g. faculty observes the same students contributing to in-class discussions while other students are not, even though it is known [body language, one-on-one discussion] that a student has an interest in contributing) and reacts with a **circumstantial response**, defined as an 'in-the-moment response of faculty member to an in-class prompt to address diversity/inclusivity '(e.g. does not always pick the person with their hand up first).

The faculty might then reflect on the confrontation. The authors define stage of **reflection** as 'incubation period in which the faculty member is



reflecting, searching, and assessing action(s) in response to a prompt either through cultural awareness or an in-class prompt' (e.g. how do I balance eager participant engagement in class)

to make a **purposeful response** or what the authors call an 'action' (e.g. offer a variety of discussion styles that allow for more varied participation in class). **Purposeful response** is 'a considered response in which a faculty member integrates some action to 'cultural diversity' within studio pedagogy'. This might then create a new situation (e.g. greater in-class participation from more variety of students) that could generate a new prompt (e.g. eager student starts talking to friends in-class because they do not want to wait to share ideas) which could either lead to an evaluation of the situation, resulting in a new prompt, or it might go unacknowledged by the instructor.

The focus of this paper was to reveal the varied responses from faculty in addressing 'cultural diversity'. The conceptual model visualizes these findings in form of a flowchart (figure 2, page 6).

6. LIMITATIONS

The authors of this paper are aware that this study is limited to a small sample size and focuses on the faculty perspective. As this study progresses, additional design disciplines will be examined (Material Art & Design, Illustration and Advertising) along with greater sample sizes across all six disciplines. As the study uses procedures from grounded theory, interviewing will take place until saturation has been determined. A similar pilot study will investigate the crucial student perspective.

7. FUTURE WORK

The authors are currently awaiting the approval of OCAD University's Research Ethics Board in order to proceed with interviews of first-year design students, access student samples, and review participating faculty teaching material. This expanded pool of participants will allow the authors to gain the unique student perspective on 'cultural diversity' in the classroom and access to teaching material and studio samples will serve to further illustrate the practices touched upon in the original participant interviews.

To date, the literature that has informed the methodology for this study is derived from the field of adult education and the social sciences. The authors hope to broaden the study and integrate design pedagogy specific literature into the research by proposing an expanded literature review focusing specifically on current design

pedagogy addressing issues of diversity and continuing to attend design pedagogy conferences.

The authors hope an outcome of this study will be a toolkit of actionable exercises that address current classroom practices of studio-based learning. This toolkit would serve to enhance current design pedagogy and address issues of 'diversity' in the studio classroom.

8. CONCLUSION

'Diversity' sounds polite and hopeful...However much it might feel good, though, diversity talk is not enough. (Berrey 2015)

The findings of the study reveal how current classroom practices of studio-based learning at OCAD University are challenging dominant design culture, addressing the value of lived experience (student and faculty), and recognizing the key role language plays in classroom communication and the design process.

The findings also revealed many situations where faculty were addressing certain challenges as they occur or through one-on-one interactions. Even though faculty reflected upon the need to build in tangible components for their studio classrooms that address larger systemic issues, they were hesitant as to how they might be addressed. In light of these discoveries there are two key outcomes from the study. First, 'cultural diversity' has multiple simultaneous meanings. The findings have made it apparent to the authors that 'cultural diversity' cannot have an absolute definition as contextual nuances need to be explicitly discussed and determined, otherwise there is risk of hollow words (coded words). Secondly, in light of this awareness, it is also apparent that 'diversity' can only happen when it is made actionable.

Design education must respond critically to the cultural and contextual realities of contemporary Canadian society and a climate of increasing globalization, by exposing students to multiple ways of seeing, knowing, and engaging with the world. In doing so, we can have confidence that emerging practitioners and educators will come together to question embedded practices and create a sincerer future for design.

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Make Your Move: Exploring a Pedagogic Toolkit for Creative Development and Global Learning in Primary Education

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The purpose of Theatre of the Imagination is to develop a methodology which helps creative development through design and making in primary education. Objectives supporting this aim include: the development of personal agency through metacognition; the development of creative skills and ideas through practical workshops; and engagement with global learning goals through discussion and storytelling. A series of Constructivist Learning Design workshops have generated tentative findings that suggest design and making can help students to achieve these objectives. An analysis of qualitative data arising from the process of Participatory Action Research indicates that the global citizenship agenda, in tandem with design and making, helps to nurture empathy and personal agency..

Constructivist Learning Design, Metacognition, Transition Design, Global Goals, Agency.

1. INTRODUCTION

Make Your Move is one of a series of pilot workshops situated within Theatre of the Imagination, the author's PhD research project, now in its fourth year of part-time study. The research project posits the view that design and making skills can help nurture personal agency, engage with the primary curriculum approach to global citizenship, and engender cognitive acceleration. Make Your Move supports the idea that young people's learning, thinking and actions, both now and in their adult lives, are fundamental to the achievement of a more just and secure global future. The researcher sets out to develop and test a methodology which demonstrates how creative teamwork can be used as a vehicle for enhancing agency and social responsibility.

An education for global citizenship includes opportunities for young people to develop their skills as agents of change and to reflect critically on this role. Transition Design (Figure 1) encourages a long-term vision for society and offers a methodology that can act as a driving force for changing attitudes and behaviour. Make Your Move is conceived to be scaled nationally and globally and to enable the exchange of ideas and experiences between primary children through

creative practice. Metacognitive learning strategies are constructed and tested through 'learning circles' and 'pilot workshops', prior to whole-class lessons to encourage creative thinking and making skills and to drive cognitive acceleration. The approach is constructivist in nature and invites participants to depict lived experiences and to generate imaginative ideas by articulating tacit knowledge through drawing and making. A portfolio of creative learning tools is under development, designed to enable children and teachers to apply strategic thinking to problem exploration.

Burkitt's (2015) research highlights how mainstream primary education finds it difficult to match specialist schools in teaching creative arts practice due to the relatively low number of hours dedicated to developing creative skills in teacher education and to developing teacher confidence in their own training. In addition, Burkitt's analysis of paintings and drawings made by children suggests creative practice helps to develop cognitive skills, self-efficacy and haptic skills at the primary level, and concludes that these skills are transferable across disciplines.

In his thesis on Translocated Making, Hall (2015) explains "it is about the production of artefacts and experiences as a mechanism through which we

can create changes in the world that influence our sense of who, where and what we are” and his contemplative approach, related to the impact of global design, is a key reason for setting out to develop personal agency in primary education through making. Make your Move demonstrates that when design thinking and making is applied to problem-based learning it supports the aims of transition design and translocated practice. Children are encouraged to reflect upon Schaar’s (1970) suggestion: “The future is not some place we are going, but one we are creating. The paths are not to be found, but made. And the activity of making them changes both the maker and the destination.”

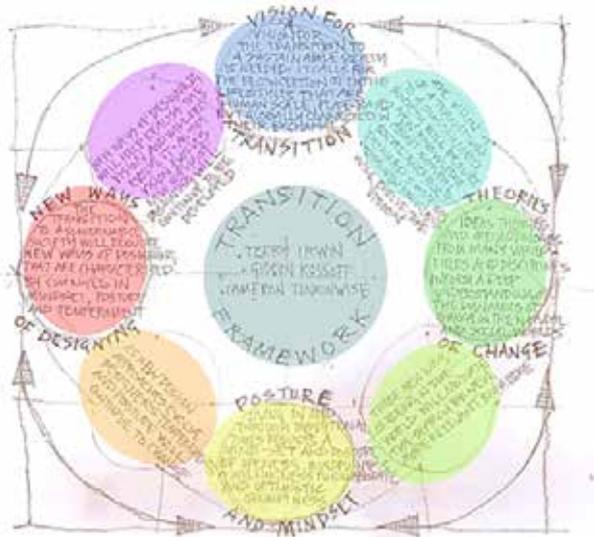


Figure 1: Transition Design Framework (Tonkinwise, Irwin, Scupelli and Kossoff, 2015). Design for social innovation challenges existing paradigms, envisions new ones and leads to positive social and environmental change.

2. BACKGROUND AND CONTEXT

The literature reviewed explores key concepts identified in the research, including constructivism, metacognition and global citizenship, to develop, implement and report on a series of educational workshops in primary education. Make Your Move tests a creative practice toolkit, designed to step out of existing institutional and curriculum boundaries of mainstream primary education based upon learning through making. Current political and social factors, in tandem with a technology-fuelled global learning agenda, have created an unstable and dynamic primary education system which has the potential to benefit from Theatre of the Imagination.

Ole Dreier (2006, pp.21-38) explains that we are all participants in social practices who can either reproduce or change these practices. New

practices and structures are co-created by participants when the status quo is challenged and ways of being shift. Nurturing responsible citizens who understand their own and others’ cultures and have a developing sense of their place in the world is at the heart of this investigation. Participants are encouraged to reflect upon cultural diversity, cultural connections and a sense of what constitutes a more responsible way of living. Eguren (2011) believes that strategic planning, using an adaptive and iterative model, is core to bringing about change and the Winterhouse Symposium Matrix for Education and Social Change (2015) was designed to help create a pattern of connections between initiatives aimed at addressing the impact of scale and levels of collaboration (Figure 2).

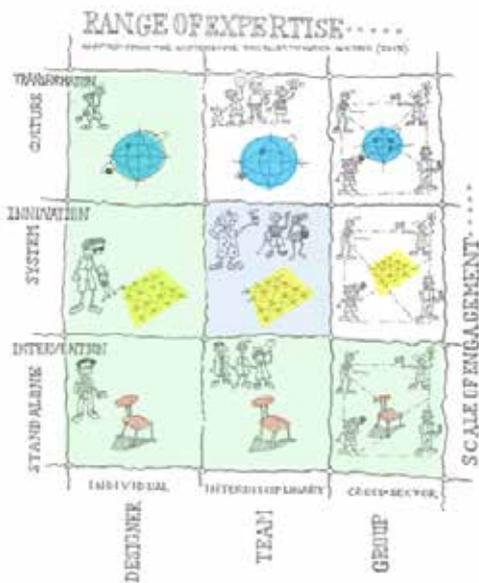


Figure 2: An adaptation of the Winterhouse Symposium Matrix for Education and Social Change (2015)

Problem-Based Learning (PBL) is a pedagogic method designed to nurture learning about a subject through the experience of exploring an open-ended problem (Armstrong 2008). The process does not focus on problem-solving, instead it allows for the development of skills and attributes which enhance learning. These include knowledge acquisition, enhanced group collaboration, communication and, in the case of Make Your Move, designing and making. Learning through creative practice is commonly found in independent primary schools, such as Steiner Waldorf, and specialist free schools which focus upon the creative arts. Less emphasis is placed on creative practice in many mainstream primary schools.

Mainstream schools do not always have the expertise or confidence to teach an experimental and ambitious curriculum through the creative arts

as, according to Burkitt and Lowry (2015), primary and secondary mainstream teachers have often reported a desire for further art educational training to build upon the paucity of time dedicated to developing creative skills during their Postgraduate Certificate in Education. There still exists a strong bias towards representational work and accurate depictions of reality in the primary school art curriculum (Burkitt, et al., 2010). In contrast, outcomes from a creative workshop carried out at a free school in Plymouth in 2016 illustrate how primary and further education students work collaboratively while embracing uncertainty (Figure 3)



Figure 3: A discussion between diploma students and primary school students in Plymouth (CB©, 2016)

3. GLOBAL LEARNING

In September 2015, the United Nations adopted seventeen Global Goals for Sustainable Development to achieve three things by 2030: an end to poverty; to combat climate change; and to fight injustice and inequality (2015). These goals helped set the values for learning and discussion in Make Your Move (Figure: 4).



Figure 4: The Global Goals for Sustainable Development (2015) touched on by participants during Make Your Move.

The framework has provided a foundation for disseminating knowledge and a platform for debate. Key aspects of the global citizenship agenda in primary schools include empathy, creative and critical thinking, self-awareness and reflection as participants work across different media and communication modes. Students learn that some beliefs can be wrong as young as four. Primary students also learn, within an absolutist construct, that people's beliefs can differ but only because one person is right and the other is wrong. Most people begin to recognise that experts can disagree on certain topics as they progress towards adulthood and adopt a relativistic view. People then learn to tolerate some uncertainty while maintaining there can be better or worse opinions supported with reason and evidence (Kuhn and Dean, 2004). Drawing and making used as cultural tools in collaborative workshops exist at an interpersonal level and can assist the task of distribution or sharing. The distributed form of higher mental function, according to Vygotsky (1978), requires a concept to exist in an external frame so that learners can discuss ideas and opinions with others including peers, teachers and those who appreciate their developmental level and potential (Mercer and Littleton, 2007). Vygotsky suggests that when children acquire a certain competency with cultural tools they begin to develop ideas and beliefs independently.

The purpose of analysing the global goals through learning circles (Collay et al. 1998) and pilot workshops, in preparation for their introduction through whole-class lessons, is as a starting point for stimulating the imagination, encouraging open discussion and generating ideas. Findings emerging from the first major research study on global learning in primary schools, undertaken by Frances Hunt et al. (2012) at the Institute of Education at University College London (UCL) suggest that global learning is linked to higher awareness of diversity and to developing socially-aware, responsible global citizens. Teachers involved in the research suggested that thinking globally also has a positive impact upon subject knowledge, skills, and values.

4. CONSTRUCTIVIST LEARNING DESIGN

Constructivism helps progression from interpersonal dialogue to an intrapersonal dialogue and this is considered part of the development of higher mental functions (Vygotsky, 1978; Brooks, 2005). A Constructivist Learning Design methodology (Gagnon and Collay, 2006) was

adopted by the researcher to integrate the teaching and sharing of facts with the teaching and sharing of skills by constructing situations based on the Primary Education for Global Learning and Sustainability report (Bourn, Hunt, Blum and Lawson, 2016). Vygotsky's (1978, pg.86) concept of the Zone of Proximal Development (ZPD) is the distance between a child's actual development level and their potential development level as seen when problems are explored collaboratively. Piaget (1932) proposed that working with peers provides experience of different points of view and leads children to think about moral rules governing co-operation and fairness in social relations.

In an episode of BBC Radio 4's *The Educators* (Montague, 2016), Ken Robinson reminds us that education is not politically neutral, by which he means whoever creates the schema has the power to decide what facts are included in the curriculum. Facts are clearly important in helping learners to understand a subject and to make decisions in the world - mental arithmetic helps an individual to work out the cost of things or to score a game of darts - but a narrow selection of the facts does not teach what, where and who we are and it does not teach us how to learn independently or collaboratively.

5. MAKE YOUR MOVE METHODOLOGY

A pilot workshop was held on 23rd and 24th May 2016 at Greenwich Primary School. During the process of Constructivist Learning Design the researcher acts as choreographer, teaches basic steps and shares cultural traditions in order to organise the production of a learning event (Gagnon and Collay, 2006, pp.195-198). The workshop (Figure 5) was delivered using a set of new learning tools and involved the following six stages:

(i) Situation

The primary concern of this element was to discuss the vision and purpose of *Make Your Move* with participants. The overarching aims of the project were to develop a personal perspective on aspects of global citizenship by exploring the concept of empathy and by encouraging cognitive acceleration through design and making in collaboration with peers.

(ii) Groups

The pilot workshop included a year 6 teacher, a student-teacher, four KS2 children, the design researcher and teachers who stopped by over the two-day period. The team worked as a design studio and individually as designers in advance of the project's introduction to the whole class.

(iii) Bridge

Participants were introduced to methods of drawing, designing and making wire models to help translate memories of an event in their everyday life into automata which, in this context, refers to moving mechanical devices which tell a story using simple cam mechanisms.

(iv) Task

Models were developed from drawings and storyboards resulting from the 'to and fro' of transforming drawings on paper into wire sculptures in the manner of Alexander Calder to tell a story through animation.

(v) Evaluation

Participants including children, teachers, students and artisans completed questionnaires before and after the pilot workshop. The group took part in a question-driven exchange of ideas and thoughts immediately after *Make Your Move* and again six months later. Evaluation of participant drawings and models was moderated by teachers.

(vi) Exhibition

The drawings, automata, videos and stories from the pilot workshop and the whole-class lesson featured in Greenwich Primary School's Arts Week exhibition in July 2016. Parents, teachers and students from across the school visited the exhibition and external feedback was gathered as a fourth strand of data.



Figure 5: Participants designing and making wire drawings that depict a personal story. Photograph courtesy of Charlotte Stirling ©

Analysis and evaluation

A triangulated approach to evaluation of the workshop outcomes included: a self-assessment questionnaire; content analysis of recorded discussion and debate; an evaluation of drawings, models and videos. The process of analysis was moderated by teachers and other professional practitioners involved in the project.

At the end of each hour of the workshop a plenary session enabled participants to explain their position, search out questions, and offer help to others. This approach became more fluent and more inclusive as time passed, which provided an opportunity for the whole group to reflect and move forward. Being in a small group meant there was sufficient time 'to think again'. The policy of 'no hands up' discussion was new to some children but successfully managed by the group – "It's no hands-up Matthew." Student-teacher Charlie described Emma and Matthew, participants in the pilot workshop who helped support peers during the whole class lesson, as "brilliant" when they shared their skills and knowledge.

Emma demonstrated that making can help self-assessment to become more insightful: "I have an automaton at home but realised I had not looked at it very closely. When you make something you really know how it works and ideas fly out of your head." Amy's drawings, design skills and making skills were fluent and it was clear that she thought carefully before filling in the questionnaire. She did not over-state her capability and her response demonstrated that there were different levels of self-assessment being applied to the task. There is a question mark over why both boys rated themselves relatively highly and both girls rated themselves at a lower level and this may be.

On personal agency and metacognitive skills

Personal agency comprises two key aspects of learning; self-efficacy and self-regulation. Self-efficacy demands good communication skills and good social skills. Self-regulation promotes thinking about how your behaviour and approach impacts upon your learning opportunities and those of others in the group. Developing participatory skills through reflection on the different perspectives of participants was key to problem exploration. Areas of difference are important when considering the role of the social world in cognitive development according to Garton (2004).

Metacognition is often defined as thinking about thinking. Throughout the workshop children were asked to reflect upon: "Why are we doing things this way?" Participants were encouraged to think

about how effectively they were working with others, what they could do to make change happen, and why their engagement with the global goals might inform global citizenship. Reflection, for Boud et al. (1985), is an activity in which people recapture their experience, think about it, mull it over and evaluate it. Participants were asked to repeat drawings, re-make models and re-draft personal stories and all those involved in the pilot workshop illustrated effective methods of reflection in action. Class teacher Imogen explained: "Over the duration of the workshop, the children developed their 'voice' and began leading the conversation with less prompts as time went on – they questioned each other, listened to each other and responded to each other in a way that the pace of the classroom doesn't always allow."

Critical reflection encouraged participants to change and develop the 'thing' being made – a sign of self-regulation and resilience on the part of those involved. Edith shared her feelings, supported by other children with nods and smiles. She said: "I couldn't believe we could make such amazing things from rubbish – stuff you could find just lying around in a corner or in a rubbish bin..." Amy added: "The thing about using rubbish is you don't mind messing about - if it doesn't work then you can just change it." Through their actions and discussions, students provided compelling evidence of how they were thinking and rethinking their ideas, drawings and models throughout the workshop.

Hamed explained: "When I finished making the cam box, you said I could help others, so I did – and found it easy and good". Learning when to help and when to let go takes empathy and sensitivity and while Hamed clearly enjoyed helping, the moment Amy expressed a wish to be left to get on, he handed the structure back and gave her space and time. Hamed's response to helping and then backing-off was an example of self-regulation through social interaction. These key features of metacognition and personal agency, self-efficacy and self-regulation, continued to build over the course of two days as participants became more in tune with the idea of working together in a 'studio' environment.

Student-teacher Charlie picked up on the metacognitive strategy of 'wait time' and second wait time. This translated into sketching, prototyping, and model making aimed at continuously improving work in hand. One of the participants, Amy, moved from expressive drawings of her mother to constructing drawings as 'blueprints' for wire model making. This required a sophisticated level of skill to produce drawings 'fit for purpose'. Charlie also applied her drawing and

literacy skills to helping pupils look closely, think deeply and experiment with confidence (Figure 6).



Figure 6: Work in progress by Charlie, the student-teacher. Photograph CS©

Six months after the pilot workshop Matthew explained his thoughts when looking back on the experience: “I felt excited because I knew this story was going to become something more than just my story – a story that everyone could see in 3D and a story that would never be forgotten. Sometimes, if you just say something people don’t listen but this was like ‘holdable proof’. I felt like - if someone saw this, it could affect how they chose to behave and also make them want to create something out of their own personal stories.”

On cognitive acceleration

According to Burkitt, creative practice helps to develop cognitive skills, self-efficacy and haptic skills. To encourage cognitive acceleration, the aim was to embed three key features into the classroom: cognitive conflict as the mind develops in response to stimulation; social construction where dialogue with others is essential; and metacognition by reflecting on how the problem was tackled.

Tom Gray, the head teacher of Greenwich Primary School, described the approach to learning in Make Your Move as “original”, by which he meant there were creative ideas, methods and interpretations, performed by students and teachers, facilitated by the design researcher. These aspects of the workshop were the result of introducing design and making skills, such as iterating ‘back and forth’, sketching and drawing, making models and

prototypes, and creating personal stories and making automata to feature in video animations.

The pilot group worked constructively together as a team and it became clear that participants enjoyed the idea of working as part of the ‘design studio’, supporting each other with enthusiasm most of the time. Methods related to the process of design and making were introduced and explored as thinking strategies. Prototypes, photographs and videos provided a record of how the drawings and modelmaking evolved over time. Charlie, the student-teacher, noted:

Every child could see their drawings, and the drawings of their peers, develop as they moved from basic stick people to Calder-like figure drawings. Moving from developing expression and feeling on paper to producing wire-drawings illustrating animated poses flourished. We could see, in real time, confidence, visual thinking and imaginative interpretations of personal stories emerging over the course of the sessions.

A moment of conflict arose when one participant suggested the automaton of their partner was “headbutting, not kissing, your mum” but dismay soon turned to laughter. Garton suggests that a theoretical explanation of empathy comes from demonstrating the ability of children to understand that others know things too, have beliefs and can think. Empathetic action coexisted with debate concerning ethics when Mathew asked a question related to giving a homeless person money in the street, the subject of his automaton. This increased cognitive dissonance (Festinger 1957) as different opinions emerged through question-driven explanatory reasoning which, according to Graesser (1996), develops independent thinking. Participants were able to discuss the responsibility of the individual, society and government in a lucid and engaged manner.

When class teacher Isabel asked Matthew how Make Your Move was different to the way he would normally learn in school his response was compelling:

It’s kind of like bringing together DT, art and literacy. In school we don’t normally bring those subjects together – in literacy you normally have an aim decided by the teacher, but this was more free and more for us to decide. We had to decide on the story and on what our characters looked like. It made me feel kind of like a master. I dunno... in charge.

It was surprising to learn that a participant assessed as “performing below the average level for his age in some core areas” illustrated a remarkable level of engagement and competence

in designing and making. Numeracy and literacy are instrumental in the pursuit of an effective education but that is, according to Herbert Read (1949), the sum of what they are. Developing self-efficacy, and self-regulation in pursuit of what it means to live a worthwhile life is, according to Dewey (2011), the true purpose of education.

Global Citizenship

Make Your Move generated a rich discussion on the topics of empathy and compassion. The dialogue flowed from an abstract, global scale to the everyday life of individual participants. All participants designed and constructed at least one an automaton illustrating their experience of compassionate behaviour. The kinetic sculptures were used in the production of 'one-minute video clips' for exhibition and to be shared with colleagues and students in India, Mexico and Spain. The medium-term aim of Theatre of the Imagination is to encourage reciprocity across continents.

Compassion underpins the global citizenship curriculum in primary education which explores equality, poverty and global warming. Make your Move set out to provoke discussion around these issues by asking questions with no simple or singular answer and by embracing cognitive dissonance as a critical position. Graesser et al. (1996) recommend educational interventions that foster dissonance by increasing student awareness of conflicts between prior beliefs and new information. Isabel explained:

During the 'Make your Move' workshop, children began by discussing their understanding of sustainability... it was great to take a step back and hear them apply prior knowledge to an organic conversation. They began by discussing solar panels and wind power - ideas and knowledge they had explored before. But as the conversation progressed, their thoughts seemed to become more philosophical and abstract when they began to question their own ideas, for example: 'I was thinking... is a bird flying sustainable? I suppose it is but then maybe it runs out of energy, maybe its wings get tired.'

Isabel believed Make Your Move had a beneficial impact upon the whole school. She said:

Make Your Move generated enthusiasm among teachers and children. As a result, the global goals have informed much of our learning this year already, and will, in fact, be the theme for this year's Arts Festival. The Global Goals can come across as too 'big' for children – and for us - to comprehend. Make Your Move focussed on personal experiences which meant that

children could see how the ethos and values really do apply to their daily lives, decisions and actions" (Figure 7).

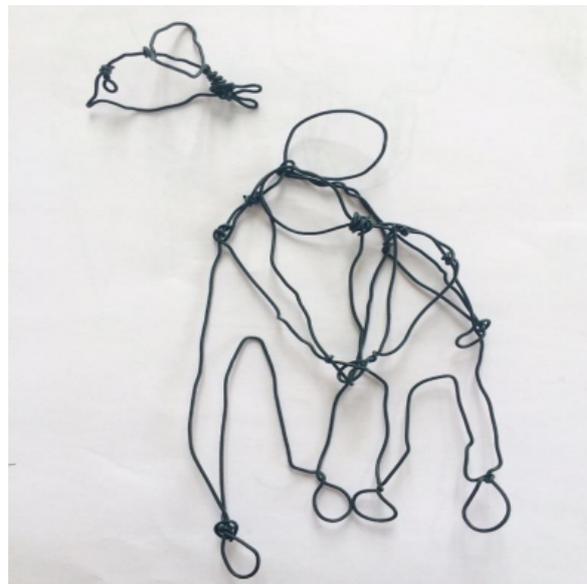


Figure 7: 'Mother and Child' by Erin, aged 10, Greenwich Primary School. Photograph CS©

6. CONCLUSION

The intention was to develop a practical methodology which helps engender cognitive acceleration; foster personal agency; and nurture global citizenship through design and making in primary education and many positive signs emerged alongside issues for reflection and review. Make Your Move helped to cultivate empathy and compassion. It is not possible to claim validity with such a small sample but it is possible to highlight potentially insightful findings, worthy of further investigation. These insights apply to Greenwich Primary School for whom the outcomes and observations proved to be valuable. Working with an outstanding school, an able class teacher and a highly motivated student teacher also demonstrated the potential of continuing professional development through practice. The importance of a reciprocal exchange between the host school and the researcher cannot be overestimated in an environment where the burden of work and scarcity of resources is increasing.

Setting clear goals for the Make Your Move workshop encouraged participants to collaborate effectively. Skills developed while co-designing, such as drawing and making, provoked a reflective interpersonal dialogue to take place (Knight and Littleton, 2015). Open discussion enabled a broad assessment of the studio activity provoked by varied participant perceptions and observations and felt similar to a 'design critique' in higher education. A moderated review of the work

produced contributed to tentative findings that suggest children, and their teachers, gain in confidence and apply newly acquired creative practice skills while working collaboratively as a 'design studio'.

Drawings and automata served as ekphratic artefacts (Pulley 2014), supporting Vygotsky's distributed form of higher mental function by illustrating 'a concept in an external frame' and by allowing learners to discuss ideas and opinions with teachers and those committed to cognitive development. Developing creative tools, related to exploring global goals through drawing and writing, helped primary children to understand that their interventions can make a difference. Feedback from experienced teacher-participants helped to improve the pedagogic tools used in creative development and global learning workshops.

Some of the insights and findings gained from Make Your Move have been transferred to other primary schools in the fledgling Theatre of the Imagination network. The potential for cultural transfer across continents is a 'next step' at a time of political fragmentation and division. Researchers who choose to work in primary

schools may find this work informative. Make Your Move brought together aspects of citizenship, literacy, numeracy, design and science within the primary curriculum and demonstrated how selected global learning goals may be addressed through design and making. Feedback from participants, teachers, artists, and designers has helped the researcher to improve the creative practice toolkit which will continue to be tested and refined through primary school workshops.

Ethical position

It is the researcher's responsibility to make sure that consent, confidentiality and anonymity are preserved, as far as possible, on behalf of all participants. Prior to Make Your Move, parental consent forms were sent out, signed and returned concerning the use of photographs of participants and their work. The names of participants and the school have been changed to help preserve anonymity. All documents related to the ethical stance taken in Theatre of the Imagination workshops have been submitted to the Royal College of Art's Research Committee and agreed by those designated with responsibility for assuring research ethics.

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Developing a Consciousness of Influence through Aesthetic Engagement and Critical Inquiry

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The aim of this paper is to address the philosophical and theoretical basis for the development of a consciousness of influence and to inspire readers to consider the importance of exposing students to power of influence and challenge them to be critically engaged with its cultivation.

Social responsibility. Educational culture. Strategies. Influence.

1. INTRODUCTION

What is the social responsibility of a professional designer? Should she be concerned with the social interpretation of her work or is it the responsibility of those within society to temper the influence of her designs? Designers with their knowledge and skill of presenting visual imagery are influential. But are they aware of this influence and its impact?

Having taught undergraduate design students in a variety of curriculums I feel that students only come to an understanding of the societal impact of design when it is addressed explicitly in curriculum. Many students do not have a full understanding of the design profession and while exposed to it on a daily basis do not critically analyze its product related society. Some of this naivety can be associated with how design and art are understood by incoming students. I have found that many students choose to study design because it is a practical application of their creativity and love of art. Many of these students perceive design as an equivalent to art and do not understand the communicative function of design nor its power to influence. Another factor contributing to a student's lack of understanding of the societal impact of design is the tradition of vocationally focused curriculum that is driven by industry need and informed by business and corporate goals. These factors as well as an exposure to visual culture comprise a student's first understanding of their future profession. Students that are not confronted with the impact of design through their education have the potential to become apathetic professionals

who do not critically reflect on their practice or their field.

There is a need to empower students, especially those studying to be design professionals, with a way to understand their practice and the source of their ideas so that they can be critical of themselves and their profession. This criticality can bring to light the social impact of design. Designers are responsible for defining cultural perception and guiding social behavior through their practice. This can be seen in how design definitions beauty or promote consumerism. Teaching students to understand and be conscious of the factors that influence their practice is essential for the development of future professionals that are socially responsible.

Designers are problem solvers. They design within the context of a problem with the aim of developing a practical yet novel creative solution. These solutions are guided by the parameters of a problem and social and cultural influencers. While the design problem is explicit, social and cultural influencers are not. Designers are influenced by their discipline, its product and theory; social norms and standards; cultural values and visual culture. All of these influencers affect the direction of a design solution. It is valuable to understand how influence guides the design process so that one can better direct it and critically reflect on its impact. I propose that students be taught to be conscious of how their design practice is influenced by professional, social, and cultural influences so that they can be more aware and engaged in the

experience that generates it, reflective of its effect on one's development, and to be critical of its authority outside of oneself. The aim of this paper is to address the philosophical and theoretical basis for the development of a consciousness of influence and to inspire readers to consider the importance of exposing students to power of influence and challenge them to be critically engaged with its cultivation.

2. CHALLENGES IN EDUCATIONAL CULTURE

Creativity and Innovation has become the product of which modern economies rely on to promote viability and growth within a global market. Specifically, innovative ventures in science and technology appear to be the catalyst that will ignite the United States economy into a state of active growth (Gallagher, 2012). The emphasis on innovation is evident in k-12 educational initiatives such as STEM and STEAM. The national push towards STEM, Science, Technology, Engineering and Math, education exhibits the perceived importance of the development of students with the skills to develop commercial innovation. According to the STEM Education Coalition, this will aid the United States in maintaining itself as an economic and technological leader within the 21st-century global market (About STEM Education). The educational focus on STEM raises the question of the origination of innovation. Can it be developed merely through exposure to scientific methodology and the tools of its creation? The Rhode Island School of Design, champions of the STEAM movement, which places art and design at the center of the STEM initiative, believe that innovation stems from the development of a creative perspective and methodology that one obtains through the practice of art and design (STEM to STEAM).

An educational focus centered around STEM and STEAM stress the mass production of innovation. This emphasis is a logical switch in mentality given the current state of labor as influenced by global capitalism. The physical production of goods has moved to developing countries leaving countries, such as the United States, in need of workers that can do more with their minds than their bodies. Given the current economic imperative, the new labor becomes a factory of ideas and innovation. Creativity will become a required skill guided by the ideals of capitalism through education.

This shift in culture is especially evident in higher education. Hard economic times and rising costs of education have brought many to question its value. These factors have caused would-be-students and parents to consider the ROI, return on investment, of a degree. This apprehension along with the difficulty of students to obtain financing has caused

many institutions of higher education to see a decline in enrollment. As a result, students, as well as schools, are aligning themselves with corporate need as a means of future survival (Belkin, 2013). Henry Giroux, a vocal critic of business interest in higher education, addresses the social impact of corporate-driven education. He warns that corporate interest will shift the public centered values of institutions to that which is profit-driven and self-centric. Additionally, he states that the development of a "mind-deadening audit culture" will suppress the educational goal of fostering a democratic society through the development of critically engaged students.

Academic departments that do not align themselves with a corporate driven mentality have currently felt this shift in institutional focus. Humanities and arts programs are feeling the need to justify their existence or reinvent themselves to fit into the new regime (Giroux, 2014). The emphasis to develop economically viable skills through education addresses the importance of the art and design in the development of creativity and innovation. Without the spark of creativity science and technology has no direction in the creation of the "new." Disciplines outside of art and design want to harness the artist's/designer's creative mind. Creativity gives art a function and power within the capitalist driven system but also allows for the potential for change through its influence. Whereas innovation is a tool for economic growth and prosperity, within the context of art, it has the potential for social and political change. Simon O'Sullivan and Stephen Zapke (2011) mirror this concept through the lens of Deleuze and Guattari in the collection of essays that support the theme of art as "the most important political mechanism" (O'Sullivan and Zapke, 2011, p. 3). Art and design feeds a capitalist hunger for commodity through the creation of new thought and sensation, but it is this craving that gives art power to subvert the system through political resistance (O'Sullivan and Zapke, 2011, p. 3).

Whereas art and design alone cannot be the force that creates a change in society it can be, according to Guattari, the source of "the aesthetic paradigm- the creation and composition of mutant percepts and affects- (that) has become the paradigm for every possible form of liberation" (Guattari, 1995, p. 91). Art and design can reimagine and restructure the world. Through the development of new concepts and new ways of perceiving it can be the impetus for a shift in paradigm that calls forth a future reality and a future people. As Deleuze and Guattari explain, "We lack the resistance to the present" (Deleuze, Guattari, Tomlinson, & Burchell, 1994, p. 108). Art and design brings forth, through a becoming, a

break from the majority and that of common sense that can result in the advent of the future.

3. ORIGIN AND FUNCTION OF INFLUENCE

Creative thought results in the development of a "product," a tangible thing, an experience or a way of being, that has the power to influence a personal becoming that, in mass, can initiate social change. These influences can be dramatic resulting in an immediate shift, such as the terrorist attacks on 9/11, or, more commonly, be the result of a culmination of influences that lead to a gradual and unnoticeable change, for instance, gradual cultural shifts resulting from the development of the internet and mobile devices. Creative thought is used for a host of reasons, not all of which are beneficial to society. It is this fact that makes it imperative to have an understanding of how creative thought is influenced and influences. Through a consciousness of influence one is better equipped to understand how a creative product affects their personal becoming, as well as their creative thought.

Deleuze and Guattari also speak of nature's tendency to imitate, "nature is conceived as an enormous mimesis"(Deleuze & Guattari, 1987). Copying is a natural phenomenon. Its utility is in the continuation of life through replication of success. Human history is written in support of these successes, and it is the reproduction of these influences within a new context that culture continues to develop.

To be influenced and to influence is an innate natural human process that is responsible for the continuation of humanity and its development. Social learning theory describes this phenomenon. It states that behavior is a product of direct and indirect observation that is learned deliberately and inadvertently through the influence of example (Bandura 1971 pg 2-5). For instance, a study of human infants age 6-18 months examined the importance of social learning in the development of food preferences. Infants through observation of adults came to identify edible plants. This study is significant because it shows how the identification of edible plants was passed down through generations. The evolution of a social learning mechanism allowed for humans to survive through an exchange of knowledge obtained through influence (Werts & Wynn 2014).

In addition to the passing of knowledge, influence is instrumental in the development of personal identity. Humans beings are a product of their genetics but evolve through observation and experience. Most parents marvel at their three-

year-old reflective selves who mimic their speech, body language, and facial expressions. Toddlers understand the world and how to navigate it through parental observation. Additionally, children gain a sense of themselves and their relation to the world through the mental models and schemas that are formed through caregiver attachment relationships as theorized by Dr. John Bowlby. These early influences from parents or caregivers guide how one thinks, feels and behaves in a variety of contexts (Bretherton 1992).

As described through attachment theory early influences create an individual's worldview and view of self. These definitions then become a base in which meaning is assigned to objects and experiences. As John Dewey explains, "the conditions of the perception lie in the organism" (Dewey, 1958 p. 243). He continues to demonstrate that knowledge is not immediate. It is a result of personal history, which through analysis develops a perception. This process results in a unique way of looking that this is a product of the exponential building of influence (Dewey, 1958 p. 317-325). Consider the act of looking for shapes or picture in clouds. What the individual sees is the result of imagination. Imagination is a product of experience that allows one to assign meaning. As a result, one's interpretation of the cloud is limited only to that which one has experience or has knowledge.

Deleuze and Guattari's (1987) concept of the rhizome can illustrate the compounding nature of influence. A rhizome is that which has no hierarchy and no one point of entry or exit. As opposed to the image of a root system that originates from a single tap root that then branches out in a hierarchical structure a rhizomatous root system is that which has multiple origins and creates a webbing of connections. The principle of multiplicity is central to Deleuze and Guattari's concept. Influence can be defined as a multiplicity. It has no determinate origin and is a result of a countless number of encounters. Additionally, influence builds and evolves through the connection of other influences. This concept is supported of by Deleuze and Guattari's principle of connection and heterogeneity (Deleuze & Guattari, 1987).

It is helpful to imagine brain cells and the interconnectivity built through the connection and disconnection of synapses. The link between brain cells is a result of learning and a result of influence (Gibb, Kolb & Robinson). When one encounters an object or experience, it is understood in relation to previous encounters. Connections are made between the old encounter and the new. The connections are a result of the influences that determine the perception of the new and a reevaluation of the old. A consequence of this process is the building or breaking apart of

connections related to those encounters. A rhizomatic network is formed from this process. The growth of this network is then guided through what Deleuze and Guattari coined as a "line of flight." Multiplicities are guided in direction and orientation by outside forces, which allows for the connection of other multiplicities (Deleuze & Guattari, 1987). A line of flight can be thought of as the influence that guides the accumulation of encounters with objects and experience. For example, formal education would be considered a line of flight. A college student that chooses a major is selecting a line of flight that determines the rhizomatic development of influence. It is the structure of the major that defines specific encounters and excludes others. The definition of lines of flight that is deliberately and inadvertently followed creates networks of influence that guide the becoming/ontology of an individual, allowing him/her to develop into his/her future self.

Elizabeth Adams St. Pierre (2014) explores the ontological focus of postmodern scholars, such as Foucault, Derrida, and Deleuze. Through a postmodern lens St. Pierre illustrates the nature human ontology as one that is tangled in reality. One is not superior or outside of the world, but instead a product of it. Foucault and Derrida question truth in experience and determine that there is no actual real essence of experience. There is no truth. Representation of the present is a result of the influence of the past. Representation is a result of personal perception, which has evolved from the interconnectivity of the past and present. This interconnectivity drives personal becoming according to Deleuze, and it is integral in shaping one's perception of self and the world (St Pierre, 2014).

Dewey mirrors this thought through an analysis of learning. Dewey describes the product of learning as individualized, given the sequence and perception of knowledge. There is no "regularity and uniformity" to the development of knowledge because it has the tendency to be "casual and sporadic" (Dewey 1960 p. 208). The maturation of intelligence is connected to judgment. It is a result of one's ability to analyze the possibilities of a situation and act in accordance. Judgments are made about the understanding of things and experiences (Dewey 1960 p. 213). Accumulation of the knowledge of things/experiences allows one to build a store that can be used for reference when faced with a situation or problem to be addressed or understood. Each circumstance is an individual case that is unique and cannot be defined precisely through previous knowledge. Prior knowledge becomes a base for understanding, but new knowledge can be in opposition to this base. New knowledge changes the perception of the old and then challenged it until it is accepted as natural and

assimilated into one's body of knowledge. This process leads to change in thought and facilitates progress (Dewey 1960 p. 207-211).

This understanding of the development of knowledge, on a small and large scale, as being a random result of connected judgments driven by influence can be unsettling since it eliminates the possibility of universal truth. Truth provides a piece of mind and a sense of control through its ability to predict and generalize. Without it, the world feels chaotic. There is, however, according to Dewey (1960) a level of control that can be obtained through the development of methods that produce intelligence.

4. CONSCIOUSNESS OF INFLUENCE

Intelligence, as well as the capacity for creative thought, is developed through worldly interactions and are a product of aesthetic perception and experience (Dewey 1960 p. 200).

Worldly interactions provide influence that builds one's interpretation of the world and themselves. Having a consciousness of influence allows for one to direct and redirect the exposure and result of influence. By enlightening one to the personal impact of influence through a conscious engagement with objects and experience, as well through as one's reflexivity, one has the power to understand influence more completely and govern how it alters personal becoming and dictates the creation of creative products.

Developing a consciousness of influence requires an individual to be aware and critical of the world and themselves. Approaching this task through a lens of John Dewey (1958, 1960) and Jagodinsky (2013) with the support of critical theory; one can start to develop a body of thought that can become a basis for critical awareness. Both scholars present a shift in being that challenges one to think and experience beyond the norm. In addition to addressing the thought behind the development of a consciousness of influence, it is also imperative to have an understanding of how it is inhibited. Through an understanding of facilitators and inhibitors of a consciousness of influence, one can have a better understanding of its application and can work toward the creation of strategies that promote it through education.

Dewey (Dewey & Boydston, 2008, pg43) calls for a rethinking of how one engages in an experience or more broadly within life. He states that by living, one is experiencing. This constancy of experience allows for the spread of apathy, which is a result of experiences where the participant is distracted and

not fully engaged in the now of the experience (Dewey & Boydston, 2008, pg43). This loose engagement is prevalent within modern culture and may be a result of self-inflicted assiduousness. It is hard to provide full focus to the present of an experience when distracted by the past and the future.

In contrast, experiences that are defined by Dewey as being aesthetic are ones that command a fully engaged self. They are consuming and permit an engagement within the present that is supportive of one's ability to develop and perceive meaning through receptiveness and analysis. Additionally, these interactions are sustained past the experience itself causing its influences to flow into other experiences carrying it forward in time allowing its influence to alter all that comes after it. An aesthetic experience is truly transformative in that it supports the becoming of a future self (Dewey & Boydston, 2008).

Having an awareness of the transformative nature of an aesthetic experience allows for one to develop and understand the lines of flight that dictates one's personal becoming. This development and understanding facilitate a consciousness of influence that is reflective of the impact of experience and that actively seeks out and consciously engages in experience to maintain defined lines of flight. The benefit of this awareness is that it promotes reflecting on the past as a way to understand current thought and action. Having a consciousness of the development of one's current self as related to influence allows one to guide its effects. Being actively engaged with influence allows for it to be directed in a way that can be more productive.

It is productive influence that promotes creative thought. In addition to reflecting on and making use of past influence, having a consciousness of influence allows one to actively become engaged in the present. It is unrealistic to suggest that all experience must be aesthetic in nature.

As previously mentioned, living is experiencing (Dewey & Boydston, 2008, p. 43). It is easy at times to allow oneself to drift through life on autopilot; being present, but not truly engaged. During these times one may be deadened to experience; not enabling it to have an influence.

Without the influence of experience, however, one restricts personal growth and creates stagnation. Being conscious of the role of influence permits one to reflect in real-time on the impact of the present and align one's level of engagement accordingly. This consciousness also promotes actively seeking out of an experience that aligns with a defined line of flight. An active engagement

with life through a consciousness of influence promotes the becoming of the individual, which in turn has the capability to influence the becoming of society.

Not only is a consciousness of influence guided through engagement in aesthetic experience; it is strengthened through critical inquiry. According to Bourdieu's concept of habitus certain beliefs, behaviors, ways of thinking, and products of human history and memory become a part of the social structure. Through socialization the origins of these become lost and are accepted as common sense (Sturken & Cartwright, 2009). Jagodinsky explains that common sense is entirely engulfing, preventing one from seeing its influence and seeing past it. Because of its nature, all ideas and solutions are a product of it. Jagodinsky calls for a liberation of thought from common sense to allow for the creation of new modes of inquiry (Jagodzinski & Wallin, 2013). Critical theorists also call for the analysis of common sense to uncover hidden knowledge for the advancement and liberation of society (On 'Common Sense').

One's understanding of common sense and its personal impact allows for the development of a consciousness of influence that can see past and question common sense thought and ideals. Merely having the knowledge of the existence of common sense allows one to begin to break from it. The subsequent questioning of its origins provides a liberation of thought and action. It must be stated, however, that it may not be entirely possible to break completely from the influence of common sense. It is at the core of socialization that is rooted deeply within personal identity.

Aesthetic engagement and a critical analysis of common sense can facilitate the emergence of a consciousness of influence. Hindrances to the development of a consciousness of influence can be understood by returning to the illustration of influence as a rhizome. Deleuze and Guattari state that rhizomatic connections can be broken through an asignifying rupture.

Once a rhizomatic connection is broken, former links can divert in other directions to evolve into new connections. This evolution can allow for the development of new lines of flight that facilitate personal growth. There is, however, the possibility that these connections will be broken, just reform to as they once were (Deleuze & Guattari, 1987 p.10). It is this reforming that provides resistance to the development of a consciousness of influence. Individuals with strong ideals and habits may be more resistant to understanding the power of influence. Through the reformation of these connections, one is unable to grow beyond their influence.

While this exercise allows for one to take a more active role in their personal becoming; individuals that do not actively seek out a consciousness of influence may be less likely to adopt its mentality. These individuals may be more firmly controlled by influence and may not be able to direct it in a productive way because its control hinders them. Through education that promotes aesthetic engagement and critical analysis one may be guided to a consciousness of influence. It must be considered that education can only facilitate a drive

The creation of educational strategies that focus on the development of a consciousness of influences through aesthetic engagement and critical inquiry can help promote creative thought and a more democratic citizenry. Given the value of creative thought, it is integral for the development of students who have methods for focusing influence into innovation, for the development of a product, social liberation, and societal evolution. These methods can help students to draw from influence to develop creative solutions. Drawing from personal influence and an understanding of cultural and political influencers can assist one in the ideation process. An understanding of influence can allow one to more easily move past obvious solutions to develop novel ones that practically address the problem to be solved. Additionally, a consciousness of influence can allow one to understand their creative patterns and blockages better. Self-reflection related to influence can enlighten one to the source of these patterns/blockages in a way that will help one to overcome them. Finally, this awareness helps combat the apathetic acceptance of the status quo and encourages the development of more engaged creative professionals. Having a perception of personal influence, as well as the influence of

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for its development. It is only through a conscious personal choice and a change in ones being that a consciousness of influence can be established. It must also be noted that a consciousness of influence may not be implemented within the entirety of one's being. There may be aspects of one's life or certain ideals of which one is reluctant or unwilling to analyze.

5. CONCLUSION

others, allows one to question the intentions of their practice related to the influence of business, media and politics. Having the ability to see past the surface promotes an engagement that can be drawn on for the good of society.

A consciousness of influence has value in the becoming of the individual and society. Through engagement in aesthetic experience and critical inquiry this consciousness can be developed and used to focus creative thought. Fostering its evolution through education can create students who have a stronger grasp of the creative process and critical awareness of the world. Fostering a critical engagement with influence through education has the power to alter the professional culture of design to be more responsible and socially and ecologically sustainable. It must be considered that educators too must be conscious of the influencers of their practice so that they can enact a conscious change in educational practice away from one that is corporately driven and vocationally focused to one that challenges students to develop a critical perspective and consciousness of influence.

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Developing Protective Body Panels for Humanoid Emergency Response Robots: How Technology Impacts Design (and vice-versa)

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Humanoid robots are being developed for hazard response in industrial facilities for the DARPA Robotic Challenge and as first responders onboard U.S. Navy ships. In both applications, the exterior panels of the robot need to clearly identify the robot in its role while also providing protection from impact, heat and water damage. In this project, artists, designers and engineers worked together to create a contoured suit of interlocking protective panels for the ESCHER (Electromechanical Series Compliant Humanoid for Emergency Response) humanoid robot designed to promote familiarity and recognition of the robot as an emergency first responder. The Virginia Tech based team of faculty and students completed color, form, and brand studies that informed changes to the visual appearance of ESCHER. Digitally sculpted 3D printed parts of Ultem high temperature plastic were designed with these studies in mind, to soften the hard angles of the existing robot frame and bring inline the overall proportions. Bridging negative spaces between hard panels is a custom manufactured water resistant flexible fabric that is extremely flame resistant and dimensionally stable at high temperatures. This paper explores the design challenges faced in working with robotics and how design can help inform technological developments, while using the ESCHER Humanoid Robot Body Panels Project as a case study

Robotics, Sculpture, Design, Visual Communication Design, Technology.

1. INTRODUCTION

Humanoid robots are being developed for emergency hazard response in industrial facilities for Defense Advanced Research Projects Agency (DARPA) and for the Office of Naval Research (ONR) as first responders onboard U.S. Navy ships (Orlowski, 2017). In both applications, the exterior panels of the robot need to clearly identify the robot in its role while also providing protection from impact, heat and water damage.

In this project, artists, designers and engineers worked together to create a contoured suit of interlocking protective panels for the Electromechanical Series Compliant Humanoid for Emergency Response (ESCHER) humanoid robot designed to promote familiarity and recognition of the robot as an emergency first responder. The Virginia Tech based team of faculty and students completed color, form, and brand studies that

informed changes to the visual appearance of ESCHER. Digitally sculpted 3D printed parts were designed with these studies in mind, to soften the hard angles of the existing robot frame and bring inline the overall proportions. Bridging negative spaces between hard panels is a custom manufactured water resistant flexible fabric that is extremely flame resistant and dimensionally stable at high temperatures.

This paper explores the design challenges faced in working with robotics and how design can help inform technological developments, while using the ESCHER Humanoid Robot Body Panels Project as a case study

2. HUMANOID ROBOTS

Humanoid robots are being considered for a wide range of applications to assist people with dirty,

dull, and dangerous jobs such as disaster response, maintenance, and space exploration. In addition, robots are being used for telepresence on worksites to allow an aging population to continue to share knowledge in the field without leaving the office. As these robots become more capable, their effectiveness on the job will in part depend on the nature they project to those humans they work with.

A humanoid robot working in an industrial application will have an appearance that makes it approachable and identifiable as to their job function. Our research primarily focused on creating the overall appearance of the robot secondary consideration has been given to added functionality in the future.

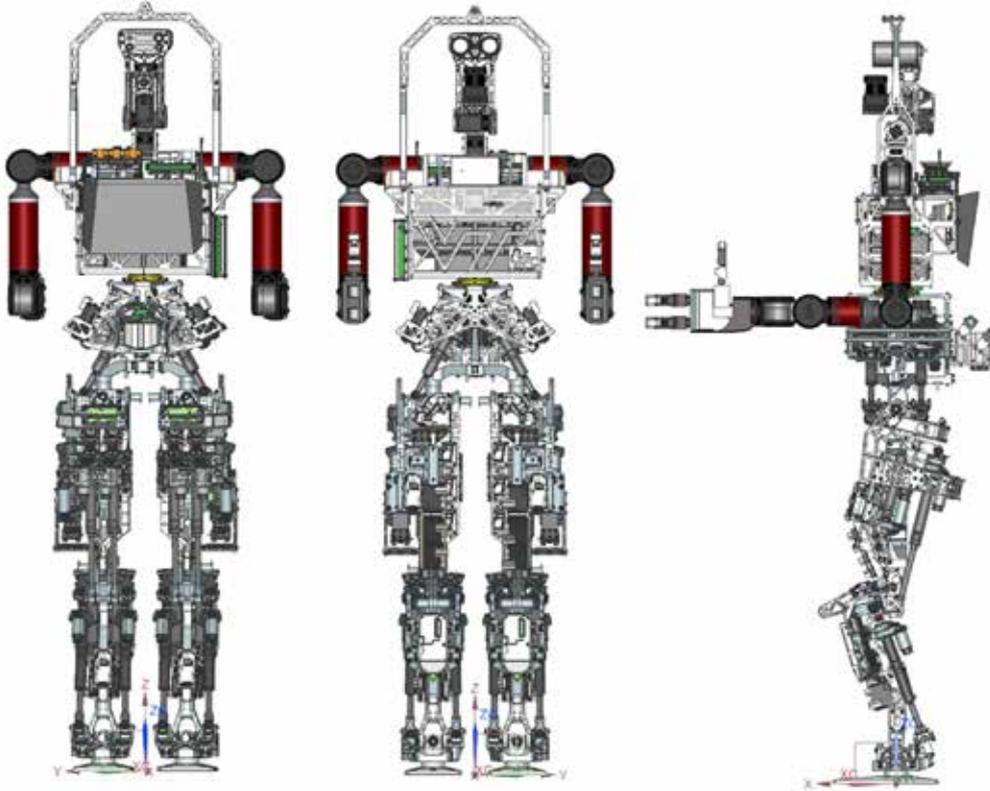


Figure 1: Diagram of ESCHER

3. ESCHER

“ESCHER is an electro-mechanical robot measuring 1.7 m high but remains lightweight at 75 kg. Its efficient design permits untethered operation for extended periods. The robot uses a multi-spectral vision suite to create a virtual environment in a range of severe, harsh conditions. Virtual environment information is used in simulation to perform path and manipulation planning, while actual locomotion and manipulation is conducted mostly autonomously with low level control.” (TREC, 2017).

ESCHER, the most recent humanoid robotic platform designed and fabricated at Virginia Tech, has a similar mechanical design to its predecessor, Tactical Hazardous Operations Robot (THOR), but is capable of climbing and longer runtime (TREC, 2017). The current framework of these robots does not provide protection and appearance that is needed for the application specific goals of the platform. Due to the expense and complexity of the base platform, it is desirable to have

interchangeable body panels that include the aesthetic, functional performance and protection that would allow the robot to operate in diverse environments. Our prototype body panels for ESCHER are designed to serve as a baseline platform on which future task-specific versions of the panels can be based. These future applications may be more specific to the environment conditions in which that robot operates.

One of the future applications for ESCHER, and similar humanoid emergency response robots, would be to help fight fires on Naval ships. Currently, when there is a fire on a large ship, the crew generally just has to seal-off the fire and let it burn out, as it is unsafe for people to enter the spaces, both because of fire and water risks. A humanoid robot, with the right equipment and protection, would be able to enter the situation without risking human life.

In the application of disaster response, there are several main functions that designed protective body panels serve: impact resistance, function

identification, increased visibility, and environmental protection. We will address each of

these in more detail.



Figure 2: ESCHER competing in the DARPA Robotics Challenge, with first phase of body panels

3.1 Impact Resistance

The Terrestrial Robotics Engineering and Controls (TREC) lab at Virginia Tech first approached the sculptor, Samuel Blanchard, in preparation for involvement in the 2015 DARPA Robotics Challenge. The TREC lab was developing ESCHER to execute a variety of disaster response and search-and-rescue tasks in hazardous environments inhospitable for humans performs many tasks autonomously while still allowing for human interaction in critical areas. The 2011 earthquake at Fukushima that caused a nuclear accident (World Nuclear Association, 2017) is an example of an incident in which a humanoid emergency response robot would have reduced damage, as it was unsafe for people to enter the site to shut down impacted equipment. These emergency response robots are generally designed as humanoids, so they are able to access the same places their human counterparts are capable of traversing.

Blanchard worked with TREC lab in developing hand-formed protective body panels, in the event that ESCHER would fall during one of the DARPA challenges.

3.2 Increased Visibility, Function Identification and Promoting Familiarity

There are many applications for disaster response robots in addition to firefighting on-board U.S. Naval ships. Therefore the exterior of the robot needs to identify its role to humans it interacts with. For instance, disaster response robots are being developed to help land based firefighters with residential fires. If a person were trapped inside the home during a fire and a robot entered this

dangerous situation, which also involved limited visibility, it would be vital for that robot to be quickly recognized as a friendly fire-fighter.

For our initial application, we were creating body panels for a robot that would compete in the DARPA Robotics Challenge (DRC). We began by analyzing the colors of our competitors, by using the DRC list of participants, we completed a color analysis of the robots (Orlowski, 2017). Overall, the predominant colors were black, white, gray, and metallic with the most common accent color being blue. The robots that received an overall bold color treatment were red/maroon (Tartan Rescue and Team Vigor). Only one used a pattern – Team Hector applied hazard symbol, orange and black diagonal lines over the majority of the surface. Additionally, only one competitor used a gradient – Team Trooper applied a navy to white gradient across the large panel surfaces.

When selecting our own color palette, we decided against any sort of unforgiving pattern or gradient in our panels, due to the fact that any modifications in the overall robot design would then be difficult to update. By utilizing solid color blocks, when an interlocking protective panel needs to be re-3D-printed, it is much easier to reintegrate into the overall design as the engineering team frequently made changes to the internal structure of ESCHER.

We also completed a color analysis of Boston Dynamics robots (Boston Dynamics, 2016), as their organization is one of the most advanced robotics companies in the world. However, their robots are generally intended for military application, and as such they are primarily camouflage and the overall design is intended to intimidate or be concealed.

For our application, we needed to focus on high-visibility.

After analyzing the color breakdown of the DRC Robots, we also researched naval uniforms to identify the robot as an official (Navy, 2016), fire-fighting suits (to examine banding of reflective materials and heat resistant elements), and integrated our findings into existing color theory (DeLong, 2012 and Klimchuk, 2006). We settled on navy blue, with a lighter gray blue, with bands of highly reflective yellow-orange. The blue tones offer a neutral base and promote recognition that the robot is a part of the US naval team, and the reflective yellow-orange bands reference signify safety. Additionally, orange is easy to see in both dark and light – “A 2009 study by the U.S. Fire Administration (USFA), a division of the Federal Emergency Management Agency (FEMA), also

concluded that fluorescent colors, including yellow-green and orange, are easiest to spot in daylight” (APA, 2014). We chose a navy/blue base, rather than black as “firefighters wearing black gear felt there were visibility issues with black gear, particularly at night. Even though all [firefighting] gear must have a certain amount of reflective tape, regulated by the National Fire Protection Association, reflective properties are often diminished by repeated washing or residual dirt and soot from fighting fires that builds up on the tape” (DeLong, 2012).

Our design also integrated form considerations, in spite of there being many constraints due to the complex internal structure of ESCHER. The external design of robots impacts how humans interact with them, so finding the proper visual positioning is very important. Simply put:

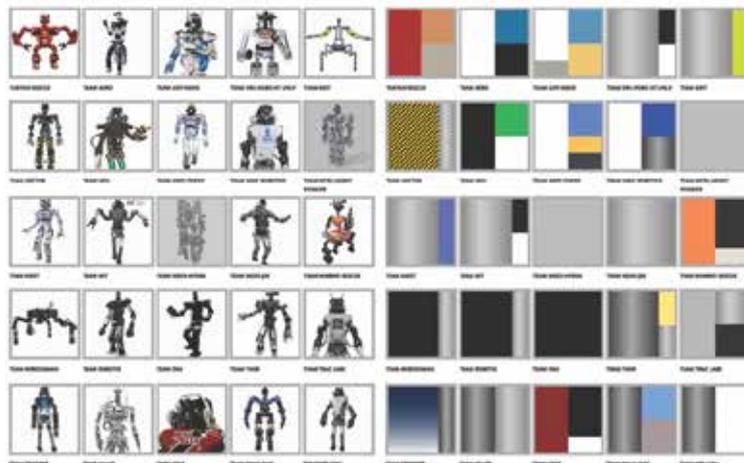


Figure 3: DARPA Robotics Challenge Team Finalists with Color Analysis

“People have empathy for robots when they are harmed, even something as simple as losing their memory. There are reports from military situations, for example, where soldiers have demanded that their robots be repaired rather than replaced, or are hesitant to place their robots in danger. There are a couple of ways to think about this in a workplace environment. On the one hand, sentiment toward these robots might help reduce equipment abuse; if people feel bad when robots are damaged, they might be more likely to keep from harming them. On the other hand, people might hesitate to push robots in hard situations where they may be damaged, at the cost of productivity, or avoid repairing and replacing damaged robots despite reduced output. Robot maintenance or replacement cycles where people feel bad for the robots may also affect morale and mental health” (Young, 2015).”

As such, we created a series of mood boards documenting existing robots and started by focusing on what to avoid. We didn’t want to create a cute robot, as we didn’t want human workers to become afraid of putting ESCHER into harm’s way would not be appropriate for a disaster response robot to be perceived casually. We also avoided anything gendered/sexual or frightening, which are the common ways in which the media portrays robots. Lastly, we avoided a look that would be overly human, as we wanted to steer clear of the uncanny valley, which is best defined as “a person’s response to a humanlike robot would abruptly shift from empathy to revulsion as it approached, but failed to attain, a lifelike appearance. This descent into eeriness is known as the uncanny valley” (Mori, 2012).

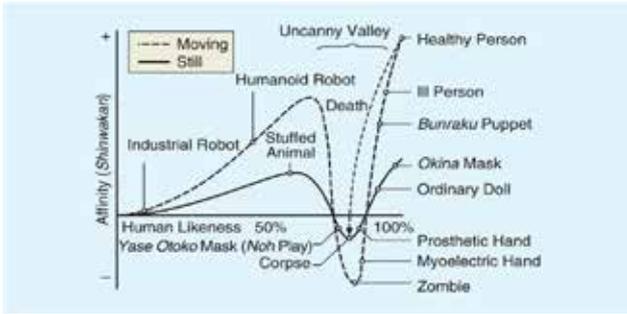


Figure 4: Diagram of Masahiro Mori's Uncanny Valley (Mori, 2012)

Aesthetically, in addition to researching trends in robotics, we put together samples of automotive, boat, architecture, and industrial designs. By looking outside of the realm of robotics, we were able to approach the visual development in a holistic manner.



Figure 5: Final mood board direction for body panel design. Pictured is Boston Dynamics' PETMAN (Boston Dynamics, 2016), NASA's Valkyrie (NASA, 2015), the Moss Arts Center at Virginia Tech, and several texture and color samples.)

3.3 Environmental Protection

The form of the external body panels also provides impact resistance and environmental protection. The robot has many environmental exposure dangers (water, fire, etc.), and as such needs shielding. We determined that the robot would need a wetsuit like under-layer to protect from water and other liquids, with inter-locking heat-resistant exterior hard panels for impact-resistance on the outside. Our team was inspired by the design of motorcycle gear, as it is closest in form to our needs. While the robot needs protection, it also needs to be able to move freely, particularly because the range of motion is much greater at robot's joints. For instance, ESCHER can rotate his hand 360 degrees, so our suit can't interfere with its underlying flexibility.

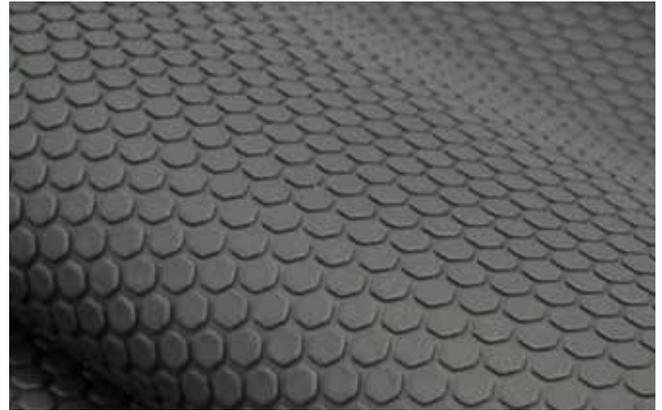


Figure 6: NanoSonic Scorpion Skin (NanoSonic, 2015).

Motorcycle gear generally has large, flexible, stretchy portions that enable riders to freely move about, yet it also has strategically located hard panels to provide impact resistance. We used the same approach for creating a "suit" for ESCHER. Our team reached out to NanoSonic a nanotechnology company that specializes in wet suits and fire-fighting gloves (NanoSonic, 2015), to collaborate on the production of custom fire-resistant wet-suit for ESCHER. They provided us with a variety of material samples that were waterproof and heat-resistant. The material can be dyed and has strengthening and fire-resistant honeycomb panels that can custom spaced (see Figure 6).

Our team reached out to the School of Performing Arts at Virginia Tech, and Professor Jane Stein and Graduate Student Alison Owen, and they developed a paper pattern for ESCHER and a fabric prototype for sleeve. This pattern and was the first step in creating the full prototype for the "wet-suit" for ESCHER. Our team is still working with NanoSonic on the development of the final piece. As their technology improves, the fabric can be thinner and more flexible and our design will adapt and improve alongside it.

The exterior hard panels also needed to provide environmental protection and be resistant to heat and water damage. As previously mentioned, we decided 3D printing the body panels worked well for allowing a flexible, interlocking design system that can adapt as the robot structure changes. As such we needed to find a heat resistant 3D printed material. While our initial set of panels are printed in a strong and flexible nylon plastic our research lead us to ULTEM, high temperature filament. ULTEM Resin "resins offer outstanding elevated thermal resistance, high strength and stiffness, and broad chemical resistance... Plus, ULTEM copolymers are available for even higher heat, chemical and elasticity needs" (Sabic, 2016). Ultem

can have a relative thermal indices (RTI) of up to 180°C. Beyond this temperature, the internal robotic components would not be able to survive, so higher heat-resistance would not be necessary at this time.

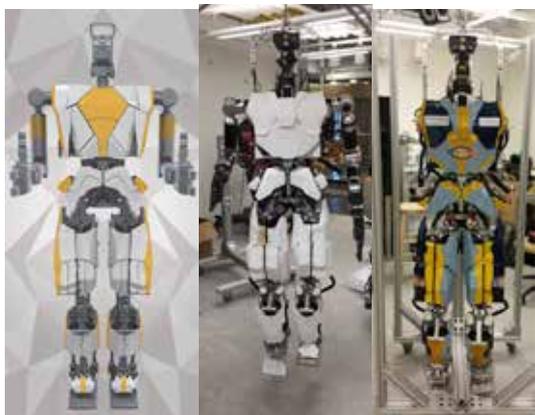


Figure 7: (from left to right) Rendering of body panels from March 2016, panel fitting, and painted panels with reflective tape

4. CONCLUSION

Overall, this project has been a collaboration of Engineers, Artists, and Designers. While the design team primarily had to respond to the needs of the engineers, the two worked together on many components. For instance, the robot has positioning visuals on the exterior, so it is able to know where the limbs are. Reflective panels had to be carefully placed, so as to not interfere with scanning. Designers also had to modify the structure and placement of the inter-locking protective body panels based on changes to the overall structure of ESCHER.

The field of disaster response robots is rapidly changing, and as such there is not a standard for design, so our team had to look outside of robotics for inspiration. The work our team and similar teams are doing is paving the way for future developments.

ESCHER has competed many tests and studies while wearing the protective body panels, but the design is ongoing.

We would like to thank the Organizers of Learn X Design for welcoming our paper at the 2017 Conference in London. We would also like to thank Virginia Tech, and more specifically, Professor of Mechanical Engineering Dr. Brian Lattimer, the TREC Lab, Phat Nguyen M.F.A. Creative Technologies 2016, the Institute for Creativity, Arts, and Technology, the School of Performing Arts, and the School of Visual Arts

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Investigating skill confidence as a concept to enhance learning development in online education – Introducing a new feature to the learning setup in a design thinking MOOC

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Since the introduction of Massive Open Online Courses (MOOCs) in 2008, researchers and MOOC designers alike are facing two major issues. On the one hand, there are the challenges the new virtual learning environment poses for course designers and pedagogues who are used to creating learning formats for traditional physical classroom education. On the other hand, MOOC designers are searching for ways to overcome high dropout rates. Therefore, there is a high unmet demand for new and engaging formats that specifically suit the online learning experience. This paper introduces a new MOOC reflection format called skill confidence rating. This format is intended to foster learning development through reflection in MOOCs. It was introduced and tested in a skill-based design thinking MOOC. Results show mean increases in skill confidence levels for both topical sessions of the MOOC. Further research will be needed to validate the use of the skill confidence rating in online education.

Skill Confidence, Massive Open Online Courses, Learning Formats, Skill Acquisition, Skill Transfer

1. INTRODUCTION

Online education has been increasingly researched since the introduction of Massive Open Online Courses (MOOCs) in 2008 (e.g., Yuan & Powell, 2013). Initially, MOOCs were thought to drastically change our educational system, moving it from traditional classroom settings to predominantly virtual learning environments. High learner dropout rates soon overshadowed this new learning phenomenon (e.g., Liyanagunawardena et al., 2014, as cited in Cress & Delgado Klos, 2014, pp.95-100). The low number of MOOC completers in comparison to enrolled learners led MOOC designers to reconsider their approach which was mainly based on simply translating learning formats from physical settings to virtual learning environments. Besides the video format, which embodies the traditional lecture, the most commonly used learning formats in MOOCs are multiple choice tests, exercises, assignments and discussion forum threads. Yet there is still a great need for learning formats that adequately foster learners' development through higher engagement in an online course setting. To this end we will turn to training design literature to advance the design

of MOOC learning formats in the following. Thereby, we focus on bridging the gap between skill acquisition during training and later skill transfer. We will incorporate the concept of confidence, which is also widely discussed in design research, to enhance learning development in online design education, and combine it with an engaging reflection format.

2. LEARNING AND TRAINING: MOOCs AS TRAINING FORMATS

The terms 'MOOC' and 'online learning' are often used interchangeably. But MOOCs are not identical to online learning. This is not only due to other possible online learning formats, but also because the underlying theoretical concept is different. We argue that MOOCs should instead be seen as 'online trainings'. Learning is not the same as training. Salas, Tannenbaum, Kraiger, and Smith-Jentsch (2012) define training as systematically designed activities to acquire knowledge (i.e., need to know), skills (i.e., need to do) and attitudes (i.e., need to feel). Learning in contrast is the outcome of a training (Landy & Conte, 2013). This training outcome (learning) can be subdivided into cognitive

outcomes, behavioral or skillbased outcomes, and affective outcomes. The design thinking MOOC we developed and tested our new learning format in focused on skill acquisition and therefore aims for skillbased outcomes.

What makes good training design? To evaluate this, we will make use of Salas et al.'s (2012) evidence-based categorization of training into three phases to maximize training effectiveness. The authors suggest the following three phases for setting up an effective training: *before training*, *during training*, and *after training*.¹

In the first phase, *before training*, a training needs analysis is conducted. This means that those responsible for setting up the training need to evaluate if the training is necessary as well as what and who it should be for. Additionally, the environment in which the learner shall apply the training content later has to be ready for this. This means it should already be equipped with resources and opportunities needed to transfer the training content. In MOOCs the corresponding phase to this first training phase is the decision phase. In this phase learners decide whether or not to enroll for a MOOC. They do so based on the learning objectives outlined by the MOOC provider and the learning material accessible before the MOOC start. There also lies the first possible explanation for the high dropout number of MOOC learners: they quickly feel that the material they get access to once enrolled in the MOOC does not match their expectations shaped by the *a priori* displayed learning objectives. This is based on the assumption that learners constantly compare their personal needs with the expected benefits while pursuing the MOOC and not only at the end.

The second phase, *during training*, focuses on creating the right learners' mindset. Salas et al. (2012, p. 80) therefore list three aspects: 'build self-efficacy', 'promote a learning orientation', and 'boost motivation to learn'. Self-efficacy can be defined as "the [learners] belief that they can perform the task" which they have been taught or which they have to perform (Salas et al., 2012, p. 82).

The third phase, *after training*, needs to ensure the transfer of the training and should be considered already at the stage when MOOCs are designed. The authors suggest to "remove obstacles, provide tools/advice for supervisors, and encourage the use of debriefs and other reinforcements".

3. SKILL ACQUISITION AND SKILL TRANSFER

¹ Salas et al.'s (2012) categorization is based on training in organizations and businesses.

In terms of the MOOC we investigated for this paper, the *during training* phase can be associated with *skill acquisition*; while the *after training* phase is where the *skill transfer* would take place. This last phase is often neglected in MOOC learning formats. This results in an imbalance of skill acquisition and skill transfer. Most MOOCs have an exact starting point, set deadlines, a predefined duration and finish date. But after MOOCs finish, there is usually no follow-up which revisits the learned content or tests the learners' actual skill acquisition or transfer at a later point in time. With our new format we want to take a first step towards closing this gap between skill acquisition and skill transfer. In the following, we will refer to findings from a study by Bell and Kozlowski (2010) to illustrate this point.

4. SELF-REGULATION: FROM SKILL ACQUISITION TO SKILL TRANSFER

In their study, Bell and Kozlowski (2010) establish self-regulation systems as a component that affects the link between a training intervention and training outcomes. In their framework, they outline the necessary elements for creating learner-centered training designs. These elements are: 'practice behaviors', 'self-monitoring', and 'self-evaluation reaction'. Practice behaviors as a behavioral component refers to "how [learners] allocate effort [...] during practice aimed at skill improvement" (p.267). Self-monitoring as a cognitive component refers to "how [learners] focus their cognitive attention and reflect on their progress toward desired objectives (p.267). Self-evaluation reaction as an affective component refers to learners' "affective reactions to goal progress", e.g., self-efficacy (p.267, see also Salas et al., 2012).

5. REFLECTION IN DESIGN EDUCATION: CREATIVE CONFIDENCE

Reflective practice in design education has been discussed as early as 1933 by John Dewey (1933), who explored experience, interaction and reflection. Building on that, Boud, Keogh, & Walker defined reflection as an activity in which "people recapture their experience, think about it, mull it over and evaluate it" (1996, p.33). Donald Schön (1983) built on both works in his work 'The Reflective Practitioner'. Aiming to grasp the way in which designers cope with new challenges in their professional lives, Schön introduced the concepts of reflection-in-action and reflection-on-action. While the former denotes the act of reflection while doing, the latter refers to the act of reflection in reference to past situations or experiences. He emphasizes the tacit knowledge of reflection in action. In comparison, our research is concentrated on reflection of certain skills developed within

learning situations. We strive to adapt Schön's reflection on action to an online learning environment, and enhance it with reflection before action (Greenwood, 1993).

Creative confidence and creative competence are defined as products of design thinking education by Rauth, Köppen, Jobst, & Meinel (2010). They claim that the repetition of working within different modes (phases of the design thinking process) and "experiencing situations where creativity is needed to master a situation leads to confidence and competence in regards of student's creative behaviour" (Rauth et al., p.6). Whereas Rauth et al. focused on creative confidence as such we are specifically interested in the development of confidence in certain skills needed for the creative work that design thinking is. We aim at anchoring this skill confidence through reflection.

6. RESEARCH QUESTION

Based on the training design literature and the use of the confidence concept in design education and research, we created a skill confidence rating (SCR) to enhance learning development in online design education (e.g., Salas et al., 2012; Bell & Kozlowski, 2010; Rauth et al., 2010). We assume that learners who are more confident with the acquired skills will be more likely to act them out in transfer settings. We therefore suggest that skill confidence could close the gap between skill acquisition and skill transfer. Furthermore, we hypothesize that learners who reflect on their acquired skills and their confidence are more conscious about what they learn. We therefore aim to enhance online design education by integrating self-reflection and confidence assessment as a learning format per topical session. Our main research question therefore is the following: *To what extent does skill confidence enhance learners' skill development in online design education?*

7. METHODS

We developed and tested the skill confidence rating for a skill-based design thinking MOOC we designed. We ran it as a MOOC prototype in a closed setting on a well-established elearning platform² in November 2016. We used a mixed methods approach to measure and analyze the success of our skill-based design thinking MOOC: a pre and post course evaluation survey, 18 qualitative interviews with course participants and the skill confidence rating (see Table 1 measurement tools overview). The skill confidence rating served to test the direct impact of exercises and assignments on the learners' perception of

their own skill development. The SCR was integrated into the topical sessions of *Observation* (week 2) and *Qualitative Interviewing* (week 3). Participants were asked to estimate their confidence with skills that are central to the methods covered in the learning unit before (e.g., *How confident do you feel about preparing for a qualitative interview, e.g., writing an interview scheme*) and after taking the unit (e.g., *How confident do you feel about conducting qualitative interviews after taking this week's learning unit on Qualitative Interviewing*). Furthermore, learners had the possibility to leave open comments via a text box. This open answer format allowed to relate the change in skill confidence to successful or poor didactic design on the one hand and to detect further learner needs on the other hand.

In this way, the SCR enabled us as course instructors to

- a) understand the initial level of participants' perception of their skills
- b) interpret the effectiveness of the course content (e.g., analyze the changes in skill confidence through topical sessions).

This constitutes our use of the SCR as a measurement tool for course effectiveness.

Table 1: Overview of all measurement tools used to evaluate the MOOC prototype. (Note. QN stands for quantitative measure, QL stands for qualitative measure.)

Measurement Tool	Type of Measure	Purpose
Course Evaluation Survey (CES)	QN, QL	compare learners' course expectation and satisfaction prior to course start & after course completion; basic demographics
Skill and Confidence Rating (SCR)	Pre: QN Post: QN, QL	examine learners' perceived skill development; receive feedback on unfulfilled needs per topical session (in post SCR)
Qualitative Interviews	QN	extract insights for MOOC iteration

For the design thinking MOOC at hand we used several learning formats that are widely applied in existing MOOCs, such as videos and exercises. In that regard, the SCR constitutes an additional learning format. All learning modes that we used in our design thinking MOOC prototype and their purpose and pedagogical basis are listed in Table 2. The SCR added value to this setup by encouraging learners' self-evaluation and creating more awareness of their learning process.

² We can't name the e-learning platform due to confidentiality reasons.

Table 2: List of all used learning modes in the MOOC

Learning mode	Purpose	Pedagogical basis
Video	teach knowledge and show examples	main method of content delivery
Exercise	rehearse and repeat taught knowledge	encourage active learning
Assignment	apply knowledge and skills in a transfer task to a new context	encourage active learning
Peer assessment	evaluate others' work and thereby reflect on the task and internalize skills	develop cooperation among students, give and receive prompt feedback
Discussion forum	connect, interact and exchange knowledge with peers	develop cooperation and interaction among students
Skill and confidence rating	measure the confidence and skill level before and after each topical session	encourage awareness of personal skill development through self-reflection
Video	teach knowledge and show examples	main method of content delivery

8. RESULTS & DISCUSSION

Our statistical analysis of the skill confidence rating is twofold. First, we calculated means and standard deviations. Second, we calculated confidence intervals. In total, 49 course members participated in the pre skill confidence rating for the *Observation* session and 24 filled in the post SCR at the end of the topical session (week 2). Two question items assessed participants' confidence with observation skills. For the first question they were asked to rate their confidence for the skill of "being attentive

towards their daily environment," with 1 = "not at all attentive" and 10 = "very attentive." The second question assessed how confident participants are with "interpreting what lies behind problems" and was also rated on a scale from 1 = "very difficult" to 10 = "very easy." Overall, the mean for both items increased from pre to post rating (see table 4 for all mean comparisons).

For the second topical session on *Qualitative Interviewing*, 40 participants filled in the pre SCR and 24 the post SCR. Three question items assessed their confidence with qualitative interviewing skills on a scale from 1 = "not at all confident" to 10 = "entirely confident". For the first question, they were asked how confident they rate their skill of "preparing for a qualitative interview", for the second how confident they are with "conducting qualitative interviews" and for the third one how confident they "feel about inferring meaning from [...] interview results". Overall, the means for all items increased from pre to post rating (see Table 3).

Table 3: Mean comparison of SCR pre and post rating for all question items per topical session.

	Mean, 95% Confidence Intervals	
	Pre	Post
Observation		
1. To what extent would you consider yourself being attentive to your daily environment (before and after taking this week's learning unit on Observation)	$M = 7.29$ ($n = 49$), 95% CI [5.76, 8.81]	$M = 9.33$ ($n = 27$), 95% CI [7.91, 10.76]
2. How easy is it for you to interpret what lies behind a problem (before and after taking this week's learning unit on Observation)	$M = 7.38$ ($n = 49$), 95% CI [5.84, 8.91]	$M = 9.71$ ($n = 27$), 95% CI [8.43, 11.00]
Qualitative Interviewing		
1. How confident do you feel about preparing for a qualitative interview (e.g., writing an interview scheme) (before and after taking this week's learning unit on Qualitative Interviewing)	$M = 6.59$ ($n = 40$), 95% CI [5.69, 7.49]	$M = 8.30$ ($n = 24$), 95% CI [7.06, 9.54]
2. How confident do you feel about conducting qualitative interviews (before and after taking this week's learning unit on Qualitative Interviewing)	$M = 6.69$ ($n = 40$), 95% CI [5.82, 9.51]	$M = 8.30$ ($n = 24$), 95% CI [7.09, 9.51]
3. How confident do you feel about inferring meaning from your interview results (before and after taking this week's learning unit on Qualitative Interviewing)	$M = 6.77$ ($n = 40$), 95% CI [5.88, 7.66]	$M = 8.26$ ($n = 24$), 95% CI [7.11, 9.41]

We also calculated the confidence intervals for all means that are displayed in Table 3. For example, means and confidence intervals for *Observation* question 2 and *Qualitative Interviewing* question 1 are illustrated in Figure 1 and 2.

The pre compared to the post confidence intervals (95% CIs) show that for all question items, the confidence intervals slightly overlap. Nevertheless, a tendency towards the means being significantly different from one another is visible (see Figure 1 and 2). To make more concise conclusions, we will need to calculate further statistical tests, like a t-test for unequal sample sizes.

How easy is it for you to interpret what lies behind a problem?

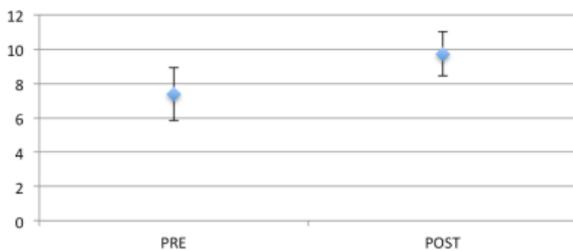


Figure 1: Means and confidence intervals of pre and post skill confidence rating for topical session on *Observation*, question item 2.

How confident do you feel about preparing for a qualitative interview?

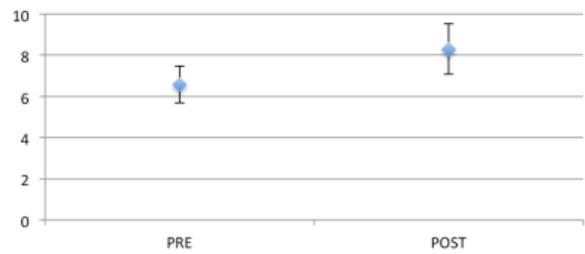


Figure 2: Means and confidence intervals of pre and post skill confidence rating for topical session on *Qualitative Interviewing*, question item 1.

We evaluated the open post SCR question items that asked learners about their unfulfilled needs by clustering their comments in a feedback grid (a common tool used in design thinking to categorize prototype testings or other sorts of feedback scenarios). Table 4 displays the feedback for *Observation* and *Qualitative Interviewing* clustered by topics. In general, learners reported fun and enjoyment when working on the topical sessions. They stated two major needs concerning the didactic design of this MOOC. First, they asked for more knowledge on additional subtopics of the conveyed skillsets. For example, they would like to learn about the concept of hidden needs, motivation, non-vocal interviewee reactions and how to create fast and effective rapport in an interview setting.

Second, they wished for more direct and concrete feedback to their task performances.

Table 4: Evaluation of the open post skill confidence rating questions listed by topical session.

	+ positive comments	- negative comments	? open questions	! new idea
Observation	- enjoyment & fun (to look out for daily workarounds)	- technical problem - unclear learning objective/weekly goal - lacking more knowledge on how to present a job story	- possibility of workarounds beyond products: "service workarounds"? - possibility to facilitate learning activity based on personal skills, e.g., visual, verbal, auditive	- enhance poignancy of topical session segments by adding more examples - more case studies - add more content to <i>Observation</i> skill: watching actions.
Qualitative Interviewing	- well-balanced content & learning speed - stimulating	- missing concrete feedback on interviewing skills		- How to do a research plan in advance exactly? Which tools could help to do

				this? - add text in videos - more content (e.g., on hidden needs, motivation, non-vocal reactions, creating rapport) - advice on interview setting - receive feedback on uploaded interview
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9. LIMITATIONS & FUTURE RESEARCH

Although the means for all question items increased from pre to post rating in both topical sessions, the sample sizes in the corresponding pre and post ratings were dissimilar. This can be explained by participants dropping out in the course of the topical sessions.

The small sample does not allow for extensive conclusions, but we do deduce that the SCR is a helpful tool for assessing skill development in learners and for encouraging learners' self-evaluation in MOOCs.

Another limitation of the current testing setup is that it could be argued that participants rated their confidence higher in the post questions solely due to social desirability or to please the MOOC designers.

To overcome potential effects of social desirability on rating outcomes, we intend to use a different experimental setup to test the SCR in the iterated version of this MOOC.

Therefore, we would divide all learners into three groups. Group 1 will be asked to complete the pre and post rating the same way presented here. Group 2 will only fill in the post SCR question items. Group 3 will serve as a control group; participants in this group will not be asked to take a SCR. All groups will be asked again about their skill confidence using the

same question items for both topical sessions in the post course evaluation survey, which participants fill in after they completed the whole MOOC. We would expect no difference for the means of the learners' post ratings between group 1 and 2. This would serve as a test against the social desirability effect. We would also expect that the group 3 results in the

post course evaluation survey will be lower than those of group 1 and 2 as we hypothesize that the skill reflection increases learners' confidence in their own skills. This effect will be even stronger if they evaluate their skills before acquiring the skills and then again after skill acquisition.

For future research, we plan to follow up on two ways in which skill confidence ratings could influence the learning process in online education. On the one hand, when learners have to reflect on their skill learning process and indicate their level of skill confidence, self-reflection might enhance learning development. Also, the rating could be interpreted as a value of the learners' self-efficacy. Therefore, the rating could have an influence on the likelihood that the learner will transfer the skills learnt in a MOOC to a transfer setting. In this way, skill confidence might help to move from skill acquisition in online learning to skill transfer.

On the other hand, skill confidence as a reflection tool could be useful for online course developers. The SCR could be used to suggest additional learning material or support to learners based on an algorithm. This means that learners that rate their skill confidence low after a topical session would be offered more tips or learning material to acquire more the skill. Nevertheless, developers would need to assess, if the low ratings are due to the learner's need for more learning material to increase their expertise or if the low ratings are due to poor didactic course design. Additional learning material or units could be a way to overcome the request for adaptive learning and a customized learning approach in online learning environments. Furthermore we mentioned a possible beneficial effect of such a reflective format on the learners' engagement due to a guided reflection on the learned skills. We did not assess this yet quantitatively, but will aim to do so in our next studies.

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Embedding Emotions in Learning Experience for Interactive Design

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Many scholars understand the limits of current research methodologies and processes of interactive design for technological and social changes. Some studies have explored the factors that influence consumer behaviour, and have adopted human-centered approaches. The role of emotions in activities focused on obtaining information has been recognised; however, few studies have investigated the role of emotions in research processes for interactive design. Hence, this study investigated methods of adopting emotional information for interactive design research. A field experiment was conducted to examine the effectiveness of extracting emotions for information retrieval in interactive design research. This research is the starting point for optimising the research processes of interactive design from an emotional perspective.

Emotion. Interactive design. Learning experience. Research process

1. INTRODUCTION

General research methodologies and processes for interactive design education adopt traditional methods. However, similar to other design disciplines, interactive design is influenced by technological and social behaviours. Some scholars further examined there are many tasks involved in the process in such a cross-discipline study. The design students need to consider the usability, techniques, communication, instruction design, etc. (Gaver et al. 2004, Clarkson & Eckert 2005). In order words, a design student needs to consider various aspects to construct the design experience for the user. In order to achieve the design goal, a design student needs to understand the needs of users comprehensively included physical and mental needs from the research stage of design process. (Senescu et al. 2014). Mental needs mostly reflected by the users' emotional changes. However, there are the limitations of current research methodologies. Some studies have explored hidden factors that influence consumer behaviour (Havlena & Holbrook 1986; Chaudhuri 2006) and have adopted human-centred approaches for research methodologies and processes. (Laurel 2003) Emotions have been recognised as an effective factor for information

retrieval, which refers to activities related to obtaining information and resources. (Yashar, Guido & Joemon 2011) However, few methods apply emotions to retrieve information in the research process (Wilson 1993), particularly for interactive design, in which measuring emotional feedback from an audience is difficult. (Liu et al. 2008). Hence, this study examined the effectiveness of extracting emotions for information retrieval in interactive design research (Malhotra 1984).

2. DEVELOPMENT OF CURRENT RESEARCH METHODOLOGIES AND PROCESSES OF INTERACTIVE DESIGN

Influenced by technological or societal changes, interactive design no longer focuses only on the execution of interface (include visual elements and graphics. It currently involves the intensive transmission of concepts, systems, and information. Design outcome is required or expected to provide the complexity of experience. Interactive design training emphasised on skills or techniques enhancement in the past. (Wolf et al. 2006) The training of interactive design was focused on the execution training the on specific professional communication design area. The

programme encoding, layout design, etc. are the main subjects to help design students develop their techniques in the specific profession in the interactive design fields. The understanding of Design History and Design Thinking was developed particularly on answering the needs of design by the subjects of design. The aesthetics of the artefact was emphasised for the purpose of enhancing interactivity. Some interactive design practices in present focus the work of interactive design in business communication. The knowledge of branding, advertising and packaging were delivered to let the design students be equipped with the abilities on generating design innovations as well as the appropriated solutions on encouraging interactivity and communication. Interactive design is highly inclusive, user-consumption oriented or even emotion attached. In this case, design research should be emphasised. Bayazit (2004) pointed out that design research would provide the insight to fulfil the increasing complexity expectation from the users. Some scholars encouraged design students to solve the design problem with an ethical focused. The interface of interactive design work as attractive visuals to impress consumers/users. Zimmerman, Forlizzi and Evenson (2007) conducted research to invest how the interactive design students conducted design research. It is found that most of the interactive projects aimed to engage massive under-constrained situations. They were difficult to be addressed by traditional engineering design solutions. Design today is more human-centered and more consumer-orientated, more influenced by technologies, psychologies and business than ever before. (Cross 2001, Ghose & Ipeirotis 2011) Moreover, there is a need for services and processes that do not require the great craft skills that the emphasised as the primary outcomes of a design education in the current climate. Interactive design is user-centred focused. The finding proposed that designer's duty included intergrading concepts throughout various studies included science, art, engineering. Also, design students had to bring empathy for users during the design process by considering users' needs and designers. However, according to the comments made by Senescu et al. (2014), such research methods are not widely applied in the design industry. This limited application results from a lack of incentive among design students, which is triggered by the complicated process. In addition, the afore-mentioned studies were limited to addressing the requirements of exchanging information for collaborative purposes. The nature of design got 'broadening'. Analytical and research methods in the subjects like communication strategy, interactive media are used strategies which are tailor made for communicating with consumers and eliciting their emotional responses. Enquiry-based learning, therefore was proposed

(Kidd et al. 1999) Interactive design students should concern with research and analysis, the study of appropriate reference, and the introduction of methods of research and analysis. Attention is given to the role of communication design in the situation transformation. At the same time, users experience approaches were proposed. The subject helps the students to develop their ability to manipulate the design process include executing interactive design elements for communication purposes such as typographic treatment, images processing, and the arrangement of colours those impact the user experience. (Alexander et al. 1977; Blevis, Lim & Stolterman 2006). Understanding effective design techniques so design students can contribute in making critical design decisions which provide greater user satisfaction. User-centred concepts are involved in the design programmes. User-centred focuses refer to the focus is on the goals and tasks aims to satisfy the needs and wants of the end user of the designed artefact (Van Duyne, Landay & Hong 2003, Wright, Blythe & McCarthy 2006). This direction reveals the importance of users' needs and preferences in the design process. Through attending in user observations, one-on-one interviews, design students would understand the will and create activities those leading users to express their emotional responses, motivations and underlying intentions involved in information processing within the task procedures (Rittel & Webber 1973). Hence, a user interface with the support of emotion extraction tools would be designed to accommodate and support user behaviours by providing natural experience and satisfying.

3. DEVELOPMENT OF EMOTION EXTRACTION

Learning from the psychologist and science studies, emotion is the key role in influencing the users' decision making and behaviours. Emotions lead people to alert significant issues or things by directing and capturing their attention and then stimulating their reactions. Happiness, sadness, anger, fear, disgust and surprise were the six basic emotions were identified by Ekman (1992). Increasing concerns were put on investigation how the role of emotion affected the users' information seeking process. Ellis (1993) analysed phases of the users' information seeking process. It was found that users experience the stages included: information searching, product differentiating, monitoring in experience, extracting feedback, verifying and reflecting.

Kuhlthau's further develop Ellis's studies and proposed another model of information seeking process. The research team found that there were certain essential elements of effective communication between users and brand. The

model proposed by Kuhlthau (2004) illustrated the activities of information seeking process through the search session conducted by users, instead of the time of they got connection with the particular brand. Scholars proposed that brand interactive with users' feeling, analysis, thinking and actions within the whole information seeking process. This information seeking process model conducted by Kuhlthau presented the 'common patterns of users' information seeking process. This extended the knowledge on some complex research questions such as when the interaction between of users and brand started. This model described the six stage of information seeking process include initial idea generation, idea selection, concept exploration, concept formulation, organisation, and presentation. Each step bonded with emotion, cognitive, and physical experience. For example, in the stage of initial idea generation, users met up with the uncertainty feelings and thoughts. In the stage of concept formulation, most users would obtain a more focused and more understanding on one brand. After understanding the information seeking process, it was possible to predict the emotional changes among the users. This would be regarded as a general emotion management. The understanding of emotional needs of the consumers would enhance the positive emotions and decrease the possible of negative emotion within design experience.

Detail understandings of how effective communication occurs lead scholars and design students obtaining knowledge on how users promoting detailed analysis and evaluating objects or event those identified. Their analysis reflected how they processing information. There are various studies focused on exploring the methods to extract emotion. Scholars investigated to obtain the emotional changes through text, speech, music, facial expressions and voices. (Bhutekar & Chandak 2012, Neviarouskaya & Aono 2013, Shelke, Deshpande & Thakre 2013, Zhang, Meng & Li 2016) Yassine and Hajj (2010) further proposed extracting the emotional content of texts through social networks on the internet. They proposed to characterise emotional interactions in social media online.

Based on the development of the social media online, for example, Facebook, Twitter, etc. and the various elements included video, audio, graphic, etc. At the same time, online communication now is used frequency in daily social activities include entertainment, meeting with new friends, dating, etc. The setting of the existing web which matching with the brand strategies. These strategies need to match with the characteristics distinguishing friends from the acquaintance. Scholars were interested in the emotion expression presented among the text written by the writers. In order to achieve this

research goal, scholars adopted mining techniques on text performed on comments those retrieved on the social medias. This is the basic concept to shape the statistical analysis model for collecting emotions for product reviews. (Garcia & Schweitzer 2011) According to the research, it was limited on the slope of emotional parameters extraction such as helpfulness, unhelpfulness and rating. However, this work provided the guidelines for manufacturing and increase customer satisfaction. This is a prevalent approach to emotion classification which premised that the overall emotional responses of the document as foundation. These techniques thus investigating the most appropriated interpretation of emotional responses in text. Some words are quite clearly presented the specific emotional changes, while some interpreted some degree of the emotional changes only. This method either uses a data-based approach to identify the emotional changes with interpretation by words.

Bhutekar and Chandak (2012) investigated extracting emotional responses from text in real-time-based devices. They proposed that people expressed their emotion through textual contents while they were speaking. They defined some emotional keywords, and modification words for thirty-four emotions. Words grouped as sentences and composed in various methods to make up as language. In human daily living, word and language are closed and significant element of communication. Neviarouskaya, and Aono (2013) proposed an approach extracting emotion from clauses of sentences. They analysed constitutive grammatical elements and adopted them in generating syntactic and semantic feature. This method utilised measuring the polarity of the sentence based on the extracted grammatical elements as a novel method. Shelke, Deshpande and Thakre (2013) want to understand the expression of emotion through internet web. They found that attitude or emotional information exists in text among the content provide extra information about the users' emotional changes and sometimes it explained the users' behaviours and decision-makings. Classification of these information and explanatory content was possible to provide the important functions on the information processing in designing user-centred systems. However, it is quite difficult to process the emotional classification with simple topic classification. It is not a not merely comparison and analysis on the of the information content, instead, the design students need to identify a set of important words or phrases before they apply the approach of classification. Zhang, Meng and Li (2016) explored an emotion recognition system automatically be suggested for the music by obtaining different characters from the music and devices for learning from existing understanding on emotional state of the collected data and information in this study. They firstly

processed the system of two-channel audio signals and developed as a system which contained classical audio features. The research team then extracted some other used for signal analysis. Eventually, these features are combined and the random forest classifier is used for the classification. This study proposed approach to adopt on a music dataset for testing in public and the experimental results demonstrate its efficiency when it compare with the latest development in the same dataset.

4. APPLICATION OF THE EMOTION EXTRACTION TOOLS IN INTERACTIVE DESIGN RESEARCH

In general design research process in interactive design projects, users' consumption experience in the past is the key reference for design students to understand. Duan, Gu, and Whinston (2008) pointed out that users' consumption experience reviews (included product reviews and services reviews) were regarded as the tool which provided consequent impressions from the marketing perspective. Both users and design students (designers in the future) depended much on those reviews of users' consumption experience. Users planed or decided to consume based on the advices provided by the users who tried in the past. More reviews were available on design experience (of the services and products) and thus, users had to filter the reviews those were relevant for improving their decision-making process. When time go by, those reviews of users' consumption experience mainly relied on the quality of the review rather than the quantity of the experience. Which means, those reviews of users' consumption experience could not provide comprehensive reflections on the quantity of the design experience indeed. Based on previous studies about emotion and interactive design (Kim et al. 2010, Masum 2008), an emotion extraction system was proposed in the present study. Specifically, the system employs users' emotional information to diversify the research findings. Instead of transmitting basic user information, the emotional responses of users were recorded during the learning process. The extracted text was then organised and analysed. Some design scholars investigate if there were other tools would help to track emotion or mood of the users. Some of them proposed that an emotion diary could be an effective tool. As per the experiment in Psychologist studies, keeping a diary on emotional changes was a valuable part of treatment for psychological disorders. (Pang, Lee & Vaithyanathan 2002). It helped to improve the negative emotions such as depression and anxiety. Some scholars investigated the means of keeping such diary as a systematic means for the mental sickness (Moran & Carroll 1996, Kuhlthau 2004,

Masum 2008). Hence, some emotional changes tracker applications on phone were designed. They were high portable, systematic, and provide users for better understand on how their emotional changes influenced and been influenced by their thoughts, behaviours, and experiences. These applications were ease of using. Users entre their emotional changes by choosing options and rating on a scale. Also, users could entre additional comments. They assisted users to label their emotional states, and they provide guidance on how the emotion elicited and changed. They provided a relatively comprehensive, in-depth method to track experience. The previous records on users' emotional changes provided users insight on how and why emotional changes happened. These records also provide wide range of emotional data base for predicting personal experience and preference. When the log recorded the length of time an emotion was lasted, the experience associated with the emotion. This was the method for users elaborating further. Hence, such kind of applications, such as Emotion Tracker, was possible tools for design research.

5. FIELD EXPERIMENT OF EXTRACTING EMOTIONS FOR INFORMATION RETRIEVAL IN INTERACTIVE DESIGN RESEARCH

A structured observational field experiment examining the effectiveness of extracting emotions for information retrieval in interactive design research was conducted. Ten design students were invited from the tertiary educational organisations in Hong Kong randomly; all of them had no more than 1 year working experience the design students were grouped into two teams, Design Team A and Design Team B, and assigned design tasks. Next, one hundred consumers from Hong Kong were invited to identify the features of the creative design outcomes. Because it was crucial to gain input from a wide range of consumers for generalising the results, participants with various educational levels and ages were invited. The profile of the participants (Figure 1) was as the following groups:

- Twenty-five participants were randomly invited from Hong Kong working class ranged in 20 and 30 years old,
- Twenty-five participants were randomly invited from Hong Kong working class ranged in 30 and 40 years old,
- Twenty-five participants were randomly invited from Hong Kong working class ranged in 40 and 50 years old,
- Twenty-five participants were randomly invited from Hong Kong working class aged 50 above,

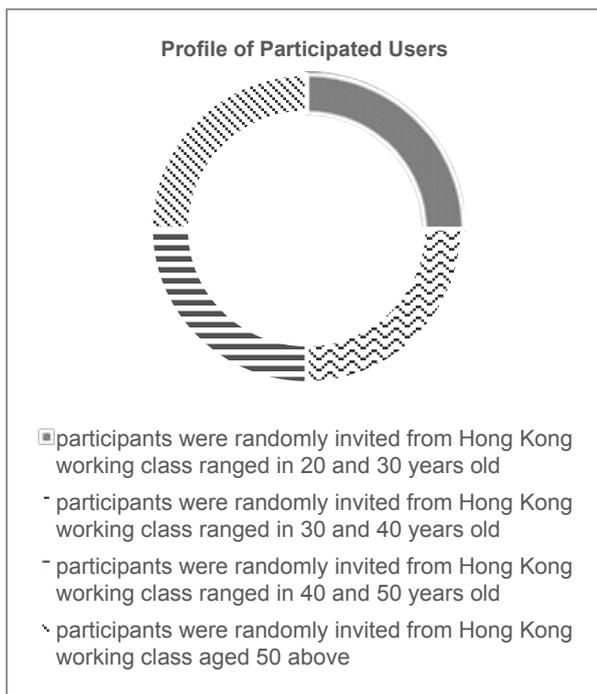


Figure 1: The profile of participated users

5.1 Research process

This study was designed in 2 stages of investigation (Figure 2). Stage 1 comprised the field observations, in which we observed the manipulation of the research stage of interactive design process both with (Team A) and without (Team B) the emotion extraction system. The assigned interactive design tasks were redesigned into an interactive wayfinding system for a commercial area in Hong Kong that caters for people who working here daily. The users are in various ages and professional backgrounds. The field observation was video-recorded. Design Team A received a lecture on the manipulation of the emotion extraction system for information retrieval, wherein they learned how to recognise and record emotions and emotional changes. They adopt emotion tracker tools to investigate and record the emotional changes of the users. By contrast, Design Team B conducted their observations without any information regarding the emotion extraction system for information retrieval. Each design student was asked to create a user portfolio after concluding their observations. In addition, the design students were asked “Which element obtained in your research was the most insightful for your design?” Key words were extracted from the answers, and were referred to during our questions directed at the consumers (see the following section). In stage 2, the design assessment processes set up by the users were recorded. User feedback was analysed to determine whether the professionals’ designs

offered favorable experiences for the users. To collect users’ feedback the following questions regarding user experiences were asked during the assessment of experience-based design outcomes:

- (i) On a scale of 1 to 100, how successfully did the design provide you with assistance during your experience in the recent design consumption?
- (ii) On a scale of 1 to 100, how closely did the user portfolio successfully describe your situation?
- (iii) Here are some key words related to your design experience. Which of them do you think is most closely related to your experience in the recent design consumption?

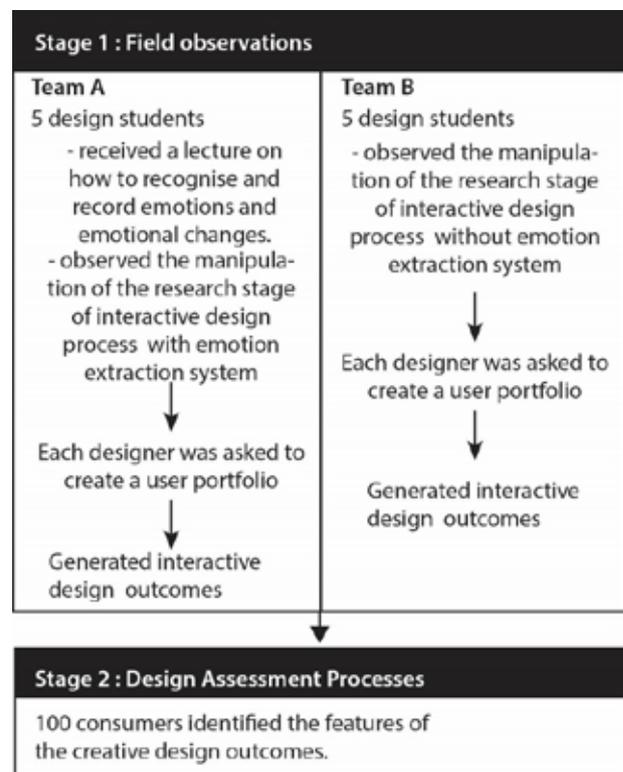


Figure 2: The research process

5.2 Research result

The one hundred invited consumers reviewed the ten design outcomes and provided individual scores (highest: 100; lowest: 1). Notably, the score regarding the satisfaction of users obtained by Design Team A was higher than that obtained by Design Team B. Moreover, the user portfolio developed by Design Team A received a higher level of appreciation than that developed by Design Team B. A comparison of the key words extracted from the design students in stage 1 and those selected by consumers in stage 2 indicated that more key words were selected from those provided by the designers in Design Team A than those

provided by Design Team B. A comparison of the accuracy percentage of the key terms was conducted. Notably, some feedback was provided by the consumers, who indicated that the design solutions supported by the emotion extraction system for information retrieval were far more creative than those not supported by the system. The presentations of visual and audio elements had a far greater ability to satisfy the needs of the users. Overall, our field observation of the design teams' design processes demonstrated that Team A were far more effective than Team B in generating creative interactive designs.

6. CONCLUSION

Awareness of the influence of emotion on different aspects of design studies is increasing, despite the dearth of exploration of this area in previous studies. The present study generally adopted marking data and users' demographic information to develop its design rationale. Based on the results of the field experiment, we argue that the emotion extraction system is an effective tool for collecting users' emotional information for interactive design. This study was a preliminary investigation designed to optimise the research process for interactive design.

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Co-Created Design Tools to Transform Student Induction

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Recognizing that both fixed and mobile technology are commonly used to create learning experiences which tie down all the requirements of the users' attention to screens at the cost of full contextual experience, the paper explores the design, delivery and outcomes of a learning experience which, by contrast, takes full advantage of the affordances of both the physical (analogue) and the virtual (digital) equally. The aim of the research was to design a toolkit for location based learning, using mobile technology (Android tablets) combined with a tailored app and social media, and to measure student learning and engagement in using the learning design. Using methods of co-creation with both Design and Media students, the project is a case study of how flipped learning techniques can be applied in learning design. In this case, the focus was on student induction, transforming it from a lecture-based, passive learning experience into a social, interdisciplinary, peer group learning experience. The toolkit can be applied effectively in other learning situations and is of greatest use in situations where the aim is for students to learn independently in groups, construct and share knowledge and where relevant locations for the learning add a valuable contextual dimension to the learning.

Mobile learning; location-based learning; social learning; co-creation; design and media education

1. INTRODUCTION AND CONTEXT

Scholarly work on the importance of induction to the retention and engagement of students (Bowskill, 2013; Thomas, 2012; Tinwell, 2013) has concluded that there are many reasons for students dropping out: financial issues; missing home; wrong choice of course; lack of preparedness for academic study and personal circumstance (Tinwell, 126). However, the outcomes of the studies all emphasise the importance of fostering the social integration of students in the first days and weeks of study, as well as during the pre-induction period (Thomas, Bowskill). To quote Thomas (25), 'according to three institutional surveys (Project 2), the majority of students (70%, n=262) felt confident that they had the ability to succeed in their chosen area of study, but most (75%, n=281) were worried about making friends when they started at university. This is supported by the qualitative evidence too, for example:

Anyone that says they're not scared is lying because there is that fear. Everyone has those giant fears of am I going to be liked, am I going to make friends, how am I going to feel living away from home ... you know... you're afraid of everything, but you've got to grow up some time. (Project 2, first-year UK student, male, mentee).

Policy changes and a competitive environment in the HE sector have increased the pressures to recruit and retain students and shifted emphasis onto the student experience, as opposed to the traditional emphasis on research, for instance. Universities have improved their approaches to induction and the retention of students has increased as a result (Tinwell, 9). Another motivator for change in approaches to induction has been the increase in opportunities to deliver information and knowledge online, via websites, apps and Virtual Learning Environments, however, there is less evidence of innovative approaches using technology as an integral part of the face-to-face induction of students.

In September 2012, the delivery of induction at Ravensbourne did not differ significantly from the traditional model of induction in UK universities. It commenced with a half-day professional services induction in the largest teaching space in the building. It was delivered in a series of lecture presentations to 150 students at a time by Heads of Professional Service departments, who did not engage in interactive methods. In a creative arts institution like Ravensbourne, the passive, information heavy approach was problematic. The design and media industries that Ravensbourne graduates aspire to work in are in great flux and

require their workforce to be adaptable, digitally adept and swift to acquire competencies in technologies of production and manufacture. Developments in the creative industries have resulted in a convergence of knowledge and skills and a resultant need for Design and Media education to place greater emphasis on collaborative, interdisciplinary and technical competencies. Whilst the industry-focused academics at Ravensbourne design and deliver their courses to reflect this, the induction experience did nothing to demonstrate this on the students' first day of study. In 2011, the institution moved into a new building, characterised by open plan, fluid learning spaces, which were evidently designed to foster student-focused teaching styles, enabled through technology. The induction did not provide any introduction to the new styles of learning the physical spaces were designed to foster. Moreover, the first learning experience students had was at odds with the nature of the pedagogy on the courses students had come to study. Students come to Ravensbourne because of the vocational aspects of the courses, all of which have project-based curricula, with continuous emphasis on specialist roles in the Media or Design industry. Constructivist principles, with an emphasis on learning as an active process of building knowledge and skills through practice within a supportive group or community (Kim, 2000) and iterative design are at the heart of that pedagogy. In summary, the method of delivery of induction was lagging behind Ravensbourne's vision to reshape Design and Media pedagogy to meet the demands of industry: a shift away from exclusive focus on traditional craft skills to mixed approaches using digital forms of design and media and a human-centred approach to design.

2. PROJECT AIMS

The aim of the project was to transform the professional services induction at Ravensbourne from a lecture-based learning experience into a social, interdisciplinary peer group experience, using mobile (tablet) technology, apps and social media. Whilst the concept of 'flipped learning' was not new, the application of the concept on a large-scale induction process was innovative. The researchers aimed to develop a sequence of activities and digital solutions necessary to deliver the same learning as in the original lectures, to similar group sizes, and thereby create a toolkit which could be applied in other learning situations and in a range of different contexts. There were two primary aims: Firstly, to place a greater emphasis on the importance of the social experience on students' first day at university rather than transmission of knowledge. This was to be achieved by making the learning more interactive

and fun, requiring team working, sharing of skills and active learning. The learning design aimed to promote an immediate sense of belonging to a wide community, which went beyond the specialised disciplines the students had chosen to study. Secondly, it was the intention to model the kind of learning (interdisciplinary, transdisciplinary, experiential) and the kind of technologies that students would later need to employ as an integral part of their academic study. With regard to the kind of learning, experiential learning (Kolb and Fry, 1975), as well as interdisciplinary (Jones, 2010) and transdisciplinary learning (Hyun, 2011; Jantsch, 1970) were the key concepts framing the learning design.

The project had a number of aims relating to the application and testing of technology for learning. These were as follows:

1. To evaluate the efficacy of mobile technology and location-based learning to engage students in group learning and trigger peer learning activities in the physical space most relevant to the area of knowledge and to support 'learning on the move' (Sharpley, 2013, p.6).
2. To create a stand-alone HTML5 player that would allow playback of web-based GLOMaker content on mobile devices by the end of the project.
3. To integrate social media apps into the design of the GLOMaker tool.
4. To propose an innovative learning design or 'toolkit' to deliver an 'induction trail' using mobile technologies.

3. PROJECT DESIGN

3.1 Fundamental Principles

The fundamental principles of the design of the learning experience emerged from the analysis of internal and external contextual factors outlined above, available research, as well as preliminary analysis of the feedback on the Ravensbourne professional services induction from a focus group of existing students. The research project was funded by JISC and therefore the project had a technology focus.

3.2 ICT Tools Employed in the Project

Whilst Virtual Learning environments, such as Moodle or Blackboard, presentation software, such as Powerpoint and communication via e-mail are usually part of the digital toolkit used to teach Design and Media disciplines, they were not designed with them in mind and do not meet all the pedagogical requirements of design or media

courses. As Maciver and Malins (2015) have identified: 'These platforms meet the needs of many types of learning situations. However, they have been designed for circumstances where learning materials are predefined by the tutor, where content is based on text, and where the curriculum is followed in a strict sequence (410). The hypothesis of this project was that mobile technology (Android tablets), a customizable app and social media could be employed to enhance student engagement in delivering induction in these subject areas. Each of the three technologies are discussed in further details below. None of the tools are new, but their use in Design pedagogy has remained largely under researched. There is greater evidence in Media pedagogy of use of the tools, but no existing scholarly research in how they can be used to enhance induction of new students.

3.2.1. Tablet Computer

Android tablets are a relatively cheap item of digital hardware. Simply by virtue of the fact that a tablet is mobile and held in the hands of the user, it is a more flexible and potentially engaging tool than fixed technology, which generally requires the user to be seated and in a passive state. The affective forms of motivation afforded by aspects of m-learning have been characterised as: control (over goals); ownership; fun; communication; learning in context; continuity between contexts (Jones, Isroff et al., 2006; Sharples, 2007). As Laurillard (Pachler, 2009) has examined, motivation has also been a focus for what m-learning offers that is different. Moreover, mobile technology enables Design and Media tutors to design learning to emphasise the visual over the textual. Creative tools (sound, camera, compass) are integrated into the device and can be used by the learning designer to design engaging, visual learning materials, as well as by the students to construct their own learning in response to a stimulus. Although the tablet does not have many more tools than a mobile phone, by virtue of its size, it is much more suited to facilitation of small group learning than a mobile phone. During the project, one tablet was used for groups of four students.

Given that we had identified that one of the primary aims of the project was to ensure social learning, the application of mobile learning as the central tool was important. More specifically, the induction trail built on the concept of mobile learning tours created by Cook and Smith (2011), in which students of Education explored the locality of their university and uncovered and documented the history and evolution of school buildings. The design would preserve the large scale learning experience of the lecture, thus maintaining the economic and time 'efficiency' and the ability to teach large numbers of students together, but

would be transformed by employing mobile technology.

3.2.2. Applications

The development and use of the open source app development tool: GLOMaker, was a pre-requisite for the project, as it was brought to the project by our research partner and was integral to the successful bid. One of the built in features of the tool was the ability to programme the items of content to be triggered either by generation of a QR code or by linking the items of content to Google map co-ordinates. The project team was excited by the potential of this feature to create location-based learning in a context like induction, where students need to become familiar with locations, as well as the activities and services that take place in those locations.

3.2.3. Social media (micro-blogging):

Part of the project funding was used to enhance the GLOMaker tool to allow seamless integration with commercial apps, such as Twitter. The wifi-enabled tablets combined with Twitter enabled the students to be in communication with a 'base camp' and with each other and to upload the content they created or the answers to the games for sharing and return seamlessly and quickly to the content for each of the game-based challenges.

3.3 Co-Creation at the Heart of the Experience

It was considered essential to co-create the induction trail with existing students, who had experienced induction themselves and who were now highly familiar with the university environment. Without their input into the design, there was a risk that the experience would not be as student-centred as planned. Drawing on Vygotsky's concept of the 'more capable peer' (1926), the project engaged second year undergraduate students in Design Interaction and Media Production disciplines in a live brief to further develop the interdisciplinary concept for new students' academic induction. By including undergraduate students in the process of developing, piloting and participating in the induction experience, the new methodology and its effectiveness ensures a user-centred design and a natural context for testing and evaluation.

Students were given an initial framework as outlined in 2., in order to meet the requirements of the project plan, which had been approved by the funder of the project: Jisc FE and Skills.

Subsequently, the 'winning' students work with their peers, academics and a learning technologist to develop and deliver their ideas and facilitate the live experience. Each group of students designed

an element of the learning experience which engaged their specialist discipline skills, whilst requiring them to collaborate across the disciplines to design the final integrated, interactive induction.

3.4 Co-Created Design Toolkit

3.4.1. Design and Preparation

The content is divided into eight topic 'stations', which correspond with the topics presented in the lectures during the original induction. These topics are matched to locations in the building that are 'relevant' to that content. Then those locations are 'augmented' or tagged with a trigger that releases the relevant content on the tablet.

For instance, the content about accessing library resources is triggered on the tablet when the students enter the library or hold up the tablet to read a QR code placed in the library or a tagged image or object in the library (all options were tried during different iterations of the induction trail). The tablets are programmed with short introductions to the content, which is followed by a single challenge of analogue and/or digital gamification.

The most significant aspect of the design that the co-creators added was to bring the learning experience together with a storytelling theme. The theme proposed and used in the original design in 2014 was 'digital zombies' ('Don't be a digital zombie!').

3.4.2. Learning Sequence

Learners begin in the 'base room', where they are placed in mixed discipline groups and encouraged to get to know one another in a large teaching space, organized 'café style' on tables of 8 to 10 students in total. A simple analogue sheet is used to foster the social bonding process (5 to 10 minutes), seen here in Figure one.

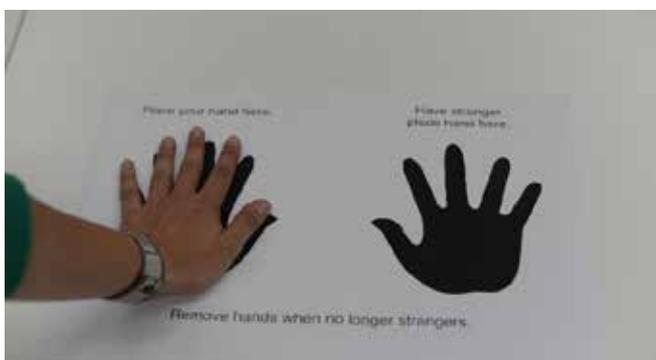


Figure 1: Analogue exercise to commence induction as social experience

The storytelling theme is introduced to the group as a whole via short films and a short presentation. This included an introduction to issues of responsibility and ethics around the use of social media.

Students form groups of 4 (two groups on each table) and think up a team name. Students are given a brief introduction to the technology and to the rules of the game are supported by student mentors to launch the first item of content.



Figure 2: Materials for the first area of content

The aim was for the new students to find the answer to a challenge, respond to the content and/or create new content of their own in small, interdisciplinary groups, facilitated by existing students.

For every successful challenge, students are awarded a physical jigsaw piece. Once they have collected all the jigsaw pieces to complete the jigsaw the can return to base camp. The jigsaws are designed and handmade by Product Design students at Ravensbourne to mirror the digital designs on the app (see right hand side of Figure 3 for the design).

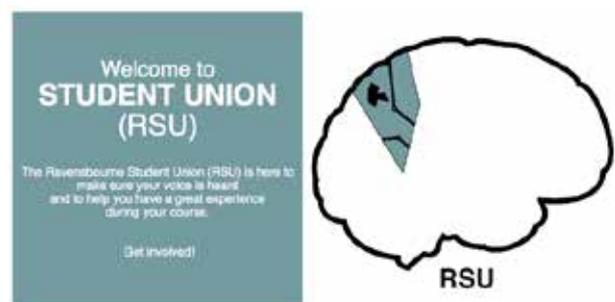


Figure 3: Example of GLOMaker tool slide triggered on the tablet



Figure 4: Solving a challenge using Augmented Reality content

The answers and/or content are shared on social media and tracked by the co-creators at the 'base camp', where a live leader board evaluates each group's progress and simultaneously 'broadcasts' the content produced internally and externally via social media.

Students have completed the challenges at each station, then they return to the base room, where they complete a quiz, which tests the knowledge they have learnt about each of the topic areas. When the quiz and feedback form have been completed, students are given access to the online materials, which support induction. These materials are planned and designed to match the design of the induction trail and provide short videos, further information and training for each of the physical stations.

The social media team assesses the results and produces a leaderboard and a showreel of content. To close the learning experience, the showreel is shown to all the students, sharing the content that the individual groups have created.

The leaderboard is revealed in reverse order and the winning team receives prizes.

4. METHODOLOGY

Because the overarching purpose of the project was social, the methodology focused on the learner experience of induction rather than an evaluation of the students' learning. The purpose of the project was to evaluate the learner experience of the existing induction (by the student co-creators of the project) and to use the results to enhance the development of the new content. The existing induction was evaluated using focus groups and discussion amongst the co-creators. To evaluate the learner experience of the new induction, the project methodology employed an online questionnaire that was issued to the students straight after the induction experience. The questionnaire was supplemented by short interviews with some students after the induction had taken place. In order to gain further insights, an ethnographic approach to research was also used. The ethnographic methodology was two-fold. Firstly ethnographic material generated on the tablet computers by students during the induction tours was analysed. Secondly, we used the method of researcher as participant observer (both student co-creators and staff research team), where the behaviours of students were observed, documented and discussed by the project team (Solé et al, 2010, 42–3).

5. PROJECT OUTCOMES

5.1 Questionnaire results

The results from the induction trail in 2016 are presented in this paper. It was completed by 602 students who completed the induction trail.

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Table 1: Question 1: Please read each statement and state if you agree or disagree. Answered: 591; Skipped: 11.

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree	Total	Weighted Average
I enjoyed learning with the mobile learning resources.	2.91% 17	5.30% 31	18.46% 108	57.78% 338	15.56% 91	585	3.78
Using digital learning resources can be useful for my learning.	1.35% 8	1.18% 7	11.00% 65	59.56% 352	26.90% 159	591	4.09
Interaction with real environments and physical objects is a useful strategy for learning.	1.19% 7	2.56% 15	13.48% 79	56.48% 331	26.28% 154	586	4.04
I benefit a lot from this form of exploratory learning.	2.23% 13	6.53% 38	26.80% 156	47.42% 276	17.01% 99	582	3.70

Table 2: Question 2: The mobile learning experience encouraged me to: Answered: 589, Skipped: 13

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree	Total	Weighted Average
Explore Ravensbourne in more detail than expected.	0.68% 4	5.80% 34	18.60% 109	58.70% 344	16.21% 95	586	3.84
Learn with digital resources more often in the future.	1.19% 7	4.27% 25	19.11% 112	59.90% 351	15.53% 91	586	3.84
Particularly experiment with mobile learning apps.	1.53% 9	5.96% 35	23.00% 135	53.49% 314	16.01% 94	587	3.76
Self-direct what and how much I should know about the Ravensbourne building and experience.	0.86% 5	3.94% 23	20.55% 120	58.39% 341	16.27% 95	584	3.85

Co-Created Design Tools to Transform Student Induction
Rosemary Stott

Table 3: Question 3: Which of the following statements are true? (We are interested in the learning experience that you had when engaging in the induction trail we provided) Answered: 590; skipped: 12

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree	Total	Weighted Average
I benefited from improving my knowledge of Ravensbourne in the real environment.	1.20% 7	3.61% 21	17.21% 100	62.99% 366	14.97% 87	581	3.87
I think Ravensbourne was successful in using mobile devices to trigger real activities in the context rather than make me consume content on the device.	1.54% 9	4.97% 29	18.15% 106	57.02% 333	18.32% 107	584	3.86
I was motivated to explore Ravensbourne in more depth.	1.38% 8	4.48% 26	19.31% 112	57.76% 335	17.07% 99	580	3.85
I have improved my knowledge of digital literacies on the induction tour (i.e.: Aurasma, Nearpod, Twitter and Goggles).	1.54% 9	5.82% 34	20.89% 122	53.60% 313	18.15% 106	584	3.81
The interactive induction trail improved my architectural knowledge of the Ravensbourne building.	1.54% 9	5.49% 32	20.07% 117	56.60% 330	16.30% 95	583	3.81
This whole experience stimulated me to try out different ways of learning.	2.23% 13	7.19% 42	21.58% 126	55.14% 322	13.87% 81	584	3.71
I enjoyed generating my own material using the device during the trail (i.e.: video, pictures).	2.40% 14	7.89% 46	23.16% 135	51.63% 301	14.92% 87	583	3.69
I was stimulated to find out what to explore in detail.	1.20% 7	7.89% 46	25.90% 151	54.03% 315	10.98% 64	583	3.66
I was stimulated to find out how to engage in the induction training.	1.54% 9	8.89% 52	23.59% 138	55.38% 324	10.60% 62	585	3.65
I found it useful being rewarded with actual tokens at the end of each challenge.	3.48% 20	9.91% 57	26.43% 152	47.13% 271	13.04% 75	575	3.56

Table 4: Question 4: Was learning with the mobile resources more motivating than other forms of teaching and learning (e.g. classroom teaching; Powerpoints)? Answered: 582; Skipped: 20

	Strongly Disagree	Disagree	Neither Disagree Nor Agree	Agree	Strongly Agree	Total	Weighted Average
(no label)	2.06% 12	4.98% 29	21.99% 128	54.81% 319	16.15% 94	582	3.78

Table 5: Question 5: How often have you used other technologies for learning before? Answered: 574; Skipped: 28

	Frequently	Often	Sometimes	Never	(no label)	Total	Weighted Average
(no label)	14.29% 82	18.64% 107	45.47% 261	20.03% 115	1.57% 9	574	2.76



Figure 5: Question 6: Please use three words to summarise your experience today. Answered: 532; Skipped: 70, Word one



Figure 6: Word two

Showing 26 words and phrases

Funny Team Confusing Slow Useful Insightful
Interactive Sociable Exciting Experience
Innovative Active Interesting
Educational Fun Challenging Engaging
Motivating Social Tedious Tiring Nice Creative
Stimulating Enjoyable Friendly

Figure 7: Word three

Showing 19 words and phrases

Good Work Induction Task Think Team Nah
Great Experience Confusing Fun Able
Nope Equipment Enjoyed Nice Forward
Allowed Engaging Ravensbourne
Interesting Way to do a Tour

Figure 8: Question 7: Any particular comment you would like to make? Answered: 157; Skipped: 445

5.2 Results of User-generated Content and Ethnographic Observations by Project Team and Co-Creators

The majority of the student generated content demonstrated high levels of motivation and fun, as well as social interaction (Figure 9). One of the criteria for scoring of the game challenges was the quality of the creative output. When students created the content, there was evidence of them collaborating, planning and engaging in group-based critical and reflective analysis to demonstrate this. One of the challenges was to create a short film on the actual tablet (rather than upload to social media). This provided the researchers with evidence that in 82% of cases, the teams attempted the short film more than once. In all cases, they developed the creative quality of their videos iteratively and engaged in informal critical evaluation of the work they had produced. This was evidence of spontaneous adjustment of the quality of the outcome and demonstrated not

only engagement with the task, but also deep learning and reflective practice in the creation of artefacts. It was evident that the students were motivated to express themselves in the creative areas they have chosen to study (figure 10).



Figure 9: Students' Photograph uploaded to Twitter



Figure 10: Students' Photograph saved on tablet

5.3 Conclusions and Recommendations for Mobile Learning Design

Ethnographic observations and user created content demonstrated that the induction trail's combination of e-learning, gamification, tasks and skills application led new students into the 'state of flow: an optimal experience characterized as a state of being fully focused and engaged in an activity' and one which is 'highly motivating' (Urh, 205, 390). Professional services at Ravensbourne have reported increases in the use of their services since the induction trail was introduced in 2014. The tablet computers fostered haptic, intuitive learning and worked well as a tool to foster group learning. By virtue of their screen size, they are suitable for mobile learning in groups. The GLOMaker tool was not as intuitive as hoped for the development of apps by student co-creators, despite the improvements to the tool, which were completed successfully and were integral to the project (integration of social media tools). Student co-creators reported that the tool was hard to learn and the results of the first designs using it were disappointing: the designs were poorly constructed and over complex. With the help of the project team, the designs were simplified. The final learning design using GLOMaker was clean and the instructions were easy to navigate for the new students. (see Figure 3).

The project involved the purchase and management of 45 tablets, which raised issues of storage, charging, maintenance and security (both online and physical), which had to be overcome. Laptop trolleys with secure storage and integral charging were an essential part of the toolkit that needed to be purchased to deliver the induction. Finding practical solutions for the storage and security of the tablets has resulted in the tablets being used in a range of other learning and teaching contexts in the institution. The learning design was relatively complex and was reliant on the connectivity to the internet being reliable. There were occasional problems with connectivity. To underpin learning design with technology still carries an element of risk and a back-up plan in case the connectivity fails is essential.

In the student feedback questionnaires, the response was overwhelmingly positive, with most questions achieving nearly 80% satisfaction. One noteworthy outcome was the potential of this form of learning to integrate students with learning differences. For example, a student with autism reported that he felt that he integrated into the group and made new friends. The negative responses were due to some students not being ready to engage in active learning or not being responsive to instructions and guidance. The only significant negative word that appeared in question 6 was 'confusing'. This resulted from the fact that students did have to concentrate and work out relatively complex navigation and instructions in an unfamiliar group. It is significant in this context that the word 'unexpected' was also used in the feedback. The intricate learning design combined with the social interaction necessary to succeed meant that new students were challenged to learn actively on their first day. The researchers have identified that the word 'induction' is not helpful. As proposed in section 1 of this paper, the term implies certain models of learning design and related behaviours from teacher and student. In 2016, the induction experience was therefore renamed to 'your first day' and 'your learning starts here'.

In conclusion, the research outcomes demonstrated that students valued highly the student-led, social experience and that the learning was engaging and motivating. Learning through collaboration and experiential, game-based challenges made induction more relevant to contemporary practice in education and in the design and media industries. The techniques and toolkit used in this project are highly applicable in a range of informal learning environments. Above all, the toolkit enables the students to become autonomous learners in locations highly relevant to learning and the teacher to become a facilitator rather than director of learning.

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ECollage and FEA Model as Catalysts for Idea Generation

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This paper presents a collaborative, future visioning concept design project on the theme of 'performance wear', conducted at the University of Helsinki for second-year student craft teachers. The concepts were designed by groups of 3-4 students. As one aspect of the project, the students made digital collages (eCollages) to present their concepts, without any prior technical training in eCollage. The students were required to use the FEA consumer needs model for apparel design (Lamb & Kallal, 1992) which describes aspects of such design through three dimensions – functional, expressive and aesthetic – when considering what performance clothing could be like in a future scenario.

We describe the outcomes of the concept design process from three perspectives: 1) What kind of eCollages the groups made and how they used ICT in their collages 2) How the use of eCollages enriched the concept presentations. 3) How the three dimensions of the FEA model were utilised and presented in the eCollages and group presentations. Three sets of data were used in this study: the eCollages, written descriptions of the concepts, and video data of group presentations, held at the final meeting of the course.

The results suggest that, at least in design-oriented higher education, open-ended design tasks utilising a digital eCollage presentation format can be successfully conducted without prior technical training given to students. How students utilised and represented the dimensions of the FEA model in their eCollages and group presentations was particularly interesting. All groups used the model in same hierarchical manner – while the order of the three dimensions varied, the way in which these were treated was constant. They emphasised one of the dimensions, a second dimension was used as a subsidiary element, and the third dimension seemed to be almost incidental to the process of all groups.

Creative design processes. Performance clothing.

1. INTRODUCTION

This paper describes the outcomes of a future visioning concept design project held at the University of Helsinki during the autumn term of 2016, for second-year student craft teachers. During the project, which had the theme of performance wear, the students created a future scenario and envisaged what the performance wear in that scenario would be like. As part of the concept design project, the students were required to prepare digital collages (eCollages) of their concepts, without prior technical training in making this type of collage, thus creating an additional challenge for the participants. In addition, the

students were required to consider the three dimensions of functionality, expressiveness and aesthetics, following the FEA consumer needs model for apparel design (Lamb & Kallal, 1992). This project was a catalyst for actual clothing design and making processes that followed in a later 'clothing in movement' course, in spring 2017. The purpose of the project was threefold: to extend students' knowledge and skills in craft design and theory; to offer a rich selection of sources of inspiration on which to base actual clothing design tasks following the concept design project; and to introduce the students to design methods and practices that they could use in their future work as craft teachers. From the research point of view our

main focus was on the eCollages and how the groups used them in their concept presentations. Furthermore, we analysed how the FEA model was utilised and represented in the eCollages and group presentations held at the final meeting of the course.

In the following chapters we will first briefly present the theoretical aspects of craft design and future visioning concept development, then present the project in detail, followed by our research aims, methods, findings and discussion of the project.

2. INSPIRATION SOURCES AS TRIGGERING FORCES FOR CREATIVE DESIGN PROCESSES

Craft design processes, as well as other creative design processes, can be described as iterative and cycling processes, in which different phases of the process – ideation, experimenting, reflection and modifications – mix and repeat until a desired design is achieved (e.g. Goel & Pirolli, 1992; Seitamaa-Hakkarainen & Hakkarainen, 2001; see also Lahti, *et al.*, 2016). Finding inspiration is of the essence in creative design. Sources of inspiration generate ideas thus providing a basis for the whole process (Petre, Sharp, & Johnson, 2006). They help a designer to find and develop design ideas and to move from the first vague mental image of an artefact to the final design (Pahl & Beitz, 1996; Laamanen & Seitamaa-Hakkarainen, 2009). Sources of inspiration both expand the design space, and constrain and direct the design process (Eckert, Stacey, & Clarkson, 2000). In ideas generation, sources of inspiration have multiple applications: they create a context for design; provide information; offer a basis and source for product features or details; and they help designers to visualise and explain their ideas (Petre, *et al.*, 2006).

Almost anything – objects, images, memories and abstractions – can be a source of inspiration (Petre, *et al.*, 2006). Although designs are usually based on existing solutions (Lawson, 2004), the most innovative design ideas often emerge from sources of inspiration that aren't directly related to the design problem. In this project, the design process leads to actual clothes, but by keeping the concept design phase separate from the actual product design, the students had the opportunity to explore clothing as a phenomenon, rather than concentrate on making specific clothes. This potentially helps them to create more innovative solutions than by simply designing actual clothes directly.

3. THE FUTURE VISIONING CONCEPT DESIGN PROJECT

Concept design can be defined in various ways, depending on context. Often, in product design, concept development initiates a design process

and is considered to be the most significant phase of the innovative, so called, fuzzy front-end of the process (Aspelund, 2006). Concept design is typically future oriented. In industrial design, concepts are divided into four categories, depending on how far in the future the concept's focus is. The first two categories – solving (0-2 years) and defining (2-5 years) concepts – are typically directly related to product design. Two later categories – emerging (5-10 years) and visioning (more than 10 years) concepts – on the other hand, aim to explore future products and consumer needs, in various alternative future scenarios, through models, narratives and visualisations. This type of concept design isn't constrained by, for example, existing manufacturing techniques or current consumer needs. Future visioning concept design produces new, even radical, ideas and promotes designers' innovativeness. (Keinonen, 2006; Perttula & Säaskilahti, 2004; Säaskilahti, Kuuva, & Leppimäki, 2005.) Future visioning concept design seeks to describe the principles of design solutions to possible future products, without actually defining the products. Instead, the concept contains an idea that determines how different aspects of the concept join together into a uniform whole. (Aspelund, 2006.)

The future visioning concept design project has been developed to provide students with 'out-of-the-box' sources of inspiration and ideas, to promote innovativeness and to help students in the actual clothing design phase. Similar concept design projects have been carried out within craft teacher education before (2013-2015), but this project had two significant differences: it was arranged as a separate course to the actual clothing design course, and, instead of using traditional collages, eCollages were used as the visual presentation method. We saw that eCollages could potentially enrich the visual presentations. In addition, we wanted to encourage the students to explore new technological solutions and digital tools, instead of providing them with specific tools or patterns to follow. In our opinion, learning to use certain computer programmes or to carry out specific tasks using ICT, without a direct connection to practice, doesn't promote the innovative use of technology or an ability to keep up with the vastly evolving opportunities offered by ICT. We think that it's more beneficial for our students – the future teachers – to learn how to find and implement new technology, and to gain the courage and self-assurance to do so (cf. Claxton, 2002).

Twenty-one second-year student craft teachers participated to the project. None had previous experience of this type of future visioning concept design or creating eCollages. However, some of the participants had skills that they could utilise in creating eCollages, such as Photoshop or video

editing expertise. There were six groups of 3-4 people, who collaborated on the concept development. The project was carried out over a period of four weeks, starting with an opening lecture in which students were given the concept design task, then introduced to theoretical aspects of concept development, and also given practical instructions for the project. During the first two weeks, all groups had two, four-hour supervised sessions where they could work with their own concepts and receive individual tutoring. Most of the work the groups conducted without supervision, by meeting face-to-face or over the internet.

The project assignment was formed around the theory of systematic visionary concept development (see Keinonen, 2006; Perttula & Säaskilahti, 2004; Säaskilahti, *et al.*, 2005). The key aspects of the project briefing were:

- The aim of the project is to develop a visionary concept around the theme of 'performance clothing'.
- The concept description must contain the following: a written description of the concept and the idea behind it; visual digital collage-type presentation (eCollage); and material experiments
- The group must prepare a 15-minute presentation of the concept to be delivered at the final meeting of the project.
- The presentation and all three parts of the concept must form a uniform whole.

The groups were asked to vision a future scenario and determine what performance clothing could be like. To help the visioning process, the groups were provided with a futures table (Fig. 1) that they were encouraged to use as a starting point for building the scenario (cf. Perttula & Säaskilahti, 2004). The groups were specifically instructed to concentrate on the emerging and visioning concept categories (outlined in red in Fig.1).

	Solving concepts	Defining concepts	Emerging concepts	Visioning concepts
Timeline	0 - 2 years	2 - 5 years	5 - 10 years	> 10 years
What isn't yet available or existing?				
What is emerging?				
What is applicable?				
What is available?				
What isn't available anymore?				

Figure 1: Futures table (cf. Perttula & Säaskilahti, 2004)

The groups were also instructed to use Lamb and Kallal's (1992) FEA consumer needs model for apparel design (Fig. 2), when considering the options for performance clothing in their future scenario. The FEA model forms a framework for user-centred apparel design. It emphasises the

importance of acknowledging the cultural context of the target users and divides consumer needs for apparel into three, partially interlinked, dimensions that should all be taken into consideration during a design process – functional, expressive and aesthetic. 'Functional' refers to aspects that relate to a garment's utility, such as fit and comfort. 'Expressiveness' describes the communicative and symbolic aspects that a garment represents, such as self-expression and values. 'Aesthetic' relates to issues of beauty and art, such as shape, colour and texture. (Lamb & Kallal, 1992.)



Figure 2: the FEA consumer needs model (Lamb & Kallal, 1992)

The students weren't given any specific technological instructions on how to create eCollages. However, we discussed with them the issues to consider in eCollage design, such as how to exhibit movement, atmosphere, touch and feeling, in a digital format. The students were also given examples of online services¹, and some tips on possible elements (e.g. pictures, videos and sounds) that they could use in their eCollage design. We also discussed the new possibilities that using a digital format could bring to material experiments. For example, by using videos, it's possible to make and represent material experiments where the key idea is on how the material behaves in certain conditions or where the material becomes destroyed.

More specific instructions were given regarding written descriptions of the concepts. These were to be written in the form of an article containing references to at least two written sources of information, and including at least one visual image that provides additional information about the

¹ <https://www.behance.net/>, <https://carbonmade.com/>, <http://dropr.com/>, <https://www.weebly.com/>, <http://www.wix.com/>, <https://wordpress.com/>

concept. The text was to be no longer than one A4 page. In addition to the written description and eCollage, the groups were required to make and represent material experiments. These had to link directly to the concept and be carried out by the group members during the project. The students were encouraged to devise ways to link the eCollage and material experiments with each other to form a uniform whole.

4. RESEARCH AIMS AND METHODS

This paper describes the first part of a wider research project that covers the whole process from concept development to the design and making of actual clothes. In this paper we describe the outcomes of the future visioning concept design process from three perspectives:

1. What kind of eCollages the groups made and how they used the possibilities of ICT in their collages?
2. How the usage of eCollages enriched the concept presentations?
3. How the three dimensions of the FEA model were utilised and represented in the eCollages and group presentations?

For this part of the research, we collected and analysed three sets of data: the group eCollages; written descriptions of the concepts; and video data of group presentations. In total, almost two-and-a-half hours of video data were collected and analysed. The group presentations took between 14.5 and 30.5 minutes each, including discussions following the presentations.

The eCollages were analysed by writing descriptions of the visual and digital design solutions that were used in them, as well as how the eCollages were linked to other elements of the concept presentations. The written descriptions were used as supporting data to help in-depth analysis. The writings provided us with insight into what the groups were seeking to present as their key ideas of the concepts. The video data were analysed using Atlas.ti² software, version 7.5.16. The group presentation videos were prepared for analysis by forming a Clickable Table of Contents (C-TOC) of each video (see Hauptmann, 2005). (An example of a C-TOC is presented in Fig. 3.) The videos were then analysed as raw data by writing descriptions and coding those parts of the data that were applicable to the interest areas of this part of the research project.

Id	Name	Start	Size
8:1	Silent video of person signing..	0:00:00.00	0:00:55.99
8:2	Background, need for the clove..	0:00:55.99	0:01:43.70
8:3	Concept, technology, how clove..	0:02:39.69	0:01:01.18
8:4	FEA-model	0:03:40.88	0:00:46.66
8:5	Intro video with cloves used	0:04:27.54	0:00:42.51
8:6	Future development	0:05:10.06	0:00:35.25
8:7	Intro to qr-codes and material..	0:05:45.32	0:00:35.25
8:8	Video of latest fashion in int..	0:06:20.57	0:01:58.21
8:9	Material experiments	0:08:18.79	0:03:43.99
8:10	...QR-code in action	0:10:49.20	0:01:13.62
8:11	Background, inspiration, instr..	0:12:02.82	0:01:16.73
~8...	Reflection, process, digi, pro..	0:13:19.56	0:02:06.51
8:13	Feedback from crowd and ending..	0:15:26.08	0:01:50.59
8:14	...about energy for cloves	0:16:24.99	0:00:21.77

Figure 3: Example of a C-TOC of a group presentation

5. FINDINGS

Five groups created a global future scenario, and one group concentrated on the future applications provided by their imaginary 'smart glove' for people with disabilities. All the groups that created global future scenarios ended up with very similar visions of the future world as a dystopia. How they utilised this future vision in their concepts, however, varied. The future scenarios, timelines, and key ideas of the concepts are presented in Table 1:

² <http://atlasti.com/>

Table 1: Future scenarios, timelines and key ideas of the groups' concepts

Group 1	
<i>Timeline</i>	Far in the future
<i>Future Scenario</i>	The rotation of planet has almost stopped and therefore conditions on Earth have changed to extremely hot, desert-like, in some areas and, to extremely cold, arctic, in others.
<i>Concept's Key Idea</i>	Visions how people could live and survive in such extremely hot and cold conditions, especially from perspective of clothing.
Group 2	
<i>Timeline</i>	Far in the future
<i>Future Scenario</i>	Urbanisation continues and finally reaches a breaking point where society breaks down.
<i>Concept's Key Idea</i>	Beehive metaphor. What happens when the hive becomes overcrowded, the queen leaves or dies and the hive breaks? Will it lead to serenity and peace?
Group 3	
<i>Timeline</i>	> 5 years, relatively near future
<i>Future Scenario</i>	How people with disabilities, especially those with hearing defects, can express themselves better and live more easily and independently by using the group's imaginary glove which includes various smart technologies.
<i>Concept's Key Idea</i>	A glove that helps people with disabilities in their everyday activities and enables them to express themselves independently.
Group 4	
<i>Timeline</i>	2156
<i>Future Scenario</i>	It is five years since the 20-year long world war III has ended. The cities of the world are ruined. A group of people has been able to create a utopia where people live in peace and harmony with each other and nature. However, they are constantly threatened by the 'bad guys'.
<i>Concept's Key Idea</i>	Visions: how the group dresses and makes clothes using recycled materials; how they express their values and belonging to the 'tribe' through apparel; how the clothing protects the group.
Group 5	
<i>Timeline</i>	Far in the future
<i>Future Scenario</i>	Urbanisation has continued and natural resources have diminished significantly. People live hectic lives in restless cities. They eat processed food, dress in synthetic clothes and rarely see pure green nature.

<i>Concept's Key Idea</i>	A luxury holiday trip to a faraway green planet, where visitors can relax and enjoy the sense of weightlessness, protected by a glass bubble. They can eat pure, natural food, dress in clothes made of natural fibres (on top of protective hi-tech underwear), surrounded by a magical and relaxing scene of travelling through a magnetic storm in space.
Group 6	
<i>Timeline</i>	2065
<i>Future Scenario</i>	Climate change has led to rising sea levels and made conditions on the planet often harsh and unpredictable.
<i>Concept's Key Idea</i>	Moveable artificial islands have become popular holiday destinations for wealthy people. The concept paints a scenario of the crowd being on a senior group package tour to the moveable island 'Atlantis'. On Atlantis the group can return to the beginning of the 21 st century and enjoy all the hedonistic pleasures that were available back then.

All six groups were able to make eCollages with either no or very minimal technical assistance. Every group used a different tool³ to create their eCollages. Also styles, multimedia elements, and use of the eCollages within the group presentations varied. Three groups (1, 4 and 6) created eCollages that were based on separate scenes of individual photos or photo-collages, using PowerPoint and horizontally scrollable website layouts. They used the eCollages as story illustrations, in which the scenes related to individual parts of their concept presentations. Groups 1 and 6 further enriched their group presentation with music and sound-effects, such as the sounds of wind or waves. Group 4's eCollage scenes are presented in Fig. 4 to 6.



Figure 4: First scene of group 4's eCollage

³ Group 1: wordpress.com, Group 2: Photoshop, Group 3: canva.com, Group 4: PowerPoint, Group 5: wix.com, Group 6: carbonmade.com



Figure 5: Second scene of group 4's eCollage



Figure 6: Third scene of group 4's eCollage

Group 4 created a vertically scrollable website that had an animated background that mimicked a view of moving through space. Their collage also had scene-type elements, but their main use of the eCollage wasn't to carry the concept presentation

from scene to scene. Instead, they used the eCollage, above all, to create an atmosphere and feeling of being in space on their imaginary green planet. They also used sound-effects to further expand their presentation. Group 3, the only group

that didn't vision a global-scale future scenario, created an online poster (Fig. 7) that included video elements directly embedded to it. The poster was designed to look like it could be used to advertise the product, which contributed to the theme of the presentation that resembled a marketing event. They used QR codes to give the audience an opportunity to use their smartphones to experiment with how the product could function. Finally, Group 2 created their eCollage using Photoshop and presented it as an individual element of their presentation. Their eCollage was an animated video where the first scene represented their future dystopia vision. The first scene then began to crack and finally shattered, to reveal a 'new world of peace and harmony'. Sound-effects were used to further intensify the scenes, for example at the breaking point there was the beep of a hospital life support machine when the heart stops.

The eCollages played an important role in every group presentation. Without them the presentations would have lacked significantly in visual and acoustic effectiveness. The size of the eCollages on screen, compared to concrete collages, –limited to the size of an A1 sheet at most – made the eCollages stand out more and offered possibilities to be used as effective backgrounds or as atmospheric elements. The ability to create individual scenes within the eCollages also brought a new dimension to the presentations. While concrete collages are hung on a wall and therefore constantly visible to the audience, eCollages can contain elements that are present only during certain parts of the entire presentations. Furthermore, animations and videos introduced a possibility to embed stand-alone elements into a presentation that didn't require verbal explanations and could still convey a strong message to the audience. The message was often further intensified by using sound-effects or music. These acoustic elements were especially effective in creating a certain atmosphere, a mental picture or feeling. Finally, the use of interactive additions, such as QR codes, gave the audience a chance to experiment with an imaginary future product.

A uniform pattern emerged from the data analyses of how the groups applied the three dimensions of the FEA model to their concepts (Lamb & Kallal, 1992). All groups used the model in same manner. They strongly emphasised one dimension of the model and built their concept and presentation around that. A second dimension was used as a subsidiary element that was clearly presented through at least one component of the concept presentation, but was still overshadowed by the primary dimension. The third dimension seemed to be almost incidental to the process of all groups. The order of the three dimensions within the hierarchy varied between the concepts, although the theme of the design project was 'performance clothing', which could have promoted functionality over aesthetics and expressiveness. In five eCollages the primary FEA model dimension was in the most significant role. Primary, subsidiary and incidental dimensions in concept presentations, as well as primary dimensions of the eCollages, are presented in Table 2.

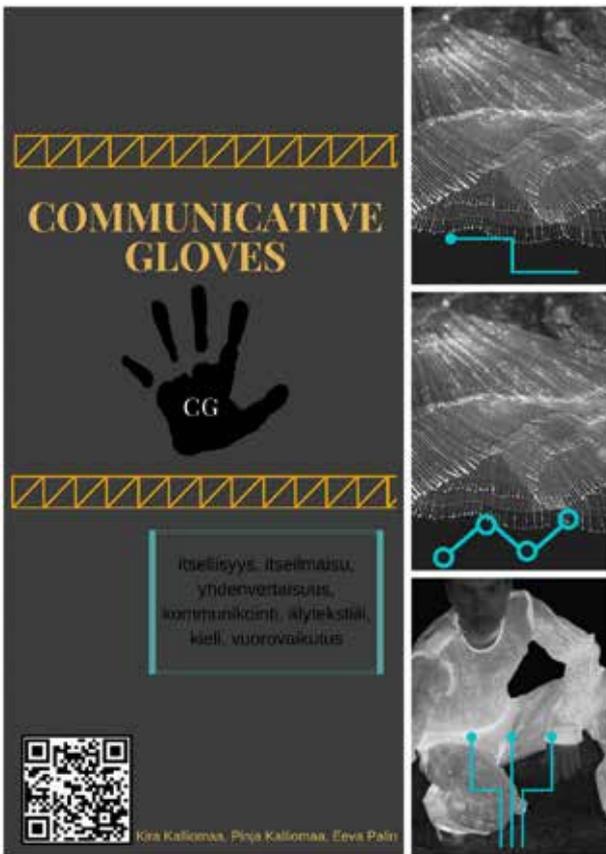


Figure 7: Group 3's eCollage

Table 2: The use of elements of the FEA model in concept presentations and eCollages

Group	Primary dimension	Subsidiary dimension	Incidental dimension	Primary dimension of the eCollage
1	Functional	Expressive	Aesthetic	Functional
2	Aesthetic	Expressive	Functional	Expressive

3	Expressive	Functional	Aesthetic	Expressive
4	Expressive	Aesthetic	Functional	Expressive
5	Aesthetic	Functional	Expressive	Aesthetic
6	Aesthetic	Functional	Expressive	Aesthetic

The most variation in the hierarchic pattern of using the FEA model occurred in how the groups handled the third, incidental dimension. Some groups mentioned it more often than others during their presentations, but even these groups didn't specify precisely how that dimension actually related to the key idea of their concept.

6. CONCLUSIONS AND DISCUSSION

The results suggest that, at least in design-oriented higher education, open-ended design tasks utilising a digital eCollage presentation format can be successfully conducted without prior technical training being given to students. We were surprised at the high level of technical and visual executions of all the eCollages we analysed. The diversity of different digital tools used in creating the eCollages raises the question of how the eCollages would have turned out if we had given the students prior training in using specific digital tools. Instead of the more advanced and high-quality executions that we observed, we could have ended up with six eCollages that would have closely resembled each other, both in terms of the technical and visual aspects of the design. Could such eCollages offer students the same possibilities for collaborative learning and knowledge-sharing, as well as such a wide variety of design ideas and sources of inspiration?

Our findings about how students utilised and represented the FEA model in their eCollages and group presentations were particularly interesting. All of the groups used the model in same hierarchic manner. They strongly emphasised one dimension of the model, a second dimension was used as a subsidiary element and the third dimension seemed to be almost incidental to the process of all groups. Lamb and Kallal (1992) acknowledge that the dimensions of the model may be paired and/or applied in a relative hierarchy to each other. On the other hand, in the previous study by Lahti & Seitamaa-Hakkarainen (2005), of collaborative design processes of conference bags, the participants strongly emphasised functionality over expressive and aesthetic aspects in their designs. However, this hierarchical application of the FEA model dimensions hasn't been found in previous studies. Therefore further research is needed to determine if a hierarchical approach to the FEA model dimensions is exclusive to this type of open-ended conceptual design only, or can be applied to other types of design process.

The project continues in spring 2017 with a course in which the students design and make actual clothing. It will be interesting to see how this future visioning concept design process and the final concepts affect students' product design processes and the actual clothing they make, as a final outcome of this project.

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Lurking and learning: Making learning visible in a Virtual Design Studio

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This paper explores certain types of student behaviour in design courses presented through an online distance learning environment and using a virtual design studio. It demonstrates that types of behaviour often considered to be passive, and therefore negative or less valuable than obviously active behaviours, can be significant evidence of student learning. Specifically, viewing other students' work is demonstrated to be a stronger (or equal) correlation of student success compared to any other behaviour measured in the virtual design studios studied. It is hypothesised that this activity is part of a larger set of social learning behaviours that contribute to a general social press or 'ecology' of studio learning. This finding has important implications for the design and implementation of virtual studios (technically and in learning design) and these are reported specifically for the interest and use of learning designers.

Distance education; design education; Virtual Design Studio; social learning.

1. INTRODUCTION

This paper presents on-going work from a large-scale study of design students in a Virtual Design Studio (VDS) at The Open University in the United Kingdom. It builds on previous work undertaken by the research team and more specifically the finding in Lotz et al. (2015): that a form of social learning through peer comparison is taking place. This paper presents updated results from additional studios in other cohorts of the course, verifying and extending the original finding.

The student actions and behaviour studied are shown to represent a valuable, but under-represented, learning activity and opportunity, a finding reported previously (Beaudoin, 2002; Dennen, 2008; Schneider et al., 2013). Future work will explore the detail of this activity but these early results have important implications for the design of virtual studios and learning activities, which are set out at the end of the paper.

2. BACKGROUND AND CONTEXT

The context of this study is design courses run at the distance learning institution The Open University UK (OU). The OU is the largest provider of distance education in the UK with over 100,000 students. Students study individual courses (or

modules) at a distance, towards a degree level qualification. Each design module represents 60 CAT/REF points of study, equivalent to half a traditional university year. OU modules have student populations of hundreds (sometimes thousands) of students – the entry-level design module (U101) has around 3-500 students in each presentation with two presentations each year.

The Open University operates an open access policy; any student may enrol on courses without any prerequisite entry qualifications. Where there are exceptions (e.g. advanced level subject-specific courses), alternative level study is always available. OU students typically study part time and their demographic makeup is different to that of design courses in other institutions – typically OU design students are older and have a higher proportion of additional educational requirements. The courses are non-selective which leads them to be aimed at novice designers with aspirations to develop design thinking and practice. Thus the entry level module is founded on the intention of instilling design practice methods applicable to a range of disciplines not traditionally associated with 'pure' design subjects (Lloyd, 2011).

Students are allocated to a tutor group of around 20 peers supported by a part-time tutor responsible for subject tuition and pastoral care for that group.

The tutor-student relationship is one key factor in being able to scale this educational model whilst still retaining an appropriate level of individual student attention and support. Tuition is undertaken through a range of communication modes (online conferencing, phone, text, email, forums, social media, etc.).

One major mode of tuition is assessment and feedback. Students submit work through an online, centralised system which is then assessed by their tutor and returned through this same system. Tutors provide tuition through extended, detailed feedback on this work, allowing them to focus on a student's specific learning needs derived from the work and their knowledge of the student from other contact.

This provides an interesting challenge in terms of design education where the replication of synchronous learning, such as might take place in a proximate studio, is difficult to achieve. Careful consideration and design of learning material is required to ensure the optimum balance between learning, teaching and tuition. When this is achieved a suitable environment within which design can be learned is possible (Lloyd, 2012). At The Open University a key element in creating such an environment is the Virtual Design Studio (VDS), an important additional tuition space for all design modules (as well as an increasing number of other subject modules).

3. PROXIMATE AND VIRTUAL DESIGN STUDIOS

The studio is a key feature in almost all design education (Kvan, 2001; Higgins et al., 2009). It emerged from the beaux-arts traditions of Europe in response to a need to expand and systematise professional design education, principally architecture (Cuff, 1992). Such is the importance of this mode of learning that it is often argued to be a *signature pedagogy* in design and in other domains of professional education, representing both the form and content of knowledge in a particular discipline (Shulman, 2005; Crowther, 2013).

The principle characteristics of this signature pedagogy can vary depending on the authority consulted but typically involve a range of active learning methods: problem-based, experiential, performative and simulated learning (e.g. Chickering & Gamson, 1987; Bonwell & Eison, James, 1991). These are supported by a series of particular affordances: physical space/press, professional community, and access to experts (e.g. Shulman, 2005; Brandt et al., 2013). Finally, the importance of social learning and support mechanisms are now emerging in literature: peer support, evaluation, comparison and peer critique

(e.g. Cennamo & Brandt, 2012; Ashton & Durling, 2016).

Of course, these characteristics represent only the *potential* learning within the studio - precisely how such learning takes place for individual students can vary significantly. For some it may be that critique generates the most meaningful learning events; for others, it may be personal self-reflection through experiential iteration of design. In addition to these directly experienced events, learning also takes place through observation of such experiences and events. This latter mode of learning is one of the simplest forms of learning development, used from childhood. Rogoff et al. (2003) refer to this as 'listening in' and provide an interesting comparison to transmissionbased education paradigms. Shulman (2005) refers to it as the 'apprenticeship of observation', demonstrating its importance in professional, practice-based learning.

In design pedagogy learning from observation is vital for developing a student's notion of what makes good or bad design. Contextual (or contingent) suitability of a design idea is very often more important than 'getting it right' and this can only be learned through exploration in a simulated (safe) environment, the design studio. More importantly it relies heavily on mechanisms of regular comparison and validation, making it an intrinsically social mode of experience and learning. The importance of developing this as a socially constructed understanding of design judgement is understood professionally and is now emerging in design education theory and literature generally (Lloyd & Jones, 2013; Ashton & Durling, 2016). Despite this there is little research that considers *specific* mechanisms of social comparison in design, for example through using models developed in social psychology (e.g. Festinger, 1954; Gilbert et al., 1995; Kruger & Dunning, 1999). In proximate studios this form of learning is often implicit and its implementation in the physical studio is assumed to take place naturally.

The studio provides a good opportunity for studying and understanding how learning through observation takes place; the locus of learning is easily identified and it has a reasonably clear focus for research. As design courses make use of virtual elements to augment or even replace studio components, this opportunity for research remains, although what learning might translate to virtual environments (and how it does so) remains an under-researched area of study (e.g. Beaudoin, 2002; Dennen, 2008; Schneider et al., 2013)

Virtual Design Studio (VDS) is a general term to denote a range of tools, systems and services used to replicate, simulate or supplement traditional

(proximate) design studios and many design programmes are now augmenting, or even replacing, traditional studio environments with virtual studios (Kvan, 2001; Arvola & Artman, 2008; Robbie & Zeeng, 2012). Most VDS spaces have been shaped by direct translation of practice in proximate studios and the affordances of the technologies available (Malins et al., 2003). In these contexts, 'virtual studio' is used to describe a place for working, i.e. a suite of design tools rather than a space for display and interaction. Other models attempt to go beyond the replication of function and use technology to support design cognition directly, such as using of virtual models as the design environment itself (e.g. Maher & Simoff, 1999).

These two models make use of the object of design in slightly different ways: the former focuses on the activity around the object and the latter on the object itself. Between these two approaches is a hybrid model of both working with and around design artefacts, a model adopted by many design

programmes around the world and the one adopted by The Open University's VDS, OpenDesignStudio.

4. OPENDESIGNSTUDIO (ODS)

OpenDesignStudio (ODS) is an online portfolio and communication space that allows students to post, view and discuss artefacts that they create and find. Digital artefacts can be uploaded to predetermined 'slots' which are presented as thumbnail previews to the entire course cohort to give a visual representation of the studio via other students' work (Figure 1). The interface is simple enough to use so that no significant time is needed for familiarisation, particularly if students are familiar with similar social media tools such as Pinterest.

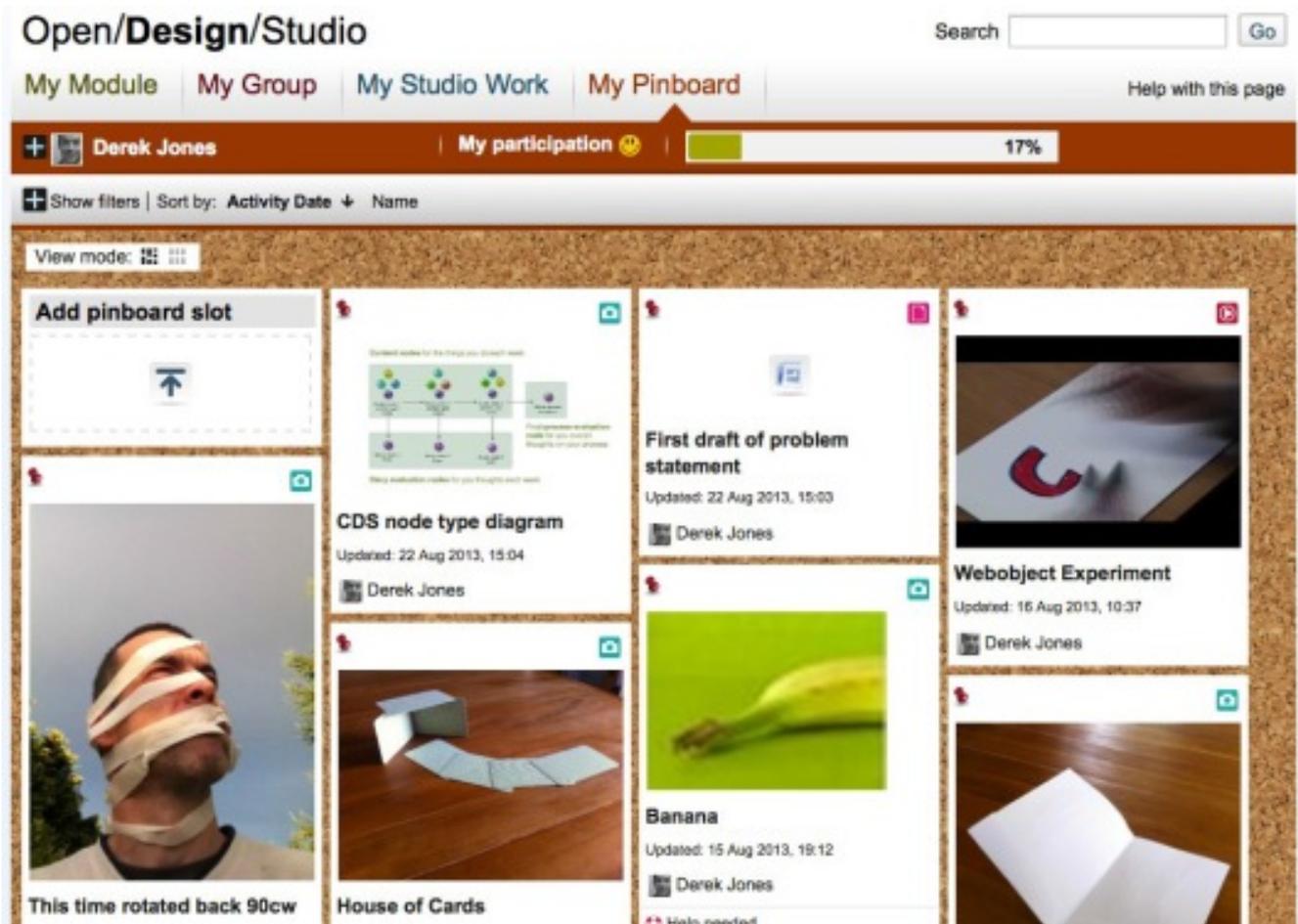


Figure 1: Main interface of OpenDesignStudio online virtual studio tool, showing predetermined 'slots'.

Clicking on a thumbnail in the main studio presents students with the slot view itself, a more detailed view of the work itself together with any text added to support it (Figure 2). Each slot can support a

range of content through uploaded file types or embedding web code. For U101, use is primarily visual through the use of image files and students can comment on individual posts using text and

audio commenting. Students can also engage in quick interaction by using Favourite, Smile and Inspire buttons that seek to encourage quick student communication and interaction. These latter actions (commenting, favouriting, etc.) are typically viewed as more active behaviours whereas the former (viewing a slot) is regarded as passive.

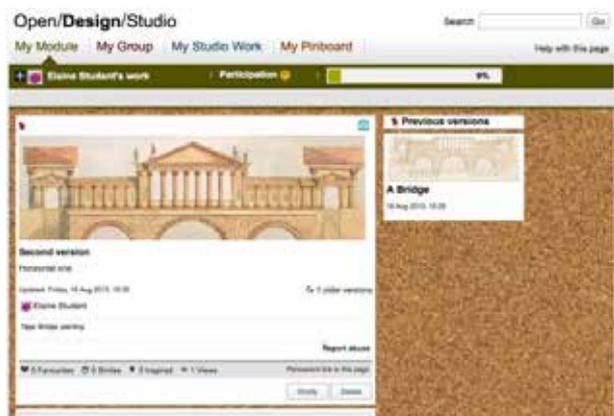


Figure 2: An ODS slot with image upload in OpenDesignStudio

ODS provides, a mainly visual space where students can communicate their own work activity. This is achieved using two types of slot: Studio slots (a series of named but empty slot placeholders to be completed for specific activities during the course) and Pinboard slots (a virtual 'space' where students can add as many slots of any type as they wish). Students are free to choose to engage with the tool and, whilst they are encouraged to make use of it, they do not have to do so in order to pass the course. They are also given options to enable them to maintain privacy on posts should they so wish.

Student use of ODS has far exceeded expectation from the first presentation in 2010. This informal evidence seemed to answer the question 'Can social learning take place in a virtual design studio?', a result confirmed by a number of other authors (e.g. Kvan, 2001; Malins et al., 2003; Pektaş, 2015). But our knowledge of how this takes place, to what extent, and how it compares to proximate studio learning is still relatively poor. Work on this has been taking place in a large-scale study internally funded by the OU. Initial findings and ongoing work are reported elsewhere (Lotz et al., 2015). This paper presents the most recent findings and looks specifically at student peer comparison measured by activity in OpenDesignStudio in one course: U101: Design Thinking, over several presentations.

5. APPROACH AND METHOD

5.1 Measures of engagement

When working with any asynchronous online learning tool the only way a teacher and/or researcher has to measure behaviour is through the actions taken by students using the interface. Very often these actions are treated as simple behaviours because they often have a single function or action. For example, when a user likes an online artefact it is often recorded as a single event: clicking a button, navigating to a link, or some other specific interaction with the software interface.

In any software based VDS there are limits to what can be measured. It is easy to measure which interactive features a student uses but these may not represent all the thinking and learning that has gone into a student's overall behaviour. For example, a series of slot views can be viewed as simply browsing behaviour but what, if any, intention is behind this browsing? Is a pattern being followed? A train of thought? A significant learning event?

Similarly some measures of activity are valued over others because they demonstrate a more active form of engagement: commenting or other active messaging (such as 'liking') is immediately apparent as a direct behaviour whilst simply viewing or observing is not (Dennen, 2008). Such differentials of valuing activity are essential in understanding detailed or subtler ideas of learning at a distance (Munro, 1991; Shin, 2002, 2003).

This issue of what to measure is important in a VDS and especially in this specific study of ODS. Firstly, it is necessary to check what it is we are measuring and how this helps verify and to inform learning and teaching design. Secondly, we hope to understand more of student behaviour through analysing individually unimportant actions that, when analysed in relation to one another, provide further insight. For example, when a student looks at another student's slot this is a relatively trivial indicator of behaviour – it is one instance of behaviour at one moment in time. Of far greater value is how that behaviour relates in its context: how it compares to other students; how it changes in time (e.g. as a representation of engagement); how it may build as a habitus of student practice; etc.

The importance of this 'ecology' of student activity emerged as part of the research process itself and in response to the initial starting question. At the start of the project the main hypothesis was that a correlation between engagement and success existed, but that this was also a relationship to be

explored as part of the research itself. The measure of engagement (E) per student was defined through actions taken in ODS as follows:

- Number of slots completed (slots to be completed during the course).
- Number of views of other slots.
- Number of comments made on own slot.
- Number of comments made on other slot
- Number of feedback requests
- Number of pinboard slots created

The measure of success (S) per student was by each student's individual final rank on a module which, for The Open University, is calculated based on their continuous assessment (50%) as well as a final submission of a portfolio and essay (50%).

5.2 Method

Data on the engagement measures was obtained from OpenStudios on three modules: U101, T217, and T317, each a module from levels of study 1, 2 and 3 respectively. This paper focuses only on the results from the level 1 module, U101, providing an overall dataset of 1171 students across 3 levels of study (Table 1).

Table 1: Total number of students in each presentation year and start month (B = February and J = October).

Module and presentation	Number of Students
U101 2013 J	457
U101 2014 B	255
U101 2014 J	459

These data were then analysed through general inspection of the engagement measures to identify potential patterns of interest. The underlying hypothesis that some relationship existed between engagement measures and student success was tested statistically. These results then informed a second series of correlation tests to verify and develop the relationships identified. Finally, these results were then related to qualitative data to complete the analysis.

5.3 Results and analysis

Firstly, the basic totals for each engagement measure can be seen in Table 2.

Table 2: Engagement measure totals per module.

Module and presentation	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	12382	116670	3834	13663	790	9977
U101 14B	5547	63194	1731	6107	482	5643
U101 14J	10039	83012	2207	7886	2087	8819

A more useful and easier way of reading these figures is to consider the average of each engagement measure per student, shown in Table 3 and visualised in Figure 3.

Table 3: Average values of engagement measures per student

Module and presentation	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	27.8	254.7	11.0	34.4	3.4	25.0
U101 14B	22.2	245.9	9.0	29.2	3.0	26.6
U101 14J	22.6	180.5	6.9	20.1	6.3	22.6

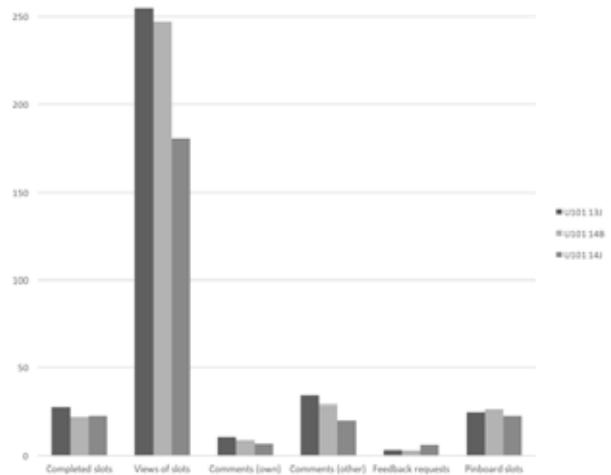


Figure 3: Average values of engagement measures per student

From these results, it is clear to see (perhaps unsurprisingly) that students view other students' slots far more than they comment on them. In fact, the ratio of viewing to commenting seems to be quite consistent (Table 4).

Table 4: Ratio of Views of slots to comments made on slots

Module and presentation	Views of slots	Comments (other)	Views to comment ratio	Pinboard slot to comment Ratio
U101 13J	116670	13663	0.11	0.09
U101 14B	63194	6107	0.10	0.09
U101 14J	83012	7886	0.10	0.11

The key difference between these behaviours is that two are clearly seen as active (commenting on slots and adding pinboard slots) and the other generally passive (viewing slots). The numbers here reveal that, regardless of how these measures are considered, there appears to be an emerging consistency in the relationships that is worth further investigation.

5.4 Correlations

To test the original correlation hypothesis, the Pearson Product Moment of Correlation between each engagement measure and student success were calculated and the results are shown in Table 5.

Table 5: Pearson Product Moment of Correlation of student engagement measures (E1-6) and success (S1) per module presentation (p < 0.001; * p < 0.05)**

Module /pre	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	r = -0.132*	r = 0.29**	r = 0.27**	r = 0.25**	r = 0.33**	r = 0.31**
U101 14B	r = 0.433*	r = 0.35*	r = 0.30*	r = 0.32**	r = 0.21**	r = 0.40**
U101 14J	r = 0.50**	r = 0.50**	r = 0.39**	r = 0.47**	r = 0.13*	r = 0.43**

Whilst this demonstrated some reasonably strong correlations they were not as strong as originally hoped for in the starting hypothesis. Moreover, the numerical data being analysed did contain points that may or may not have been numerically large outliers in behaviour. The Spearman rank correlations were then calculated to check the Pearson results (Table 6).

Table 6: Spearman rank correlations of student engagement measures and success per module presentation

Module /pre	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
U101 13J	p = 0.079	p = 0.468	p = 0.370	p = 0.428	p = 0.390	p = 0.441
U101 14B	p = 0.422	p = 0.512	p = 0.467	p = 0.511	p = 0.400	p = 0.457
U101 14J	p = 0.463	p = 0.610	p = 0.489	p = 0.591	p = 0.198	p = 0.498

These data show that the Pearson correlations seem to be generally valid and there is a reasonably linear relationship to the correlation. The higher values for the Spearman Rank are considered to be as a result of 'false outliers' – students whose activity leads to significantly higher

values but that cannot be considered true statistical outliers. For example, some students can have a number of comments that is an order of magnitude higher than others. These extreme commenters can affect the Pearson results.

The results for all engagement measures demonstrate consistently moderate correlation with student success. This correlation seems to be linear and is statistically significant for this course. But what emerged that was of interest was the comparison of correlations to one another. Generally, viewing slots is a stronger indicator of student success when compared to other measures – for the Spearman correlations, the average of views of slots is the highest of all correlations (Table 7, Column 3).

Table 7: Average Pearson Moment and Spearman Rank for engagement measures across three presentations of U101 (13J, 14B, 14J).

	Completed slots	Views of slots	Comments (own)	Comments (other)	Feedback requests	Pinboard slots
Pearson Moment	0.27	0.38	0.32	0.35	0.22	0.38
Spearman Rank	0.32	0.53	0.44	0.51	0.32	0.47

In other words, 'passive' student interaction in ODS, as indicated by *viewing* other students' slots, is the strongest and most consistent indicator of student success on this module. The second strongest indicator of student success is commenting on other students' work (Table 7, Column 5). This was expected as the original study (Lotz et al., 2015) found almost identical correlations between success and number of comments made, and to number of slot views, despite the relative difference in activity. Some students have a much higher rate of comments than others, but a majority of students can still gain good success without commenting.

Interestingly the number of Pinboard slots created result is very close to the number of views, suggesting that intrinsic motivation might be a significant factor to consider in any evaluation of possible learning mechanisms. These slots do not have to be completed, and are not assessed. They are not part of the 'structured' slots in the studio. This may indicate a more intrinsic motivation to use this space to broadcast and share ideas or it may reflect

some other conceptualisation of the studio design that has not yet surfaced.

6. CONCLUSION

In an interactive virtual design studio certain actions are normally considered 'passive' and even

referred to negatively using terms such as 'lurking' or the framing of this as something to be avoided in a learning context (Küçük, 2010; Preece et al., 2004). But the evidence and results presented here demonstrate that seemingly less active behaviours and activity can be just as (and sometimes more) valuable in different ways.

Firstly, viewing other students' work is a significant activity in the studios analysed. This supports similar findings that so-called inactive students are indeed engaging in learning activity (e.g. Beaudoin, 2002; Dennen, 2008).

More importantly, there is evidence to suggest that it is activity that students are *intrinsically* motivated to engage in. It is also clear from the sheer volume of activity that 'formal pedagogic encounters' (Webster, 2008) are unlikely to be the norm but that the activities still contribute to a positive learning experience.

Secondly, this engagement measure demonstrates the strongest correlation to student success – even over and above more apparently 'active' engagement measures such as commenting or interacting. This seems to support the idea that far from being a passive activity it may indicate a deeper level of learning engagement that is often unrecognised. What is shown here is the importance of measuring such activity – the studio researched here avoids the issue of 'not leaving a mark' noted in Dennen (2008). These findings suggest the following final recommendations:

- Recognise less active types of interaction in learning design and make use of their positive contribution.
- Avoid references to 'lurking' or other negative terms around less active modes of interaction.

- Consider encouraging less active methods and perhaps even modes of engagement.
- Enable measurement of less active behaviours in the design of interfaces or databases
- Avoid interface, database and technical designs that make tracking such activity impossible (e.g. non-tracking in slideshows, thumbnails, image browsers, etc.)
- Ensure that any online environment tracks 'passive' activity, such as viewing, and consider other such activities that might be of relevance in the specific subject.
- Use the data from less active behaviours to inform learning design and to support teachers / tutors
- The 'fingerprint' of a student's behaviour can be of significance – active behaviour might be strategic and passive behaviour can indicate much deeper learning activity.
- Maintain an understanding of these possibilities and keeping knowledge of them up to date in a learning community (e.g. through discussion between learning designers, tutors and students).

This is an important result for anyone involved in the design, implementation or running of a VDS: simple online activity in a virtual studio, such as viewing something, is potentially valuable evidence of social learning taking place.

Further work will consider the detail of possible mechanisms behind these findings but this key finding is a useful result on its own: apparently 'passive' behaviour and activity should not be ignored by teachers and learning designers of virtual design studios.

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Collaborating with External Partners in Industrial Design Education: A Review of Success Factors

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Collaboration with external partners constitutes an important aspect of project-based learning tradition in undergraduate industrial design studio education. Collaboration with industrial partners, in particular, involves complex issues ranging from sustaining long-term and mutually beneficial partnerships to not being hampered by intellectual property rights. Based on an extensive review of 15 years of collaboration with industrial partners in an educational context, the paper highlights opportunities, challenges and good practices in collaboration projects, and identifies the indications of a successful collaboration together with the factors which impact the success of collaboration.

University-industry collaboration. Industrial design education. Design studio. Semester projects.

1. INTRODUCTION

Collaboration with external partners constitutes an important aspect of project-based learning tradition in undergraduate industrial design studio education. Collaboration with industrial partners, in particular, involves complex issues ranging from sustaining long-term and mutually beneficial partnerships to not being hampered by intellectual property rights.

Middle East Technical University Department of Industrial Design where the authors are employed, has been carrying out collaborative projects with industrial partners for the last 15 years as part of its educational strategy in its junior and senior years. Besides extracurricular activities such as seminars and workshops, we conduct educational projects with external partners in the context of semester projects or graduation projects.

We started systematic collaboration with firms in 2002 with graduation projects, and since then, we have collaborated with over 180 industrial partners for graduation and semester projects (Evyapan et al., 2006). We have developed a special scheme for the projects carried out in the graduation semester and have been applying and improving this scheme continuously. In this scheme, each student determines his/her project topic, and a

suitable external partner is assigned to the student accordingly. The student and the collaborating partner mutually determine a project statement and the student carries out his/her graduation project in the Department, receiving regular feedback and design development support from the collaborating partner (Evyapan et al., 2006). Graduation projects are presented in an exhibition and evaluated by a jury open to the public at the end of the semester.

Semester projects, on the other hand, are conducted in the regular semesters of the undergraduate programme. Project topics are determined by the studio tutors and projects are carried out with the whole class, either individually or in teams. Usually two projects are carried out in a semester, one short and one long-term. For most of the projects conducted in the third and fourth years, the Department collaborates with partners from the industry. These projects are closely related to the studios' educational objectives, and unlike graduation projects, firm selection is not based on student preferences. They require a close supervision of the process and outcomes, and involvement of the collaborating parties.

We define collaboration in education as a quality interaction among all the parties –the Department, external partner and students– towards the achievement of a common goal (Korkut & Evyapan,

2005), which is the successful completion of the project that satisfies all the parties involved: For the Department, the achievement of educational objectives; for the student, a developed design proposal that can take part in the student's portfolio; and for the firm, having access to new approaches, methods and ideas.

This paper focuses on semester projects carried out in collaboration with industry, reviews our Department's educational collaboration with firms in studio courses, and identifies the factors that impact the success of these collaborations. The paper is based on an extensive analysis of the project documentation, and observations and insights of studio tutors regarding the projects. The project documentation includes design briefs and all hand-outs, reports or presentations prepared by collaborating partners, electronic mail messages exchanged among parties, tutors' studio course documentation such as diaries and folders, and project catalogues.

Quantitative and qualitative data concerning the projects were derived from these documents and an excel sheet that summarized the processes was generated. This sheet contains information on the project dates, topics, the ways in which collaborations were initiated, liaisons from the collaboration partners, types of support provided by the partners, contribution of the Department to the projects, how the project outcomes were used and how the students benefitted from the results. We analysed the content of this table in order to identify the factors which impacted the success of collaborations.

2. COLLABORATION WITH INDUSTRY IN THE JUNIOR AND SENIOR YEARS OF THE UNDERGRADUATE PROGRAMME

The undergraduate programme in our Department is four years, at the end of which, graduates receive a bachelor's degree in industrial design. An academic year is composed of two semesters, with 14 weeks in each semester. In their first year, students receive a basic design education, followed by the second year where they receive an introduction to the industrial design process and practice with individual and team projects. Collaboration with industry for education typically takes place in the third and fourth years of the programme.

Although there have been sporadic project collaborations with firms in the past, our regular collaboration with industry started with the graduation projects scheme that we initiated in 2002. Since then, the fourth year studio has regularly carried out projects with industry both in

the fall semesters and in the graduation project semesters. The third year studio started to collaborate with external partners more regularly after 2009, and their collaborating partners are less diverse in comparison to the fourth year collaborating partners. The third and fourth year studios carry out collaboration projects with particular sectors. The NGOs collaborated with for semester projects also differ according to studio years. These differences in sectoral partnerships are due to the differing educational objectives of each studio.

The third year studio focuses on design for sustainability, participatory design, and development of product families, and have partnering firms from a more focused range of sectors. Semester projects in this year mostly involve collaboration for glass packaging and glassware, ceramics and sanitary ware, lighting, and small electric household appliances projects. Participatory design projects are usually concerned with developing future sustainability scenarios and conducted in collaboration with NGOs or relevant institutions. Students also gain experience in exploratory design research for understanding values, needs and preferences of users, and experiment with various generative methods and tools in the exploration of design ideas.



Figure 1: "Autonomous Campus Shuttle" project in collaboration with Anadolu Isuzu, 2016-2017 Fall Semester, 4th year studio final jury.

The educational objectives of the fourth year studio comprise understanding the local and global markets, carrying out field research and applying the findings in the design process, identifying context appropriate design problems, exploring design opportunities and developing diverse and alternative design proposals. The fourth year

semester projects focus on user needs in the local and global markets, also involving large scale complex projects, and cover a variety of topics. Semester projects in this year mostly involve partners from the sectors of vehicle design (Figure 1), white goods, and office furniture among others carried out in lesser numbers. The NGOs collaborated with in the fourth year are usually from professional contexts.

In the third and fourth years, collaboration with industry is central to our studio education, as the industry supports our education by bringing to our attention real-life needs and problems, design development expertise, sector related know-how, market research, technical feedback, and materials and manufacturing knowledge. Our partners have various motivations for collaborating with us in educational projects. Introducing the particular sector and promoting the firm to prospective designers, contributing to design education, and obtaining new perspectives and fresh ideas are among the general reasons cited by our collaborating partners. There are also more specific reasons for firms to seek the Department's collaboration such as gaining design insights concerning local users and usage contexts, and developing alternative approaches to create new markets.

Bailey et al. (2015) differentiate among live, collaborative and partnership project models followed in university-industry collaboration. In live projects, the emphasis is on student learning with limited mutual benefits to the educational institution and partner firm, resulting mainly in inspirational ideas. In collaborative projects, emphasis is on mutual commitment and mutual benefits, providing more input from the parties of the collaboration, and resulting in framed and communicated ideas. Partnership projects, on the other hand, place emphasis on a proactive relationship between the partners, in which partners have come to closely know each other's needs, culture, goals and ethos towards the delivery of new products and practices that have real business impact on all parties. In this model, the university members are involved in further developing the projects following the student submissions, and contribute to their refined delivery to the partnering firm (Bailey et al., 2015). The collaboration model we follow accepts the students as the central actors, and places more emphasis on the realisation of educational objectives set for the studio courses.

3. SECTORAL DISTRIBUTION OF COLLABORATING PARTNERS

In the last 15 years, we have carried out 48 collaboration projects with a total of 26 partners

from the industry and NGOs in the third and fourth year semester projects. From among these 26 partners, three were NGOs, 22 were manufacturing firms, and one was a marketing firm. Eight partners are based in Ankara where our university is located, ten partners are based in İstanbul, and the remaining eight are located in six different cities. The firms and NGOs collaborated with involve 13 sectors, ranging from white goods and electric household appliances, glassware and automotive to outdoor playground equipment (Figure 2). The number of manufacturing firms is almost equally distributed among large scale production companies and SMEs (12 and 10 respectively). All the same, we tend to collaborate with large scale companies more than once. The total number of collaborations with SMEs is relatively limited and collaborations are rarely repeated with the same partner.

The sectors with the highest number of collaborations are white goods/electric household appliances, automotive, glass packaging and glassware, ceramics and sanitary ware, and office furniture (Figure 2). The collaborating firms from these sectors are mostly large scale (11 out of 15), and these are among the top 500 firms in Turkey. The majority of these firms are among the earliest in establishing manufacturing facilities in Turkey, making them experienced in developing technologies, and creating know-how in product development. Some of the firms among the white goods and ceramics sanitary ware sectors are pioneers in setting up in-house design departments, and in using design consultancy services of freelance designers (Alparslan & Börekçi, 2011).

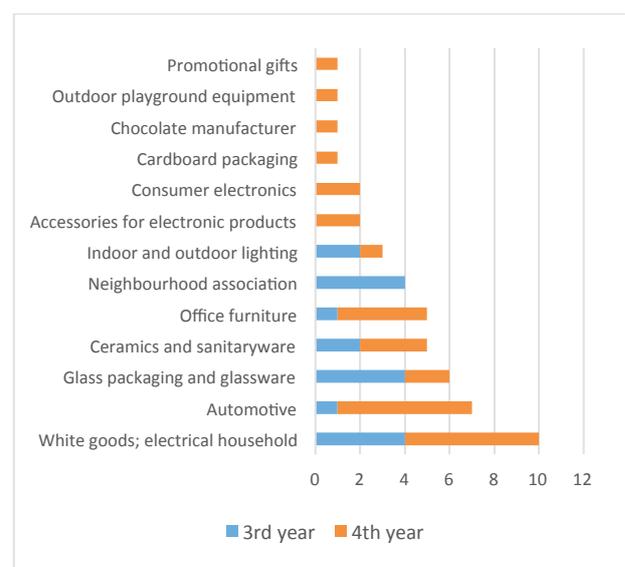


Figure 2: Number of collaboration projects according to studio year and sector.

4. WAYS OF INITIATING EDUCATIONAL COLLABORATION

We identified five different ways in which we initiated collaborations with our partners: Past collaborations with a firm, collaborations initiated by alumni, collaborations initiated by past and newly acquired acquaintances, collaborations initiated by firms previously unknown, and collaborations initiated by the Department's initiative.

Past collaborations with a firm: Past collaborations between the Department and firms have facilitated collaboration in semester projects. Since each student works on a separate project with a different partner in the graduation projects, we have been in touch with a wide range of sectors and firms. Previous collaborations in graduation projects have been, in several cases, an initiative for partners to collaborate with the Department in semester projects. Past experiences of firms with students is also a factor in the initiation of new collaborations; these may be through field visits to the manufacturing facilities and summer internships our students carried out in firms.

Collaborations initiated by alumni: Our alumni employed as in-house designers or R&D team members in the industry were also involved in initiating collaboration projects with the Department. Our graduates have experience with the expectations, processes and work loads of projects as former students themselves, which makes them more familiar to our support needs. Furthermore, since they have professional experience in the field and are authorized in providing this support, they are motivated to initiate contact for a collaboration project. The motivations of our graduates can vary. Since their experience as students involve similar collaboration projects, they are willing to take initiative in providing a similar contribution to the education of new generations. In some cases, our graduates carry out their field research for their graduate studies through such collaborative projects, which also benefits the firm. In some other cases, reinforcing their role in the firm as designers through collaborating with external partners may play a role in the initiation of projects.

Collaboration initiated by past and newly acquired acquaintances: Past acquaintances from other media such as sectoral exhibitions, design fairs, meetings organized by public or private institutions, and professional design consultancy meetings that our departmental staff members attended, played a part in the initiation of collaborations. Some parties that we met through such media contacted the Department to conduct collaboration projects. In one case, an internal acquaintance within our university acted as a

liaison and referred our Department to a firm for a collaboration project. Another medium has been meeting firms through academic events such as conferences and workshops.

Collaborations initiated by firms previously unknown: In several cases we were contacted by firms previously unknown to the Department through visits, phone calls and e-mail correspondence for collaboration in educational projects. Our general approach in such cases is to assess whether the project and the support offered can be turned into an educational collaboration particularly benefitting the students' educational experience. Depending on the sector, topic, scale, firm expectations and support possibilities, the firms were presented with the options of collaborating for graduation projects and for semester projects.

Collaborations initiated by the Department's initiative: The studio tutors plan the semester and determine the project topics to be carried out ahead of time, and take initiative in contacting firms or other parties for collaboration. Collaborations can be initiated in two ways: Either a tutor suggests a firm or a party, and then a context-appropriate project topic is determined, or the project topic is determined and then a suitable partner is sought for. In this case, the areas of expertise, know-how and experience in product development of a firm are primarily considered, as well as the product range, diversity of human resources available, and manufacturing capabilities. We strive to align our educational objectives with the firm's area of expertise and prospective expectations from collaboration. In some cases where a participatory or co-design approach is adopted, the studio tutors may seek collaboration with other parties such as NGOs in order to collaborate with actual users.

Another consideration for us is whether there is a prior acquaintance in the firm who can understand our educational objectives, or a champion who can guide the process and act as a contact person between the Department and the firm. In such cases, it is important to be able to understand whether the firm has motivation, can provide commitment and there is a mutual understanding between the parties that the main purpose of the collaboration is educational.

5. CONTRIBUTIONS OF FIRMS

Contributions of firms to an educational project is manifold. First of all, firms bring a real need to our attention by introducing a problem area related to the sector or the market. We make use of this real need in the development of the design brief and the way in which we formulate the design problem.

During the design process, we expect firms to visit the studio for the project initiation, to introduce themselves and present their approach to the brief. If relevant we also make a field trip to the firms' manufacturing facilities in the early phases of the process. In some cases, the firms provide the resources for travel and accommodation for intercity visits.

Partners contribute to our design research and problem identification stages in diverse ways. These include visits to in-house research laboratories, arranging presentations by marketing experts, training given to students by professionals for product trials, and providing access to users on sites for task related field research. We also host partners for technical and design feedback during studio hours (Figure 3). These include presentations, product demonstrations, workshops and desk critiques given by experts from various areas, and may involve using product samples, parts, tools and such resources lent for the project and brought into the educational premises. We also expect firm representatives to attend interim and final juries for evaluation. Besides technical and design feedback, the project evaluations of collaborating firms bring the point of view of professionals from the sector and set a common understanding of project expectations among the parties.



Figure 3: *Negotiating problem areas and initial ideas with the representatives of an NGO in the third year studio.*

We have received on most occasions, support for the preparation of the final project presentations. This may involve financial support for students' presentation poster printouts, and final model expenses. On a few occasions, we had logistic support from firms for the realization of the final models. This support has been human resources, tools and materials brought to the Department workshops for model making, or having the final models made in the manufacturing facilities of the firm.

Most collaborating partners are enthusiastic about sharing the outcomes of the projects. They are willing to support expenses for project catalogues, Department participation to national and international project exhibitions or business fairs, and student participation to awards and competitions. Many partners also contribute to the improvement of the educational setting and acquisition of technical equipment.

From the students' point of view, the contribution of collaborating partners have a positive role in strengthening the content of their portfolios, arranging local or international internships in the collaborated firms, continuing partnership in the form of graduation projects, and eventually finding opportunity of employment in these firms.

6. CONTRIBUTIONS OF THE EDUCATIONAL INSTITUTION

The Department contributes to the process by evaluating the firm's initial project statement and preparing a design brief that reinterprets the problem context and creates a wider solution space for exploring diverse design alternatives. In some cases, collaborating partners may come with a narrowly defined design problem to address in the project that may not match with our educational objectives. This reinterpretation of the firms' problem statement makes it possible for students to respond to the brief without only focusing on solving specific problems.

The studio tutors plan the project process and calendar, manage the design process, and sustain communication among the parties. Besides these, the tutors spend 12 studio hours per week, in which they give desk critiques, conduct workshops and evaluation sessions. We share project phase documents generated for the class, and the outcomes of the stages of the process are usually jointly evaluated with our collaborating partner. Our collaborating partners are able to observe our conduct of the design process, the stages we follow and the methods we use in the studios. Firms also have the opportunity to meet students as prospective design professionals, employees, customers and representatives of target markets.

In order to support students in their process of idea generation, we use various methods from the literature, among which are synectics, biomimicry, scenario building and braindrawing. Throughout the years we have also developed our own generative methods. One such method is what we call the "Matrix", which was initially developed during a collaboration project in 2003. This method involves a matrix table bringing together design solution

themes and project dimensions to explore a wide range of alternative design ideas (Korkut & Doğan, 2010). “Switch task” is another method we developed while carrying out a collaboration project. Its intent is to further develop initial ideas using four or five context-related tasks as directives (e.g. “switch user”; “switch location”; “switch time”) to ensure the exploration of ideas from all possible problem-related aspects (Börekçi et al., 2016).

7. VISIBILITY OF COLLABORATIONS

We put a great deal of effort in promoting the outcomes of our collaborations for various reasons. Among them are first to acknowledge the support provided by the firms to our education. We also wish to share the results with the public in order to contribute to the promotion of the Department and also of the profession of industrial design. We use various media for this, and the financial support of the firms contribute to the realization of various events and activities.

Exhibitions: The collaboration projects are regularly exhibited as part of our annual Graduation Projects Exhibition, and other internal university events such as alumni day and educational fairs. We also exhibit selected projects in national business, innovation and sectoral exhibitions and fairs, and occasionally in international design and business fairs. Some of our partners exhibit selected projects in their own promotional activities such as local or international trade fairs, or as part of their permanent collection in their own premises.

Awards: Among the collaboration project outcomes, there have been applications to awards. Our students apply for design competitions and international design awards such as IF and Red Dot. On one occasion a firm received a corporate responsibility award for a collaboration project focusing on design for sustainability. Awards and prizes earned for these projects find media coverage, which contributes to the visibility of our collaborations.

Publications: The semester following the completion of a collaboration project a catalogue is usually published in print and online. This is an effective way of promoting the project outcomes and acknowledging the contribution of the firm. Some of our collaboration projects also find coverage in sectoral magazines and various publications. The presentation of papers in academic events is another way in which we increase the visibility of our collaboration projects. Studio tutors present conference papers on the collaboration projects with firms, describing the process and methods involved, evaluating the

outcomes and discussing the implications on design education.

8. INDICATIONS OF A SUCCESSFUL COLLABORATION

As indicated earlier, a successful collaboration in educational projects refers to quality interaction among collaborating parties, resulting in the achievement of expectations to a satisfactory degree, manifesting itself with the quality of the project outcomes, willingness to repeat collaboration, and transfer of IP rights.

Quality of project outcomes: The quality of outcomes of a project reflects the quality of collaboration to a significant extent. The quality of the driving design idea, its originality and level of creativity, the level of detailing and finalization, and appropriateness to the identified design challenges indicate to which extent the educational objectives were met. The quality of presentation including 2D presentation boards and 3D models, on the other hand, indicate the extent to which time was managed well for a project, the students were guided well and were confident with their design decisions (Börekçi, 2015).

Willingness to repeat the collaboration: When a collaboration project ends with success, generally both the Department and the partner are willing to repeat the collaboration in the following years. With some firms, we have carried out multiple collaborations, with some others the collaboration has not been repeated. The pattern is highly related with the project process and outcomes meeting our educational objectives as well as the expectations of our partner, and the diversity and quality of support that the partner was able to provide. In cases where these conditions are met to a satisfactory degree, we expect to develop long term institutional collaboration relations with the partners.

The challenges or the barriers before developing a regular collaboration relation are a mismatch between the expectations of the parties, disproportionate level of development set for the project within an unrealistic timetable, or else, a champion in the firm dominating the collaboration and hampering access to other expertise within the firm.

Projects resulting with the transfer of IP rights and rewards: Our departmental policy in terms of IP rights is that, we cannot oblige students to sign any sort of agreement with a collaborating firm as the studio courses are compulsory. Therefore, firms usually begin collaboration with the knowledge that IP rights belong to the students, and that if there

are projects that fall within the interest of the firm, IP rights transfer agreements will be signed with the students once the project is concluded.

Some partners offer a reasonable monetary or in-kind compensation to all students for the transfer of IP rights to corporately acknowledge the outcomes of the collaboration. In some other cases, a partner is interested in acquiring the IP rights of a selected group of projects, which usually results with an agreement between the firm and the students. On rare occasions, we have firms that prefer signing an agreement with all the students prior to the project, to ensure project confidentiality and the pre-emptive acquisition of IP rights; in a recent case, we adopted a policy of providing an alternative project brief for those students who do not wish to sign such an agreement.

In order to acknowledge the time and effort given to the collaboration project, some partners offer in-kind rewards to the students who participated in the project, without claiming the IP rights. Some partners prefer to reward a selection of projects that they consider the most successful according to their own criteria.

9. CONCLUSION

In the light of this review, we propose the following factors which impact the success of our educational collaborations: Partner's willingness to give priority to educational objectives, partner's previous experience in educational collaboration, mutual trust based on previous collaborations and rapport, partner's motivation and commitment, preparedness of the educational institution for collaboration with external partners, educational milieu supported with appropriate design approaches, methods and tools, and students' motivation and commitment.

Partner's willingness to give priority to educational objectives: A win-win educational collaboration project is possible when a collaborating partner recognizes that the main objective is to enhance the students' educational experience, and not to acquire a low-cost professional design service. Furthermore, the more a firm is willing to widen its perspective regarding the design problem and allow it to be restructured through the design brief developed collectively, the more the students can provide novel and alternative visions.

Partner's previous experience in educational collaboration: When the collaborating partner already has experience in educational collaboration, either with our Department or with other universities, this helps in setting a common

understanding regarding the project process and outcomes. The partners with collaboration experience have more awareness about the educational context and more realistic expectations concerning the project schedule and outcomes. Additionally, they are more familiar with the approaches and methods used in design education, and therefore are more flexible and confident regarding the process.

Mutual trust based on previous collaborations and rapport: Previous successful collaborations and rapport between the studio tutors and the firm representatives is important for building and maintaining trust. When the collaborating partners are confident that the collaboration will result with benefits for all parties, the process is eased, communication is enhanced, commitment is ensured, and the process is efficient and productive. We have observed that such collaborative relations have consolidated over the years, contributing to the quality of the collaboration process positively.

Partner's motivation and commitment: Partners' motivation and commitment are a major factor in the success of collaborations. A partner's motivation has an impact on the commitment it is willing to make. Partners with specific motivations tend to be goal-oriented and more committed. The more the firm representatives are interested and involved in the process, the more the students are directed with guidance and supported with feedback. Partners in this case contribute with multiple expertise to the process, introduce other parties as contributors when necessary, provide technical assistance and allocate financial resources. This commitment motivates the students, helping them to build the necessary background knowledge for the development of design proposals and take critical design decisions more accurately and on time.

Preparedness of the educational institution for collaboration with external partners: The initial phases of partner selection and negotiation of the project framework play a significant role in the success of a collaboration. It is critical to evaluate objectives, capabilities and resources of a partner and align these with the particular design studio's educational objectives. Managing the design process and project schedule in accordance with the students' needs and firms' expectations is necessary for the effective participation of all parties, which takes extensive time and effort for the studio tutors.

Educational milieu supported with appropriate design approaches, methods and tools: As mentioned earlier, we have 14 weeks in a semester, with 12 hours per week dedicated to

studio. This provides a continuity in the design process, and this continuity is ensured by scheduled desk critiques for students, in order to closely supervise their progress. Studio tutorials are supported with methods devised according to educational needs. We give particular importance to the early stages of problem identification, user and field research, and concept development stages of the projects, as throughout years we have observed that an appropriate formulation of the problem leads to context-appropriate design concepts (Börekçi et al., 2016).

As a strategy, we encourage team work in the design process for the students to benefit from group dynamics. Students work in teams for the stages of research and idea generation, and in using creativity methods in the studio, even when the projects require individual submission. We conduct team projects for complex large scale projects such as vehicle design.

We find it important for students to make interim submissions to ensure that they take critical decisions on time, and are able to progress. As a strategy, we expect students to develop two alternative design proposals for their preliminary jury, although they submit one final design proposal. This is done to encourage thinking in parallel lines of thought (Lawson, 2000) and thus enriching the design development stage.

Students' motivation and commitment: A final factor impacting the success of a collaboration project is the students' motivation in, and commitment to, completing the project at a satisfactory level. Students' interest in a project topic affects their motivation, whereas their confidence in various methods used throughout the process, and in the desk critiques they receive, affect their commitment to the project. Self-confidence is built with their ability in being able to take accurate and timely design decisions. A major factor in this is the attitude and approach of the design champion in the partnering firm who provides feedback and guidance to the students in a collaboration.

Presenting collaboration projects in their portfolios, seeking internship or employment opportunities in the firms, and receiving financial support for participating in awards and competitions are among other motivations. Additionally, a mild competition among students for being listed among the selected projects to be rewarded, being selected for internship, or being selected for the graduation project collaboration are other factors that positively affect student motivation and commitment to a collaboration project.

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FREE Architecture – An ethnographic approach to architecture practice – Learning through digital

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As architects, we study the behaviour of the inhabitant, taking into account collective and individual subjectivity. However, it becomes difficult to generate transformative architecture when the user is seen as a bank of ergonomic data and space is understood as mere geographical coordinates. This results in the construction of spaces that are separate from existential depth, where the user is not actively involved in any of the design process, which affects his will, interests, and values. This also prevents interaction between different types of knowledge that arises from these spaces. Through this horizontal interaction, it is possible to obtain architectural design that transforms its context. Digital ethnography is a methodology that raises questions related to the practices of everyday life through a flexible and multilevel scheme where the virtual space reveals the social practices of a community, freeing up the space and scope of architecture and connecting lay with expert knowledge.

Ethnography, transformative design, transdisciplinary, sustainability.

1. INTRODUCTION

The principle of post--structuralism brought intellectual concepts proper to the Frankfurt School and French philosophers, mixing semiotic, structuralist, and phenomenological paradigms into the field of architecture (Sykes, 2010,p. 14). These ideas were implemented in different architecture theories as a counter to the positivist and structured models of modernism (Eisenman & Johnson, 2013,p. 4). They were critical, speculative, and somewhat utopian (Sykes, op.cit,p. 15), along with many tasks and responsibilities that the architectural discipline has not been able to cope with thus far. Currently we must add the technologic paradigm, thanks to digital tools created during the early 1990s and perfected in the 2000s. Which introduced new concepts of what "reality" means in terms of "media and simulation" (Eisenman, 1995,p. 144) creating an imposition for the "visual" and "new forms" within contemporary architecture.

Is into phenomenology paradigm that we find architectural theory that counteract capricious

forms. Husserl and his followers¹ rose in prominence based upon the subject (person) – object (place) relationship and the sensorial qualities that a space emits. But this relationship is still an "individualistic view of phenomenology ", who perceives an object, leaving aside the perception of the "social and political experience " (Montaner, 2014,p. 130). In this sense, we must think about how the community (the social dimension) interacts with the environment. Currently, architects and habitants appear to work separately, resulting in a city of makeshift construction and buildings without a sense of belonging. This creates a city in which economic interests often create architecture based on image, and repetitive and unilateral schemes, where active participation is excluded from all parts of the architectural process. Architecture is still struggling to overcome this complexity.

Henceforth, the goal of freeing contemporary architecture is based upon the construction of new

¹ One of his followers was Juhanni Pallasma, whose book *The Eyes of the Skin – Architecture and the Senses*, reviews the bias toward vision and the suppression of other senses

connections and experiencing different ways to approach space problems.

The question is: How can a new understanding of space and its interactions generate an architecture that meets the needs of today's society?

What type of disciplines must architecture connect to in order to avoid its extinction?

While many concepts have changed over time, it is vital to raise the issue of the renewal of architectural thinking from a pragmatic point of view. The post--architectural context will become reality if architects continue to be disconnected from the people, other discipline theories, and new technological affordances. In order to achieve a free modern architectural structure, free of typologies, ideologies, aspirations, heroism and utopias (Rajchman, 1998,p. 111), architects must expand their self--imposed limits and appropriate new methods and tools, especially those that are used in the social sciences. There is a need to rethink concepts and categories based on the "new facts of reality" (Montaner, 2014,p. 36), and what better than social methodologies to illustrate this process?

1.1 "The inhabitant" from the "social"

The word "social" is often an abstract explanation that other disciplines use to avoid doing their own experiments by placing all the responsibility on the social disciplines. However, the theory assembly must be done through all disciplines so that, through the social sciences, the word "social" can be truly understood (Latour, 2008, p. 14). In this way, architects can avoid the inevitable accusation that "social architecture" has become the new "green wall of sustainable architecture," meaning that it becomes the latest overused trend in the industry. Current society must be reviewed in depth in order to include it, not only as an adjective, but also as a complex phenomenon that influences architecture and vice versa.

The traditional sociological model aimed to explain "social reality" by reinterpreting the data that informants may provide by attempting to remove unconscious factors of their everyday life (opt Ibid, p. 59). The work of the architect is also to reinterpret shapes, symbols, and social dynamics. If the figure of the sociologist is replaced with the architect, and the informant is replaced with the inhabitant, an empathic and horizontal relationship would be created instead of a relationship based on superiority (vertical layout), which brings about simple architectural aesthetic whims in cities without nurturing the real needs of humankind.

Based upon the premise that societies are defined by their historical contexts, which are susceptible to change (time), contemporary society, according to Castell, "is defined by contemporary processes of

globalization and the emergence of the net--society." This net-- society is directly dependent upon existing communication networks and their actions (Castells, 2009,p. 41). These networks are the results of a new technological paradigm, which could be defined as "networks of social interactions, which are open, flexible, adaptable and able to survive, transcending the barriers of space and time" (opt Ibid.:p.44)



Figure 1: A diagram of society, according to Castell's Communication and Power (2009).

In this network the local is mixed with the global in the historical context, transforming themselves into an object--network within a global network. As a result new forms of *online* influence emerge from these global networks in urban environments (Ignacio & Bender, 2010,p. 254). Therefore, contemporary society can be analyzed through the interactions between actors and objects that create networks. A phenomenon that has yet to be contemplated in detail in architecture, but widely developed by social science through digital ethnographic methodology.

2. FLEXIBLE AND OPEN DIGITAL ETHNOGRAPHY "METHOD"

While ethnography was developed in the 20th century by sociologists and anthropologists, such as Malinowski, Boas, and Mead Brown, it has exceeded the limits of such disciplines and is currently being used in the field of education, business, and design. Thus, it is common for various disciplines to use digital media to collect data. Architects use it to collect quantitative information that provides input for the design process, including square meters, laws, regulations, similar projects, and, in some cases, social aspects. However, this process lacks reciprocal influence as it generates data, but does not provide any flow--back or empathy between

them, thus making it impossible to create a design that can transform real space.

It is necessary to understand that social worlds exist inside this "virtual reality," which is loaded with "aspects of human action and experience" (Garcia, Standlee, Bechkoff, & Yan Cui, 2009, p. 54) which cannot be understood separately from the offline world (Pink, 2014, p. 174). These worlds become indivisible and complex, where the flow of power in the online-offline world has changed from user to pro-consumers who, through their own actions, produce content and services that they consume themselves (Jenkins in Scolari, 2013, p. 84). It is in this construction of the world that we can take advantage of the benefits of the Internet and computer-mediated communication (CMC; Garcia et al., 2009, p. 53). It also allows us to create a "cultural profile of who we are" (Curran, 2013, p. 64), one that is limited by digital techniques and the availability of technological advances (time temporality). In fact, it is necessary to mix online interactions with offline, face-to-face discussions, especially for architects, who will need a more spatial interaction.

Therefore, it is necessary to ask, how can one avoid getting lost in the immensity of information in the "adjacent world" as an architect? When an ethnographer examines a particular topic, the principal objective is to define the field site and analyze the social dynamics that happen through a screen "with textual, visual, aural and kinesthetic components; complicating its analysis" (García et al., 2009, p. 64). Is necessary to develop abilities in the analysis of textual and visual data; such as interpreting texts in e-mail, chat and instant messaging, using images, colors, page layout and website graphic design. Recurrent use of digital online interviews, emails, chat rooms, videoconferences, and webcams are intended to create empathy and participation. But there still some issues that concern both traditional and online ethnography like getting access to research, establishing a relationship with research subjects, and obtaining volunteers for interviews (opt Ibid, p. 68).

Within these restrictions lies the ability of participants to verbalize their emotions, the characteristics of automated tools, and the authenticity and veracity of the profiles of the people you interact online (Cherny, 1999; Mann and Stewart, 2000; 2002 in Garcia et al., 2009, p. 68). An example of taking advantage of social media tools, Javier Toret used Twitter, to analyze a series of protests that were happening in the social movement 15M in Spain. This showed how the generation of emotions and network analyses, as well as personally analysing big data, could

generate a degree of understanding about a complex phenomenon:

"In the network (and more specifically, Twitter) the whole phenomenon is not reflected, but part of it. However, it can be used for a comparative study of influences, and even as a first intuition to reinforce (or modify) raised hypotheses" (Toret et al., 2013, p. 151).

While analyses can be done through different software, with the ability to transform texts into emotions, humans should always interpret the results and keep track toward the main objectives and selected categories of the phenomena to be studied. Each new discovery sets the tone for "reviewing categories that do not work, and redefining frameworks for analysis, through "reflection both in the field and outside of it. Therefore, it is important to compare different levels of knowledge between experts (academics and professionals) and non professionals (society). As it can lead to multi-level and multi-platform research that uses a wide range of data collection methods.

This non linear methodology make it possible to review theories and have a clearer understanding of the "setting" without the need to "live for a long period of time" (Hine, 2015, p. 56) *in situ*. But in order to use ethnographic methods in architectural design, it is first necessary to identify a common purpose among ethnographers and designers. In their book *Un/Certainty*, Drs. Sarah Pink and Yoko Akama explain it in this manner:

We understand our work as being substantively engaged in processual worlds where ethnographers/designers are always working with emergent qualities and with people who share their journey into the immediate future (Pink & Akama, 2014, p. 4)

Therefore, the limits of society discussed above are transformed when observed through the digital ethnographic lens. This transforms the space from a specific place with existing geographical coordinates into a field site. This provides the ability to expand networks based on their different layers of information. The user ceases to be a simple entity and becomes a social actor with the ability to influence the networks that are configured through their practice. Time also becomes a constant variable called uncertainty, thus nullifying the possibility that any result obtained is categorized and permanent.



Figure 3: A diagram of flexible boundaries based on a digital ethnographic methodology

2.1 Deconstructing the dynamic space. Fieldsite: practice

There are different approaches to architectural space, but it is when speaking of digital ethnography that space becomes a space of action.

“From a Practice Theory standpoint, the field is not conceptualized as a stationary point, nor as a place the ethnographer enters and inhabits; rather, the ethnographer’s movements and trajectories define it” (Gómez Cruz & Ardévol, 2004,p. 33).

The ethnographer participates in the co---creation of a multifaceted study that allows him or her to learn from the participants, thus creating a deep level of participation and enabling emotional attachment and understanding. This allows the research “weave the relationships between **“particular things, events, subjects and connections show up and take on significance”** (opt lbid,p. 34) or as Hines (2007) said, “the traces between people, objects and places “ **These relationships show us the practices of everyday life**, which work as a paradigm shift that articulates “the media, society and culture” in an empirical field (opt lbid,p. 29).

This empirical field will be analyzed as a dynamic space and a holistic world where practices are mixed in theoretical concepts in order to reach a social understanding that depends on the ethnographer’s objectives.

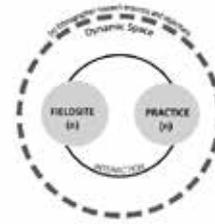


Figure 2: Diagram of Dynamic space.

2.2 Uncertainty

Ethnography, as an evolving field, is based on uncertainty that embraces the temporary configuration where the validity of each diagnostic or method depends on time, since often both are overwhelmed by the speed of technological advances. However, it’s not only ethnography that is affected by the uncertainty of time; we all live in this condition. In architecture time change the space needs, so the dynamic space should be in constant valuation and intervention. Therefore, uncertainty becomes “a way of thinking across practice” through movement and knowledge. As Sarah Pink and Yoko Akama point out:

...multiple factors or sensory pieces of information crystallise momentarily and create an insight. Shortly thereafter all the factors and sensations move again” (2014,p. 10).

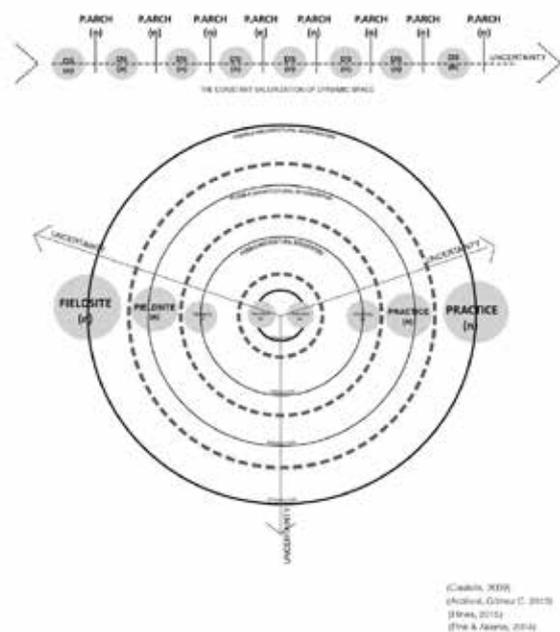


Figure 4: Diagram of dynamic space through uncertainty.

Through this discussion, we have created a starting point for working together in practice. Space may be defined “not as a specific geographic area or a cultural unit, but as a **dynamic space**” (Hine, 2015, p. 58), which can be considered an expansion, depending on the objectives of the investigation and the needs of contemporary society. This view of space grants researchers the freedom to rethink the meaning of architecture as a practice.

Such a practice is open to changes in context based on the complexity, is free of formalism and stylistic--typological dogmas, avoids aesthetic whims, and insignificant buildings generated from political and economic interests.

2.3 Constructing the research model

Now, it is necessary to ask how we can start to analyze this dynamic space as architects and not as social researchers. This model is based on the deconstruction of the field site and practice concepts, which uses the definition of space developed in the Practice Theory used by Ingold,² Gómez Cruz,³ and Ardévol.⁴ In order to subtract analytical categories and subcategories that would guide every empirical observation.

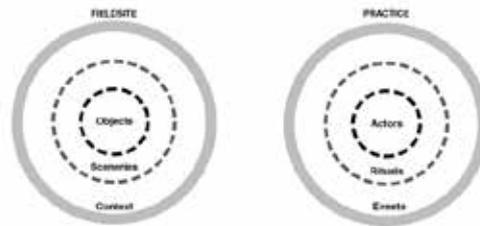


Figure 5: Diagram Categories and subcategories from the dynamic space.

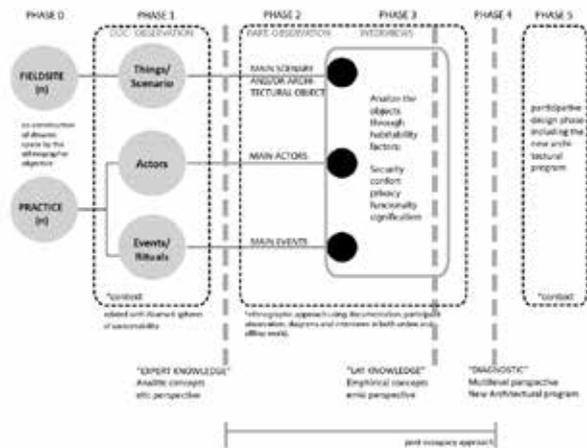


Figure 6: Research model of dynamic space.

Strauss and Corbin (1990) divide their analysis strategies into three interwoven phases:

Deconstructive (open coding), constructive (axial coding) and confirmatory (selective coding). It generates a spiral reflexive process in which sampling (S), collection (C) and analysis (A) are repeated with a progressively narrower focus in each of the three phases...The ethnographer may already have a well---defined theory (constructed through previous research or drawn from another author), so that he or she can start his or her research from the second phase (construction) straight, or the third one (confirmation) (Gobo, 2008, p. 227).

The research model proposed in this paper not only includes the three main phases addressed by Strauss and Corbin, but it also presents Phase 00 where the researcher's degree of knowledge and objectives about the topic of study guides the research, as well as two more phases (04 and 05) that clarify the architectural program and further design process. So the community needs can be transformed by the architect in a complete architectural program.

^{2 2} Ingold researches and teaches the connections between anthropology, archaeology, art, and architecture (the “four As”), and considers it a way to explore the relationships between human beings and the environments they inhabit. This approach is radically different from the conventional anthropologies and archaeologies of art and of architecture, which treat artwork and buildings as though they were merely objects of analysis. Instead, Ingold looks at ways of bringing together the “four As” on the level of practice, as mutually enhancing ways of engaging with our surroundings.

^{3 3} Gómez Cruz is interested in the relationship between technology and society, digital culture, visual culture, photography, new media, creativity, practice theory, ethnography and many others. He is currently a research fellow at the Digital Ethnography Research Centre, RMIT in Melbourne, Australia.

⁴ Ardévol's research focuses on media anthropology and the development of qualitative methodologies for the study of cultural practices and new media at the Universitat Oberta de Catalunya in Spain.

PHASE 00

General Objective: Identify the type of relationship between actors, rituals, events, architectural objects and sceneries within a community.

Specific Objectives 1.-, 2.-, 3.-

DYNAMIC SPACE								
Community			Empirical Category	Subcategory	Observable	Method		
Online Offline	Identifying the events-rituals, individual or collective actors, architectural objects and sceneries to outline the contexts. You can begin to	PHASE 01 (deconstruction)	Actors	Demographic profile	Name, nationality, age, sex	Observation-Survey		
				Occupation	Scolarity and current occupation outside and inside the community	Observation-Survey		
				Life style	Cultural activities, interest and	Observation-Survey		
					Sceneries	Context	Locations	Observation-Survey
					Objects	Buildings	Locations	Observation-Survey
					Events-Rituals	Activities	Main topic	Observation-Survey
						Duration	date/hours/updates	
						Influx	Number of posts, comments, participation.	
			Identify the relationships and positive values that emanate	PHASE 03 (Confirmation)	Actors - Object	Name generator	(+)Strength	Observation-Survey
						Relationship type links	-	
					Frecuency	Duration	Commitement level	
					Actors - Practice	Name generator	(+)Strength	Observation-Survey
				Relationship type links	-			
					Frecuency	Duration	Commitement level	
	Identify the negative relationships and values that emanate from each one. Translating it into demands and needs of dynamic space	PHASE 02 (Construction)	Actors - Object	Name generator	(-)Strength	Observation-Survey		
				Relationship type links	-			
						Frecuency	Duration	Commitement level
					Actors - Practice	Name generator	(-)Strength	Observation-Survey
				Relationship type links	-			
					Frecuency	Duration	Commitement level	
	Confirm if the demands and interests can be translated into architectural intervention, following the parameters of habitability.		Objects	habitability	security confort privacy funcionality signification	Observation-Survey		
				Practice	Architectural program	New space requirements	Observation-Survey	

Figure 7: Categories matrix of dynamic space

2.3.1. Phase 00

The first phase of any research is to determine the phenomenon or the community to study, as well as the researcher specific interests and first hypothesis of architectural program. The research field should always be limited by the main and specific objectives of the study. Emerging issues and interpretations may arise that expand or limit this practice.

2.3.2. Phase 01

Deconstruct the information from both online and offline worlds, using ethnographic methods, based on a non---intrusive observation or lurkin (Shoham's, 2004 Garcia et al., 2009,p. 59) and through an unsystematic procedure that involves being "ready to change focus whenever a noteworthy action or interaction occurs" (Gobo, 2008,p. 228). This phase requires the researcher to keep in mind the first boundaries, which are outlined in Phase 00. The data obtained in this phase should outline the context (historical,

political, economic, social, spiritual, environmental, and technological) by:

- Identifying agencies related to the seven contextual themes according to the objective. This information can be official documents, laws, geographic data, etc.
- Look for the main online sites. Analyze the design features of each platform and sites that encourage participation and interaction between the different participants. Using an observable guide, highlight the use of colors, page layouts, images, profile photos, and graphic design, using screenshots as a method of collecting data. The web site www.web.archive.org can be used to observe changes in the physical appearance of a website.

PHASE 01					
Element	Category	Observable	Register	example- Results	
Community www....	Design aspects	Graphic design	Color palette, chart quality,	screenshot	Grayscale, good quality
		Function	Type and number of functions	screenshot	Help, Chat and hyperlinks.
		Graphics	Tipos de gráficos	screenshot	Pictures, diagrams
		Access to other pages inside web	Number of hyperlinks	screenshot	/terms-conditions/, /trademark-rules/, /commons/access-the-commons/, /join (page not found)/, /start-a-chapter/.
		Access to other pages outside web	Number of hyperlinks	screenshot	Facebook, Twitter, LinkedIn, Youtube, Vimeo y Pinterest
		profile pic	Request / optional	screenshot	

Figure 8: Observational guide Web Design interaction in Phase 01

- Identifying the most common events and significant rituals among them.
- Identifying the most common scenarios and architectural objects associated those significant rituals.

OBSERVATIONAL GUIDE									
Objective: Identify important actions, places, activities and architectural objects in the last 3 active months of the community.									
DYNAMIC SPACE									
Element- Community	Event	Type	Duration	Scenario	Object	facebook	facebook	facebook	
				Contexto	Building	Invited	Interested	went	
January									
https://www.kalamazoo.edu/evnts/ Oral Testimonies Project				Justice and community	3,30 ACSL, 200 Monroe St, Kalamazoo, MI 49006	ACSL			
https://www.kalamazoo.edu/evnts/138465884/1056/							428	86	81

Figure 9: Observational guide events-objects-participants, example in Phase 01

- Identifying actors and gathering demographic characteristics, such as age, race, class and gender, and personal characteristics, from profile photos and personal web pages. It should be taken into account that participants can create fake profiles. However, some of these interactions may occur from a linked personal account, such as Gmail, Twitter, and Facebook. It is less likely that someone would generate

a fake profile to use only on social media. Offline interactions should be contemplated if the official pages do not provide sufficient information.

Facebook	Actors											Image analysis			
	Name	Type	Origin City	Current city	Age range (25-34, 35-44, 45-54, 55-64)	Sex	Occupation	Contact	Positive discourse	Negative discourse	Net discourse	element	elements	Appropriation of space by actors	Area
Concepcion Renteria	participat		Chicago	30-35	F	multimedia artist	http://www.facebook.com/concepcionrenteria.com/	x				http://www.instagram.com/locations/location/8055414/	25 s	lacion de usos multiples	
Joe McLaughlin	participat		Chicago	30-35	M	architect	http://www.facebook.com/joemc1980/	x							
Joe Bruck	participat		Chicago	40-45	F	ARCHITECT	https://www.facebook.com/joemc1980/	x							
Adam Schumacher	participat		Chicago	30-35	M	Working Architect	https://www.facebook.com/adam.schumacher.12/	x							
Katelyn Schumacher	student		Clarkston, MI	18-24	F	Architecture	https://www.facebook.com/katelyn.schumacher.82/	x							
Mike Ehrhardt	Research		Michigan	30-35	F	Research architect	https://www.facebook.com/mike.ehrhardt.1000000000000000/	x							
Stephan Price	Student		Portia, MI	18-24	F	Architecture	https://www.facebook.com/stephan.price.8/	x							

Figure 10: Observational guide list of participants, example 02 in Phase 01

2.3.3. Phase 02

Reassemble the concepts with new patterns to construct a framework, and focus on the main rituals, scenarios, and architectural objects from the observational guide from Phase 01. This phase involves re-analyzing the hypothesis in terms of the systematic, regular, and categorized observations in both online and offline practices

- Identify the logic of significant practices among users by observing the files, comments, hash tags, and pictures in open-source formats over the last three months in order to draw a map of relationship through positive and negative values in the community. This information should be linked to a specific scenario

PHASE 01				
Element	Category	Observable	Register	
Community www...		Participantes	main participants	excel
		Type	pictures, comment, likes	
		Themes		excel
	Significant practices	Interaction	Amount of post, number of responses, groups, last update	excel
		Emotion	Positive negative	

Figure 11: Categorizing and registering web interactions in Phase 02

2.3.4. Phase 03

Return to the field and confirm data to clarify relationships that are still poorly defined between the scenarios, objects, and actors. Use a survey based on relationship questions and habitability factors, such as comfort, privacy, security, functionality, and signification to understand the current relationship between objects and people. This survey can be structural, semistructural, or deep, depending on whether online or offline distribution is used. It is recommended to use a structural online survey to achieve higher participation.

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Empirical Category			Survey		
Subcategory	Observable	No.	Items	Multiple options	
			<p>Apply this instrument after making the observation guide. It is possible to preside over the generators of actors if one already has a record of the main actors and if it is not sought to analyze the personal relations within the community. Generators of spaces and events can be reduced to a minimum of 1, (33 questions) or extended up to 3 max. (59 questions).</p> <p>Introductions greeting: If this survey has come to you, it is because you have a close relationship with (community) and your name has come out requests in our first study. This project aims to analyze (community) in a dynamic way. Studying the relationship between places, inhabitants and architectural objects, through the events they perform as a community. This research is done for (purpose), I thank you in advance for your participation, which is of vital importance for this research. The survey consists of (num) questions which you can perform in a maximum time (min.). All results will be confidential and used only for (purpose), which you can consult at: Web (link), if you want to know more about the investigation or you have doubts and comments write us to (email).</p>		
Actors	Demographic profile	Name, nationality, age, sex	0		
	Occupation	Scholarly and current occupation outside and inside the community	1		
	Life style	Cultural activities, interest and proximity with the community	2		
Scenes	Context	Locations	4		
	Buildings	Locations	5		
Events/Epochs	Activities	Main topic	6		
	Duration	date/hours/updates	7		
Actors - Object	Influx	Number of posts, comments, participation.	8		
	Frequency	Duration	9		
Actors - Practice	Frequency	Duration	10		
	Commitment level		11		
Actors - Object	Frequency	Duration	12		
	Commitment level		13		
Actors - Practice	Frequency	Duration	14		
	Commitment level		15		
Actors - Object	Frequency	Duration	16		
	Commitment level		17		
Actors - Practice	Frequency	Duration	18		
	Commitment level		19		
Objects	Frequency	Duration	20		
	Commitment level		21		
Praxis	Frequency	Duration	22		
	Commitment level		23		
			<p>24-28. How would you rate the following characteristics of space 1, 2 with (open-hour) use:</p> <ul style="list-style-type: none"> Integration attractive design Can be used in different ways Access adapted to the different socio-cultural needs of people Always alive (historic) The establishment of the different activities Interaction with the community Environmentally correct Security elements Provides continuous physical exercise Provides a wide field of view of the surrounding elements Allows the reach of all components comfortably Facilitates the use of services or safe or personal assistance <p>29. Do you think that the space determined for the unknown with the largest floors are the proper?</p> <p>30. What would you change about space?</p> <p>31. Do you think that the space determined for the activities with the minor floors are the proper?</p> <p>32. What would you change about space?</p>		

Figure 12: Survey guide of dynamic space Phase 03

2.3.5. Phase 04

The Diagnosis will generate a new architectural program with the real space needs. This can be a new object in a specific scenario or an intervention in a pre-existing object. Feel free to innovate and break schemas.

2.3.6. Phase 05

Based on the new architectural program, gather the main actors of the community and start a dialogue by creating a vertical structure to generate a transformational design, similar to what Akama suggested in *Designing Future Designers: A Propositional Framework for Teaching Sustainability* (2015).

2.4 Transformational design

It is recommended to use the same methodology to establish an empathetic relationship with the actors in the architectural design of the obtained requirements. Although, according to Dr. Akama, there are different phases of interaction (the user experience [UX], the co-design, and transformational or sustainable design), each depends on the role of the user in the design process. While the UX marks an interest in how the user will experience the designed object, it fails to influence in any way the decisions of other actors and disfavors their interests and values. The interaction between both lay and expert knowledge may continue in order to give place to a "shared meaning construction" between the people and the spaces that are being designed. That is, the user must "intervene in the set of power relations" in order to achieve the different objectives and purposes of the community (Castells, 2009, p. 45). This proposed sustainable design is mixed with "transdisciplinary design, transformational design, participatory design and innovative social design" (Burry, 2013, Manzini, 2010; Sanders & Stappers, 2008; Sangiorgi, 2011; Steiner & Posch, 2006 Akama et al., 2014, p. 2). Sustainability, as proposed in this context, should include the interactions between "social, political, economic, environmental, technological, and spiritual spheres," thus raising awareness of how everyday life is related to the world (Fry, 2009; Ingold & Gatt, 2013; Walker, 2006 Akama et al., 2014, p. 5).

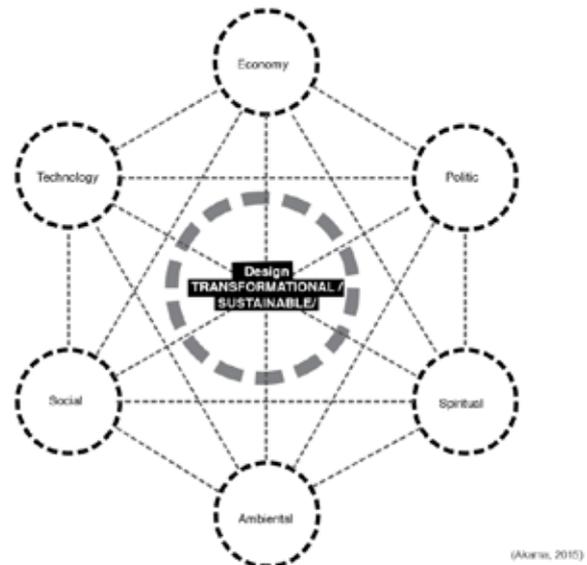


Figure 13: Dr. Yoko Akama's diagram of the six spheres of sustainability from *Designing Future Designers: A Propositional Framework for Teaching* (2015, p.5).

This "diagram" can be used both at the starting time of the project and to analyze its results in the community. Thus, the architect begins to resemble a sociologist or anthropologist who is "tracking, mapping, describing and connecting the 'controversies,' languages, interests, discourses of subjects and scenes involved" (De Grande, 2013, p. 15).

3. RECOMMENDATIONS

Both approaches, design and anthropology, take up the "do" from speculation, thus creating prototypes and testing as if in an "urban lab" (Pink & Akama, 2014, p. 51). However, this "laboratory" lacks structure and continuity; that is, the need to generate shared concepts that complement both disciplines. These two anthropological interpretations are similar in the sense that it is possible to start a paradigm shift in terms of what architecture can offer, as both can rethink big data and technological affordances from an anthropological perspective. "A medium that makes it possible to reach more people should not ignore the most appropriate sampling procedures" (Couper, 2000 in Rodríguez & González, 2014, p. 163). Thus, "datafication" is born, which is helpful to understand the cultural space through a new interpretation of habitus⁵ (Curran, 2013, p.64).

⁵ 5

The concept of habitus is one of Pierre Bourdieu's fundamental contributions to sociology and one of the key terms of his theoretical construction. However, he did not invent this concept. It dates back to Aristotle who said habitus was the Latin translation that Aquino and Boethius gave to the Aristotelian concept of hexis. For these authors, habitus plays a key role as an intermediate term between

The relationship between "social media data" and the phenomenon of Big Data can be used to study the behavior of society in real time, without the need for invasive work (Casteleyn, Mottart, & Rutten, 2009 & Murthy, 2008 in Canhoto & Padmanabhanb, 2015,p. 1141). Taking our online activities (e.g., posts, tweets, and purchases) to understand our tastes and interests. As well as ethical questions about the use of the world personal data.--- dreams, ideas, pictures, emotions from a million people. Extracting massive information from individual practices through different platforms, specially the social media where we can analyze every day patterns.

However, in the right hands, these data banks can be of great help, instead of been use for capitalist ends. Although today access to social network algorithms is limited for researchers and there is still discussion about this massive methods in different fields. This has been raised attention by journalists, academics, and industry professionals, as well as many researchers⁶, who have written essays about the limitations of Big Data (Curran, 2013,p. 69). These critics must be taken into account when investigating how to improve the credibility of qualitative study and knowing the limitations of digital interaction.

3.1 Ethical issues

Other concepts that can provide this feedback, such as public and private space, which can, in turn, influence both ethnographic field research and architectural design. Public and private (offline and online) spaces are generated through practice and

the act and the power. On the other one hand, through the habitus, the potentiality that is generically ascribed to beings in a particular ability to perform actions is transformed. On the other hand, between the outer and inner, habitus explains the internalization of the external, thus linking the past to the present story updates. This problematic would be developed in our [XX] century, mainly due to the phenomenology of Merleau-Ponty and Husserl, which already provides a systematic theorizing that is always in terms of perception and individual action. Such concepts provide an analysis of perception and individual action that was taken up by Bourdieu. On the other hand, the concept is also found in the work of some classical sociologists, such as Durkheim, Mauss, and Weber who use it without defining or theorizing it. Other authors, such as Mannheim, uses "stratification of experience," which is very similar in its theoretical function. However, it is in Bourdieu where habitus receives both a systematic and sociological formulation. Bourdieu explicitly proposes the habitus as a concept that serves to overcome the opposition between "objectivism" and "subjectivism." The "objectivist" theories explain social practices as determined by the social structure, meaning the subjects would have no role and would be a mere "carrier" of the structure of relationships. In turn, "subjectivist" theories take the opposite approach, as they explain social actions as the aggregation of individual actions. Román Reyes (Dir): Critical Dictionary of Social

⁶ Such as Bell (The Lies of Big Data), Crawford (Big Data, Big Questions, 2014), and Boyd (Six Provocations for Big Data, 2011).

activities that are often formed by "multiple orders of value and groups of people often parallel to each other" (Ignacio & Bender, 2010,p. 19). Their differences are based on the availability of each, and although it seems that cyberspace is an entirely public place, many of the interactions that occur are private in nature (Walstrom in García, Standlee, Bechkoff, & Yan Cui, 2009,p. 74). Therefore, it is necessary to rethink these ethical issues in order to avoid seeing the subject as dehumanized data. This should be done in order to counter personal narcissism, which influences "the absence of the sense of community in contemporary life" (Nesbitt, 1995,p. 72).

Thus, an ethically led project can generate close ties among all involved where "the researchers act as hosts" (Derrida, 2000 in James & Busher, 2013,p. 203) from the outset by clarifying the rules of engagement between participants (James and Busher 2009 in James & Busher, 2013,p. 204). This practice should be understood as "an interrelated set of bodily and material provisions" that is "organized around shared understandings" (Schatzki, 1996 in Ardèvol, 2013,p. 14). This allows the researcher to "avoid methodological individualism and to overcome sociological determinism" and to "put research in the field of everyday life" (Ardèvol, 2013,p. 14).

3.2 New opportunities

For an architect who has always acted through abstractions, digital ethnography could be more than a tool; it could be as a form of "collaborative epistemology" to understand reality. According to the social sciences, lay and expert knowledge should work together to create better understandings and theories; however, the natural flow between these two worlds does not come easy in the field of architecture. This model aims to bridge this gap by connecting the dots that each level of knowledge lacks instead of seeking a relationship between disciplines and falling into utopian concepts, such as postmodern architectural theory.

This progression between the two worlds (physical and digital) is what grants greater flexibility to the research model, and making it applicable to any of the design processes and post-occupational assessments of the architectural object. By acting systematically, nonlinearly, and flexibly and connecting technological advances with everyday social practices. This would create a construction practice, "a neo-geography where open collaboration deals with both local and global challenges through interoperability of empirical and qualitative data from different sources" (Armstrong & Shumack, 2011,p. 2) that determine the forms and spatial opportunities.

Finding concrete solutions was not the main objective of the present investigation. Instead, it aimed to open up an honest and open discussion about architectural design methodology for continuous, proactive, and collaborative experimentation that is based on digital ethnography and the design field by looking for replication and feedback in the processes of architectural design. These designs can become

transformational if they are appropriate for their time and undergo constant renewal. This model can be used as a general guide that can help to achieve a freer architecture in theory and practice with enough realistic sustainable and deeper connections between the architecture objects the actors that interact with them and the decision the architect takes while exploring the dynamic space.

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Visual Discussions as Critical Thinking Strategies for Design Students

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The goal of this paper is to present the results of a research that aims to understand and explore means to developing visual literacy in graphic design students. Design students were asked to hand in visual reports after reading an assigned text. If Visual Literacy is an ability to interpret and develop images, then, constructing and developing visual arguments after interpreting a text could be a way to achieve visual literacy. What this research shows is that in this process, not only visual literacy was exercised, but students also showed signs of critical thinking skills. This was visible thanks to the group discussions around the sent images that were presented during class, and also, it was observed that critical thinking took place in the process of developing images because students were interviewed so that they could verbalize their own design process. So, these findings could be the starting point to understand better the relation between both skills, in order to design specific lessons so that students may develop them when coursing design programs.

Visual Literacy, Visual thinking, Critical Thinking, Design Education.

1. INTRODUCTION

What would happen if students handed in photographs and visual reports instead of written assignments after reading a text? Would it be more challenging? Would it constrain or spike group discussions? Does this activity help developing visual literacy? The main findings show that in order to develop visual reports students need to reflect upon the reading, synthesize and come to some conclusions, which are activities that express critical thinking, and until then can they translate into visual language what they are trying to say. Also, reviewing as a group every handed in visual report, enables group discussions. The research shows that photography turned out to be a great way to visual reporting the ideas in the text. This is because photography is a means of expression that students use almost everyday and everyone has access to it thanks to smartphones. Moreover, students feel comfortable taking pictures and they can do their photographic report with objects that they have in their home, after reading the assigned text. A different activity was also assigned when the group watched a video in class such as documentaries or movies. Students had to re-design the front cover of the video, also resembling the main ideas or those that they found interesting. The results show that this visual reporting was a great way to motivate students to identify and express their own statements. In other words, they didn't settle at translating ideas from the video into visual reports; instead, many times they went further and expressed their own arguments after

reflecting upon the video. These findings represent an opportunity to discuss and explore the role that visual literacy plays in design education, and the benefits that it could bring to the classroom, such as promoting critical thinking, when it is consciously planned and engaged in class.

2. VISUAL DISCUSSIONS AND DESIGN EDUCATION

Teaching practices in Design education that privilege practical work are more common than reviewing concepts and discussions over specialized texts, at least in some Mexican universities. This not only provokes that students find it hard to read and discuss abstract concepts in class but also generates some resistance from the students and little interest to participate in such activities. So, the design studio and its teaching practices tend to be perceived as opposed to design theory seminars, implementing a problem and project based education on the former, and a lecturing modality on the latter. Also, hours and sessions spend on the design studio are considerably higher than on seminars, and so, students read and discuss abstract concepts less and less thorough the design curricula because generally these type of activities are not addressed in the design studio, and professors that teach in it tend to delegate them to the seminar's sessions. However, although these activities may seem to develop reading comprehension skills, they also promote critical thinking, and this is a capacity

needed in every professional in the 21st century, and so, it must be practiced and developed throughout the whole design curricula, being not solely a responsibility of design seminars.

The Critical Thinking Community, and the *International Center for the Assessment of Higher Order Thinking*, define critical thinking as follows: Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness. (Scriven & Paul, 1987).

As we can see in this definition, there are daily activities in both the design studio and the design seminar related to critical thinking. For instance, the first part of the definition describes activities more common to the design studio, such as conceptualizing, analyzing, and synthesizing, but probably activities such as observation, reflection, reasoning and communication are less common. In other words, if critical thinking is considered as a fundamental professional ability, it should be developed in every class, regardless the theoretical or practical orientation of the class. Also, there are authors that are calling attention to an automatization of the design studio, in other words, the tendency to focus on developing products in the design studio without reflection, cultivates students eager to complete tasks, to graduate, and to get employed (Taboada & Coombs, 2013; cited by Chamorro-Koc, Scott, & Coombs, 2015). Thus, developing critical thinking represents two great challenges for design education; firstly, confronting the lack of interest from the students of getting involved in activities of introspection, reflection and discussion, as well as reading specialized texts; secondly, slowing down the automatization of the design process in the design studio; both challenges are constraining the development of critical thinking in design students. So, including photography and visual reporting in the design studio aims to understand and explore means to developing visual literacy in graphic design students, which results show that is linked to critical thinking.

Visual Literacy is a fundamental skill for the 21st Century. It seems that it is important not only for designers and visual artists but for every other profession as well. I have discussed this concept deeply in other works (López-León, 2015a y 2015b) and its importance in design education, so in this paper I will only emphasize a few aspects.

Firstly, it is important to note that what it means to be illiterate could have a broader meaning in the 21st century. Some authors (Bamford, 2006; Riddle, 2009; Stokes, 2002) declare that knowing how to read and write will not be enough, and that one needs to be literate in different areas to be able to perform personal and professionally. In other words, if an illiterate person is one that does not know how to read and write, there should be also a concept or term to define someone that does not know how to, send an email, use a smartphone, understand visual narratives, comprehend another cultures, among others that have nurtured the discourse of the importance of developing multiliteracies in schools (Kellner, 1998). For example, there are new terms referring to literacy, that reflect the concerns and reality of our world, such as, ecoliteracy (Stokes, 2002: 11; Center for Ecoliteracy), defined as the capacity to understand and develop practices from a sustainable perspective; and even now there are also discussions about media literacy (Burn and Duran, 2007). So it is important to discuss these new literacies among which there is visual literacy.

The North Central Regional Education Laboratory report (NCREL :15), identified four abilities: Digital Age Literacy, in which there is included visual and information literacies; Inventive Thinking integrating creativity and risk taking; Effective Communication involving Interactive communication; and lastly High Productivity, including effective use of real world tools. The Digital Age Literacy includes eight essential literacy categories, that according to NCREL should be promoted in higher education. Basic Literacy, referring to mathematical abilities; Scientific Literacy which implies understanding concepts and scientific processes; Economic Literacy, as an ability to identify and analyze public and economic policies; Technological Literacy, to understand and use technological tools; Visual Literacy, as a capacity to interpret and create visual messages; Information Literacy as abilities to analyze and synthesize information; Multicultural Literacy, to understand and respect cultural differences; and last, Global Awareness as a capacity to understand global interconnectivity. In other words, visual literacy is clearly seen as a capacity among others that are fundamental not only for designers, but for professionals in the 21st century.

Secondly, it is also important to note that written and verbal language have had a privilege place in education, exiling visual images almost completely. According to Arnheim (1969), mistrust in visual images can be traced to the greeks. In other words, the western world inherited from the greeks despising visual images and the senses, because they are subject to different interpretations, and represent illusions: in other words, appearances

can be deceiving. However, Arnheim declares that it is only through the senses that a human being can know the world, “a child sees and recognizes before he can speak” says Berger (1972: 7). So it is convenient to ask ourselves if visual images can be used as a resource for reasoning in the classroom, and promote critical thinking through them. At the same time, it is necessary to consider if reading and understanding visual images requires specific training and developing particular abilities, and if so, explore the best ways to do it. Such group of abilities it is known as visual literacy. Prior to the work of Dondis (1973) *A Primer of Visual Literacy*,

The International Visual Literacy Association (IVLA), attributes the coining of the term Visual Literacy to John Debes in 1969 (IVLA, 2015) and, although the Association recognizes that many new definitions have come along the way, they still refer to the author’s original definition as follows:

Visual Literacy refers to a group of vision-competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret the visible actions, objects, symbols, natural or man-made, that he encounters in his environment. Through the creative use of these competencies, he is able to communicate with others. Through the appreciative use of these competencies, he is able to comprehend and enjoy the masterworks of visual communication.

In this definition it is clear that these “vision-competencies” are fundamental to graphic designers and visual communicators, but also to every profession that encounters visual images on a daily basis, from scientific schemas to sketching technological innovations (Bleed, 2005). At the same time, this definition presents a challenge to education in those professions, among which is graphic design, demanding specific tools and methods that help developing these “vision competencies”. So in order to explore different ways to do it, this research experimented with photography and other visual reports that then were discussed in class, enabling visual discussions.

3. PARTICIPANTS AND METHODS

The results that are presented in this paper correspond to the visual reports of 14 participants that were taking the Advertising course, in their last year of the Graphic Design Undergraduate Program. This research was conducted from a qualitative perspective, which means that participants are not considered for the study because of statistical representation, instead, they are selected because they can bring different points of view to the research that will allow a better and deeper understanding of the object of study. In other words, from a qualitative perspective, this research did not include probabilistic and systematic samples, but heterogeneous participants that could allow to identify different viewpoints, because this perspective aims to “a deeper understanding of the subjective aspects of the human experience” (Kincheloe y McLaren, 2005; quoted in Martínez, 2015: S63), and constructing from them general conclusions; “it is a modality of generating knowledge proposing a deeper understanding of the way human beings experience the reality in which we live” (Martínez, 2015: S59). From this perspective framed by experience, the qualitative researcher is a subject that allows himself to be “touched by reality” and its intrinsic relation with the object-subject that it studies, it allows him to establish a “reflexive and autocritic” position (De la Cuesta and Otálvaro, 2015: S43) and describing a phenomena in a more holistic and less fragmentary way. Moreover, the interpretative aspect of the researcher is also an ineludible aspect of the qualitative reserch (Martínez, 2015), being this one of the emphasis that guide the results in the present document.

So, in this research, focus groups were conducted to understand the student’s experiences, opinions and process. The assignment in the advertising class consisted in the following: the teacher assigned reading material which every student had to read for the next session, and then, after the reading, they had to take a picture with their mobile phone, tablet or digital camera, to finally upload it to a digital database or platform such as Moodle. The next session, the teacher accessed Moodle during class and every visual report was discussed with the rest of the participants. A second version of this task was also assigned, during class, the participants watched a movie or documentary related to advertising, and instead of a picture, they had to redesign the movie’s DVD or Blu-ray cover. This second version was designed to compare between the translations from written to visual language, and from visual to visual, it also compares tools between a camera, and graphic design software. Without further explanation I will now present some results of the research.

4. RESULTS

The first image corresponds to a pilot study prior to this research who has been addressed in other work (Lopez-León, 2017). The assigned reading was a chapter from the book of Marshal McLuhan (1996) *Understanding Media*. The chapter is famously entitled “The medium is the message”. In general terms, the author emphasizes that media have come to form a symbiotic relationship with the messages they transmit. So, for a graphic designer it is important to reflect upon the role of media during the design process. The handed in image



Image 1: The medium is the message

represents a practice maybe only common to third world countries, prior to the boom of PET bottles for drinks like sodas. PET bottles allowed consumers to buy a drink and dispose the bottle in the trash, before that, a consumer had only two choices: either he could buy the beverage and drink it directly at the corner shop, or he could bring an empty glass bottle to exchange it at the corner shop and pay only for the liquid, or else, the consumer might be also charged for the glass bottle. So, little corner shops began to sell drinks in a plastic bag, tied with knot around a straw, that way the consumer did not have to pay for the glass bottle and so, could take the drink wherever he wanted to take it. What it is interesting about this image, is that by not showing the iconic Coca-Cola bottle, it becomes evident the fact that the whole brand communication (in other words the message) it is embedded within the bottle (the medium). At the same time, it shows that the student is linking the main ideas of the reading to personal experiences, which is a sign of knowledge appropriation.



Image 2: New consumers

The next image corresponds to a reading on new consumer profiles in the 21st century. The student shows in this image, something that was common to find on other visual reports, her friends helped her posing for the photo. This is important because shows that the reading was part of a conversation outside the classroom, and so the student and her friends had to think about it and discuss it. Also, it shows that the student was linking the ideas of the text to personal experiences. Through the image, the student is reflecting upon the variety of products and brands available for everyone and for every personality.



Image 3: New consumers II

Another common practice was to hand in pictures not taken specifically for the assignment. For example, this student handed in a picture taken during vacation with her family. She visited a fashion store in Dallas Texas. So, she points out that stores no longer sell items and products, but also create experiences. With this picture she recalls the interior design of that store, specifically arranged to create experiences.



Image 4: Simulacra and Simulation

Another assigned reading with interesting results was Jean Baudrillard's "The Precession of Simulacra", which is the first chapter in the book Simulacra and Simulation. The chapter main ideas reflect upon the sophistication of simulation in daily life, even substituting what is real with the signs of the real. This image recalls Rene Magritte's painting. This is not a pipe, writes the student, neither is this a pen. The pipe is not a pipe, is a drawing of a pipe, nor is the pen, is a photograph of the pen. With this double substitution the student reflects upon appearances. This image also shows another resource that helped students express what they wanted in their visual report: drawing. Some students combined drawing with objects in their visual reports, which is interesting for visual literacy development.

Other images of students reflect upon logos that imitate real things, changing the meaning of the thing, or expanding it:



Image 5: The Joneses

The next set of images correspond to visual reporting of the movie The Joneses, a fake family that live in a upper class neighborhood (image on the left), to promote products and brands by being aspirational. The task was slightly different. Students had to redesign the movie poster, so some of them turned out to be somewhat similar to the original. The first poster (image on the right) represents a phrase from the movie, "the right products for the right people", the student also enhances glamour and represents it in a playful way.



Image 6: The Joneses II

To represent scenes or objects from the movie was a common practice. This student represents a mirror that appeared a few seconds in the film, but by incorporating it in the poster it emphasizes the concept of reflection in a holographic way; she says "the mirror reflects what they are not".

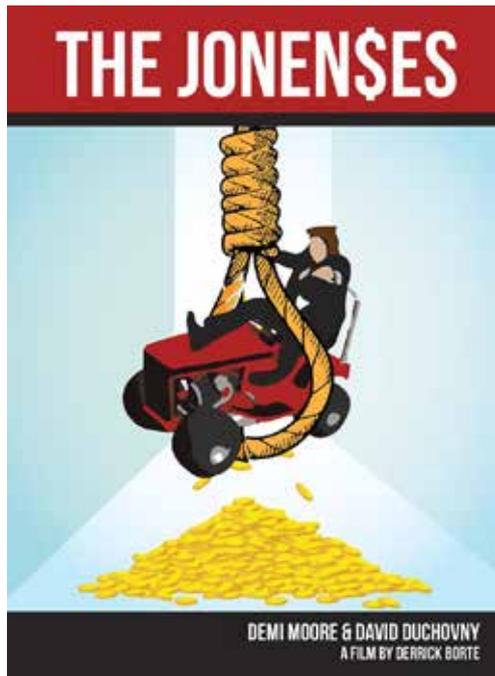


Image 7: The Joneses III

Another important scene was near the end when a secondary character commits suicide. The student chose to represent this, by incorporating in the poster another element from a scene in the movie: a lawn mower owned by the same character. This and the previous poster show both synthetic thinking, and analysis skills, also, communication, all related to critical thinking.



Image 8: The Joneses IV

A price tag was another element that appeared in different visual reports, as well as other material from the movie.

5. IN DEPTH INTERVIEWS RESULTS AND CONCLUSIONS

After these assignments where students had to hand in visual reports after reading a chapter of a

book, a journal article or watching a movie or documentary, In depth interviews were conducted to know better how this assignment challenged the students and if this challenge promoted critical thinking. So, some of the verbalizations of the students in those interviews are presented next.

About visual reporting in general, they felt more comfortable and motivated.

- It makes you try harder; you need to be more creative to say something that you understood. There is a process within you that makes you wonder "is this really representing this idea".
- With a single image you can express many ideas that you found in the movie.

Opinions about the Process are divided; generally they found photography more challenging in some ways.

- It is more complicated with photography, the process is longer, because you need to identify what you want to represent, and then see if you have the items within close reach or maybe you need to go out to take the picture.
- Photography needs to be more spontaneous, you look around and you need to reflect if there is something related to the information; you observe, something catches your eye, you capture it and relate it. Redesigning posters is backwards; you process the information and then redesign it.
- To take a picture is faster but needs an open mind, it demands more creativity than redesigning a poster.

Written reports are perceived as means to express ideas literally. Visual reports reflect knowledge appropriation.

- It would be a lot easier to do written reports because you can say everything that you are thinking about. It is harder to synthesize, because maybe not everybody will understand it the way it was intended.
- Sometimes is easier to represent a complex idea visually than to write it.
- With written reports, the information is sitting there, instead of visually, because this way you put to work the information, and it becomes your own.

Discussing Visuals in class was an activity well perceived as a way to confirm and discuss different ideas.

- It is really cool to present the images to the group and discuss with them because we can see different ways to understand the reading or the movie.
- It demands a lot from us, it enhances our creativity.
- There are parts that my classmates represented visually that I did not notice and it is like going over the main ideas again and again.

Results and conclusions

Working with visual instead of written assignments, generates a positive impact in students' approach to reading or watching supplementary materials. From the handed in visuals to verbalizations that students expressed during the interviews, it is safe to say that, working with visuals it is a great strategy to enable other abilities such as critical thinking, because students expressed the need to analyze, synthesize, evaluate information, observe, retrieve from experience, before developing a visual report. Also, most of the images refer to previous experiences, which could be a sign for knowledge appropriation. Finally, discussing visuals instead of texts allowed everyone to have an opinion and so, group discussions were more fluent than ever. On the surface, it would seem that the group was discussing visuals, but deep down they were also discussing abstract concepts or interesting ideas picked out from documentaries or film. If visual literacy is understood as an ability to interpret and generate images, photography and visual reporting enables to develop this ability, motivates students, keeps them engaged and collaborates with critical thinking. So bringing visual literacy to the classroom becomes a fundamental strategy in the students' process of becoming professional designers.

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Putting yourSelf on the Line: An Alternative Critique on Digitalisation

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This piece describes the development of an alternative model for cultural evolution that shifts the emphasis from What to How. What we understand of the world is determined above all by How we understand this, and there are three fundamental forms of artificial cognition that can be discerned in this: 'The Body, the Book and the Button'. These three constituent and conditioned forms of cognition are distinguishable, but difficult to see independently from one another as they permanently interact with one another. And through the interplay of externalisation and internalisation they become 'invisible' as technology.

Theory. Practice. Design. Technology. Research.

1. INTRODUCTION

Utopia and *Dystopia* together represent the greatest possible contrast with which we can imagine the future. As a complementary dichotomy, it regularly features in the repertoire of Hollywood, where we are presented with the same story (but with different actors) time and again. As such, these two visions of the future would seem to constitute a modern version of the typical mediaeval altarpiece: a triptych in which the 'day of judgement' is flanked by representations of heaven and hell. In the modern version, we ourselves embody the middle panel; the two side panels – *Utopia* and *Dystopia* – represent both a theoretical model and a concrete reality, which means that we evaluate our current age based on this contrast. Modern commercial technology behemoths (such as Facebook) promise us that *Utopia* is already within our reach in the here and now. *Utopia* is thus effectively held hostage by commerce, leaving nothing for politics but *dystopia*. In this arena, the various parties accuse one another of being the harbingers of *dystopia* as soon as they come to power as rulers. In other words, neo-liberalism (commerce) and neo-conservatism (politics) cannot be viewed independently of one another, and are like conjoined twins, dancing a parody of a tango before us. The upshot of all this is that, if we wish to explain the world to our children, there are only three categories of people: *refugees*, *terrorists*, and *tourists*.

This ~~visual~~ essay of course results from a *tourist*, but a tourist who hasn't physically travelled. An array of locations (thinkers) were visited on an exotic safari of thoughts, raising the question of how the three archetypes of post-historic society could potentially relate to disciplinary power through (digital) technologies. One of the disciplinary problems that digitalisation, or rather the mathematisation of reality, provides us is that theory and practice are no longer separate entities: the *discretisation* of the everyday. This hidden challenge is made explicit by integrating it into this research. The point of departure herein is the idea that digitalisation must not be unilaterally left up to commerce or politics. But that it should, for instance, be part of Digital Studies at an art school. But what then would a theoretical framework for Digital Studies look like? Responding to this (design) question entails, as theory and practice coincide, two approaches. It is about content as well as form

This piece describes the development of an alternative model for *cultural evolution* that shifts the emphasis from *What* to *How*. What we understand of the world is determined above all by *How* we understand this, and there are three fundamental forms of artificial cognition that can be discerned in this: '*The Body, the Book and the Button*'. These three constituent and conditioned forms of cognition are distinguishable, but difficult to see independently from one another as they permanently interact with one another. And through

the interplay of externalisation and internalisation they become 'invisible' as technology.

With regards to the form, this visual essay employs the *making process* as a research strategy by drawing from different archives (input) during the process of writing as an *experiment* (methodology) to come to a meaningful *synthesis* (output). In the realised product, the recommendations that have resulted from this research have been implemented in the research report. In doing so, this visual essay is an ambivalent diptych: a report that is dead serious in acting as though it is research. Stemming from artistic ambition, it is a play directed against the bureaucratic system to formulate an alternative but fully fledged critique on digitalisation

2. THE VISUAL FREEDOM FIGHTER

Dear Luca and Zenne,

On the evening of 14 July 2016, at the Minerva Art Academy graduation ceremony, I gave a speech to the fifteen students whom I had supervised. Most of them were illustrators and graphic designers, but in the broadest sense of the word, as they also included social designers, comic book writers, one interactive product designer, a documentary photographer, and one 'traditional' graphic designer. Although I love all my students equally, towards the end of my speech I did devote special attention to the two whose work had been nominated for the Minerva Art Academy's design award: documentary photographer Luuk van den Berg and graphic designer Jan Hamstra. Although in appearance their work defies comparison, it occurred to me that they both dealt expressly with the question of how to orient one's moral compass in a strongly polarised world. As a photographer, Luuk van den Berg explored this concept by delving into public life in Istanbul and documenting the tensions between tradition and modernity. As an adolescent and graphic designer, Jan Hamstra's approach involved immersing himself in the radical thought and actions of others, with the terrorist and resistance hero as the extremes. Jan Hamstra's final submission was, among other things, an individual twist on the graphic novel.¹ It is a graphic novel of diptychs, whose text – consisting of unrelated quotes by Leon Trotsky, Mao Zedong, Malcolm X, Osama bin Laden, Ulrike Meinhof and Edward Snowden – reads as a single narrative. The diptychs are sharp woodcarvings in two saturated colours: a reproduction technique with a rich history among politically engaged artists. At first glance, the work seems to present a clear juxtaposition. But the generic, interchangeable nature of the quotes suggests that terrorists and

¹ A graphic novel is distinct from an ordinary comic book due to a more literary approach, and usually targets adults as the intended audience

resistance heroes share a comparable idiom, thereby 'tainting' the images with ambivalence.² So essentially the work can be read in multiple ways: for example, it can also be interpreted as an (albeit indirect) self-portrait of a young adult seeking moral orientation. Jan Hamstra's woodcarvings and Luuk van den Berg's photographs share a similar theme, and closer examination also reveals a common and striking structural device: the diptych. In Hamstra's work, the device is visible on every spread of two mirrored pages. In Van den Berg's work it manifests as two separate publications: one is a more traditional documentary with an objective, descriptive intention – analogue, black-and-white street photography, with a clear focus on the subject and an invisible 'author'. The other publication is a contemporary love story between a Dutch boy and a Turkish girl that thematises cultural prejudices and the limitations of photography as a medium, using texts (reminiscent of a private journal) and colour photographs from a family album interspersed with images from mass-media. As in Jan Hamstra's work, this creates ambivalence, as each publication complements and manipulates the meaning of the other. The apparent objectivity of one work is disrupted by the explicit subjectivity of the other, while the multimedia strategy forces the various images in to a veritable imbroglio of cultural disorientation and the associated moral dilemmas.

I concluded my speech by pointing out that both designers – artists – teach us that between the 'post-modern archetypes' of the terrorist and the resistance hero addressed in their work, another position is possible: that of the *visual freedom fighter*. It may be an oversimplification of reality, but on that evening it seemed like a particularly appropriate description. Graduates receive their diplomas not only as designers based on 'acquired competencies', but as proven artists, people whose artistic practices and products have an impact on the viewer.³ That very same evening and the next day, this simple treatment of the terrorist and resistance hero in my speech received a cynical retort in reality.

During my speech – and now it becomes difficult to employ such polarising terms – a person in Nice labelled by the media as a 'terrorist' drove a truck into the crowds watching the fireworks on the promenade as a celebration of the French revolution of 1789. The sorry outcome was 84 dead

² 'Tainting' is a significant term in this essay. I will clarify why I place 'tainted' in quotation marks further on.

³ This is not stated as such in the competencies themselves; rather it is described as 'communicating meaning' (semiotics?). However, meanings such as 'evocative', 'affective' or 'provocative' tend not to be counted as 'criteria' or 'meaning' (phenomenology?) in this sense.

and 50 wounded. On the morning of Friday 15 July, I awoke unaware and still feeling fulfilled from the previous evening. Sometime later, I listened with dismay as I learned about the full scope of the events in France. While the news broadcasters continuously presented new details about the drama in Nice, the end of the day saw a military coup attempt in Istanbul, Turkey. The media was working overtime. Shortly after that I received a text message from Luuk van den Berg, who said that his friends in Istanbul already believed that the coup was destined to fail, based on the numbers of military in the streets. The failed coup cost around 300 people their lives, and 9000 public servants were instantly dismissed. In the meantime Turkey had declared a state of emergency, and France's has been extended.

That same week, an ex-marine in Baton Rouge, USA shot and killed three police officers in broad daylight. And a crazed German boy killed nine people in a Munich shopping centre, after which he committed suicide. Some days later, a Syrian refugee set off a nail bomb in Amsbach, Germany, and a priest's throat was slit in northern France..... These news reports clearly revealed that events once limited to far-off places were now a part of our own backyards. But the question seems like a chicken-and-egg scenario. The term *global village* – which was coined in 1962 and had been employed optimistically since the advent of the World Wide Web – is now becoming a euphemism, for example.⁴ It may be that a 'village' constitutes the outermost limits of an individual's physical and mental comprehension, and as a concept and mental model represents our understanding of the world at the same time. It is not that the world has become a village, but that it has become part of *our* village.⁵ In this reality, all the world news (and 'real news is bad news, either about people or for people') is no less a threat to the village within us. (McLuhan, 2002, p. 228) The news also seems to merely confirm our fears of otherness and foreignness, imprisoning us within a vicious circle where we become victims of our own imagined fears – fears that we are only too eager to see confirmed in the news. Media philosophers such as McLuhan and Flusser point out this mechanism when they state that all media have a (usually

concealed) feedback loop between sender, medium and receiver, the specific features of which are determined by the medium. The news media are not there to keep us informed, but are 'programmed' to show us what we expect to see, and the public outrage elicited by terrorism and failed military interventions are the 'pre-programmed' feedback we give to the news machine. (Flusser, in *het universum van de technische beelden*, 2014, pp. 66-78) The free press presenting information that allows us to arrive at our own 'free' opinion becomes a hilarious contradiction, a modern myth, (Cassirer, 2008, p. 38) and one that is not demystified by labelling media magnates such as Rupert Murdoch or Silvio Berlusconi as 'guilty'. They are 'pre-programmed' as well: prisoners of the news machine just like its consumers, only they are on the preferred side of the bank account.

But we will leave this aside, Luca and Zenne, as there are currently also ten thousand immigrants living either in a kind of post-historic no-man's-land at the farthest limits of fort Europe, or sojourning in 'permanent' refugee camps in their 'own' region. They are fleeing the chaos and war of their homes, where the bombings by wildly different and barely distinguishable factions are interspersed with the bombs and interventions of allied forces in areas such as Afghanistan, Syria and Iraq. (Bauman, 2012, pp. 47-77) I am convinced that these 'incidents' and the 'no-man's-land' cannot be viewed separately from the so-called success story of neo-liberal economic globalisation on the one hand, and neo-conservative politics on the other. I will explain later how these two seemingly diametrically opposed views are directly related and form a complementary diptych. If I needed to summarise the world for you, I would point out how there are now only three categories of people left in the news media: *refugees, terrorists, and tourists*.⁶ And as I just explained, the feedback loop also applies here – just as Hollywood dishes up the same fictions time and time again, only with different actors, since that is how the public responds to Hollywood. In the same vein, the news continually presents variations on refugee crises and terrorism, surrealistically interspersed with last-minute holiday offers and luxury cruise ships. All three archetypes share a common attribute: the mobile telephone. Terrorists use it for invisible ('liquid') organisation; refugees to determine their routes; and tourists as a selfie device, the modern equivalent of the 19th-century Claude glass. (Delpeut, 2009).

⁴ McLuhan, M., Gordon, W. T., Lamberti, E., & Scheffel-Dunand, D. (2011). *The Gutenberg galaxy: The making of typographic man*. University of Toronto Press.

⁵ As Saul Steinberg once clearly illustrated with a cover design for the New Yorker: a drawing depicting the view, the perspective, of the New Yorker (in this case, a resident) in which details are only present until the end of the street, with all objects beyond that merely 'schematic representations'. Mexico and Moscow have become abstractions, mental models.
https://en.wikipedia.org/wiki/View_of_the_World_from_9th_Avenue.

⁶ Taking a sample, we see that the front pages of newspapers are dominated by three messages: news about refugees or terrorists, and advertisements for exotic holidays and last-minute travel deals aimed at tourists.

Why am I writing to you about this, and why is this part of a Master's thesis? It is because the principle outlined above also applies to the two traditionally divorced roles of (somewhat ironically) the 'omniscient' father and the 'ignorant' researcher: they are no longer distinct. It is through advancing digitisation that traditional opposites (or dichotomies) such as culture and technology, art and commerce, or work and leisure are dissolved. (McLuhan, 2002, p. 369) In economic terms, the world has 'gone global': events on the other side of the world have an effect on us, and contrariwise, our day-to-day reality impacts unknown locations elsewhere in the world (unknown to us, at least). Although this globalisation had already existed for some time, it was subject to a certain degree of 'natural' delay. At least, this is how we see things now, since globalisation now operates at the speed of light. The closure of a bank in America (e.g. the Lehman Brothers in September 2008) means, among other things, that we in the Netherlands must pay higher taxes.⁷

In this context, Polish sociologist Zygmunt Bauman refers to 'liquid modernity' (Bauman, 2012) and Belgian philosopher Lieven de Cauter makes reference to the now global permanent 'state of exception'. (Cauter, 2015) It is in this 'mediaeval reality' – the return of feudalism, with multinationals as the powers-that-be and consumers as their subjects – that you two are growing up. Aged only three and six at the start of the twenty-first century, you are as yet unaware of the implications. In an art education programme, it often feels inappropriate, unethical, to think about matters other than those described above. In these aimless times, where is the sense in getting worked up about a theoretical framework for digital studies? For that is the question I am grappling with. *What would a theoretical framework for Digital Studies within the Design programme at the Minerva Art Academy look like?* This paper is my answer to that question, albeit a partial one. You should actually regard this paper as an initial survey, and at best, an extensive prologue to the theoretical framework itself. The prologue, centred around the model titled 'The Body, the Book and the Button', aims primarily to thematise how our cognition is related to these three forms of media, and as an extension thereof, the problematisation of the medium/technology, and the 'Button' in particular.

Why do I not seek out another topic, something like: strategies for the modern politically-active designer, new scenarios for a discombobulated world via social design, or even more extreme: art and politics? Would that not, I sometimes wonder, better serve the purpose of channelling my

concern? There are various reasons why I decided to flesh out the Body, Book and Button model. Paradoxically enough, I believe I am acting under Lieven de Cauter's motto: 'Pessimism in theory, optimism in practice'. (Cauter, 2015, p. 237) Although this paper is a theoretical exploration that would imply pessimism, at the same time it is born of artistic practice, and therefore requires an optimistic approach. As such, it draws no clear distinction between theory and practice. Does this make it fluid, or a 'hybrid'? Perhaps, but it is not intended as some kind of opportunistic fad. I am thoroughly aware of the critical significance of Bauman's 'liquid modernity': opportunities for few, uncertainty for many.⁸ Sticking to the 'form' of liquidity, or the lack of a clear boundary between theory and practice, produces both a substantive discrepancy and a methodological risk.

I see Bauman's analysis as a theoretical model for coming to grips with various complex and closely interrelated phenomena – a model that enables critical thought for diagnosing modern times, which he calls 'Liquid Modernity'. I believe that this analysis, with its emphasis on the term 'modernity', is of crucial importance to such a theoretical framework, and has close ties with the implications of the 'Button' – a connection that Bauman himself does not clearly explicate. That is my first reason for not ignoring this subject. My decision to apply a different structure than the one used by Bauman in his research, one that is more in line with classic literature study, was due to the fact that I am problematising the medium, including the linear narrative. This does not mean that I reject the linear narrative, but that I view the 'disciplining' (or to use Stiegler's term, the 'grammatisation') by the medium, as problematic, in the sense that *what* we can know is closely related to *how* we can know it. This paper therefore not only reports on research as clearly as possible, but also constitutes an artistic survey of the core possibilities offered by the medium itself. As such, the research question is a two-pronged one: imagining a theoretical framework concerns not only its content, but also

⁸ The critical significance of Bauman's Liquid Modernity includes: opportunities for few, uncertainty for many. The painful irony is, of course, that this Master's thesis in art education would never have existed without this 'liquid modernity'. Master's programmes are 'marketed' as lifelong learning, and as an ideal opportunity to keep abreast of developments, but also contain the harsh reality of 'superfluity' in the event of failure or rejection of the programme (as Bauman points out on page 128 of *Liquid Life*). Over the past two-and-a-half years, I have spent an average of five evenings per week sitting and reading – with pleasure, but also with you two in the back of my mind. Although dedicating this thesis exclusively to you both is necessary at the very least, this section was written specially for you. Dearest Luca, Zenne and Carmen, *Mia Vita mille grazie!*

⁷ https://nl.wikipedia.org/wiki/Lehman_Brothers

its form. In reality however, it is through experimentation that I reject this distinction. My deviation from the form/method of ordinary research reports is a result of the hypothesis being pursued, stating that *what* we know owes its entire existence to *how* we know it. This report incorporates the results of the survey itself, running the calculated risk of 'tainting' both the survey and the results with ambivalence. One could also posit (avoiding any connotation of the fashionable term 'hybrid') that I am drawing from the nearly five-hundred-year-old tradition of the essay as part of humanism, as first developed by Michel de Montaigne (1533-1592) and summarised by Louis Stiller as 'personal study for the common good'. (Stiller, 2007, p. 14)

Another reason for choosing the subject of the Body, Book and Button, Luca and Zenne, is because this letter to you both sets the context for the rest of this essay – a context that is broader than merely the one formed by design students at an art academy such as Minerva. It is this context, and the reason why I lament the lack of 'digital studies' at art academies, that demands the necessity thereof to be addressed. This necessity is rooted partly in digital technology itself, and partly in the current 'liquid modernity' of the world. The 'large-scale' perspective of global dilemmas cannot be viewed separately from ongoing digitisation, which can be reduced to the minute perspective of 'the Button'. In attempting to 'arm' my students (such as Luuk and Jan) with this alternative model of cultural evolution to be of significance within this global context, I may be getting 'too big for my boots' and risking failure in my research. So be it.

As a means of addressing the urgent need for a digital studies course, I will return to why neo-liberalism and neo-conservatism form a complementary relationship – like the mutually reinforcing halves of a diptych – and how in a globalised world everything is interconnected, whether we like it or not. A key source for formulating the Body, Book and Button model was provided by the work of French technological philosopher Bernard Stiegler, whose point of departure is the hypothesis that man is *technological* by nature. In other words: our natural state is one of deficiency, and that we fill ourselves out with technological prostheses. However, he also states that this is in itself no problem, as it is our natural state. (Stiegler, 2014) We are, in the words of Dutch philosopher Jos de Mul, 'artificial by nature'. (Mul, 2014) In his writing, Stiegler applies (among other things) a dynamic and interactive model including three elements – the *individual*, the *collective* and the *technological* – which, although they can be discerned, cannot be isolated. It is a theoretical model comparable to Bauman's, useful

in laying a conceptual basis and not so much for rigid purposes of classification. In other words: talking about the individual presupposes the presence of the other two operators, the collective and the technological.⁹ As such, one of Stiegler's claims is that philosophy fundamentally questions the meaning of technology, or alternatively: 'the actual object of philosophy is therefore technology.' (Stiegler, 2014, p. 34)

In modern society, which is dominated by technology, the unclear role adopted by politics in relation thereto is problematic for Stiegler. In his view, politics not only relates to the dynamics of the relationship between the collective and the individual (in the classical sense of a fair distribution of prosperity and goods), but encompasses all three domains, given that we as humans are essentially *technological* in nature. In neo-liberalism – the predominant economic model, and essentially a competitive one – politics places technology at the mercy of a market aimed at satisfying urges, thereby reducing the individual and the collective to consumers instead of citizens: 'The main problem in industrial society is therefore modifying the behaviours of individuals who make up society and who are no longer called 'citizens' but 'consumers', while the object of consumption – the commercial goods – have become the predominant operator in the socialisation of those individuals.' (Stiegler, 2014, p. 107) Unilaterally thematising cognition and problematising the role of technology therein from the perspective of technology alone is insufficient to make the urgent need for Digital Studies palpable. Using Stiegler's model, I would also like to emphasise the (albeit inseparable) roles of the individual and the collective by outlining the contours of the political aspect, reflected in both neo-liberal economic globalisation on the one hand, and neo-conservative politics on the other. I hope to clearly show that these seemingly diametrically opposite views are directly related. Because the three operators are discernible yet inseparable, I will

⁹ An interesting and more feminine variant on human beings as technological apes is the publication titled: 'The artificial ape: How technology changed the course of human evolution' by Timothy Taylor. Ignoring whether they do so intentionally for now, technology philosophers generally tend to place a more masculine emphasis on paleo-technology (spears, fire, iron, etc.). Taylor points out the externalisation of the womb via the baby sling, effectively turning humans into artificial marsupials. It was this innovation, he claims, that allowed women to give birth to partially-grown offspring, permitting the capacity of the brain to increase. This represents the most literal impact of the externalisation of 'the Body', being internalised by that very same body by allowing babies with bigger brains (i.e. cognitive ability) to be born. Taylor, T. (2010). *The artificial ape, how technology changed the course of evolution*. New York: Palgrave Macmillan.

associate them where possible with the element of technology. To illuminate the political aspect (the legal mediation between individual and collective) I draw mainly from the work of the above-mentioned philosophers Zygmunt Bauman and Lieven de Cauter.

Following Zygmunt Bauman leads to a confrontation with the reality of contemporary politics, which lacks an unambiguous orientation for guiding our behaviour. In his publication titled 'Liquid Times: Living in an Age of Uncertainty' he lists five developments that contribute to modern (and post-modern) uncertainty. (Bauman, 2012) Firstly the transition from solid to liquid modernity, which means that social structures alter more quickly than people can adapt to them. Secondly, the separation of power and politics: politics outsources its duties to market parties, thus reducing citizens to consumers. Thirdly, the abolition of the principle of solidarity, and by extension the fourth and fifth element of posthistory: there are no longer any horizons that provide direction to long-term actions. All action focuses on the present moment. And lastly, hyper-individualism, reflexiveness: all responsibility lies with the individual, who is responsible for assessing all the possibilities within the uncertainty of contemporary life, and must remain flexible. (Bauman, 2012, pp. 15-19) Bauman then summarises the development of these five perspectives using three metaphorical archetypes: the gamekeeper (Christian Middle Ages), the gardener (rational modern age) and the hunter (liquid modernity). 'We are all hunters now, or told to be hunters and called/compelled to act like hunters, on the penalty of eviction from hunting, if not of relegation to the ranks of the game,' Bauman analyses. (Bauman, 2012, p. 132) Merging these five orientations described by Bauman and the metaphor of the hunter and relating them to the 'Button' produces the image of the citizen as consuming photographer, or photographing consumer. Let me explain.

The scope addressed by this paper includes the fact that *what* we know is determined above all by *how* we know it. By saying so, I do not imply that the camera is the 'culprit' responsible for liquid modernity, however it does serve as an example of how tightly our cognition (via photographic and other devices) and liquid modernity are interwoven. In the nineteenth and early-twentieth centuries, the camera was primarily a tool for documenting our world in a miniature format – conservation of the present. Such usage was the embodiment of rational modernity. We also became more aware of transience, because the 'ghosts' of the past at once reminded us of how things used to be. (Munnik, 2013, p. 218) Cameras were mainly pointed at the world around us, and its documentation in a mini-

museum, or in the words of Susan Sontag: 'The most grandiose result of the photographic enterprise is to give us the sense that we can hold the whole world in our heads — as an anthology of images'. (Sontag, 2008, p. 11) Here, Sontag refers to the unification of hunting and adventure in the act of photography – we 'shoot' a picture, after all. The elite hunting for the 'big five' in Africa, for example, has been replaced by photographic safaris accessible to all, either in Africa or in any historic city in the world. The camera has made *tourists* of us all.

The first photographers literally hid beneath a cloth, and it is from within this unintended form of modern camouflage that they documented the world as distanced and unseen observers. Modern mobile phones have two lenses, one aimed at the surroundings and one included specially for taking self-portraits, or 'selfies'. And here is where Bauman's reflexiveness, or hyper-awareness, rears its head: plunging neutral, stalking, 'hunting' observers who are rationally (and operationally) mapping out the world into hyper-individualism. These two variants form yet another complementary diptych, characterised by an ever-incomplete collection. Neither Enlightenment nor Romantic, the camera is both. This act of collection harbours one of the disciplinary forces of photography: the fact that we take ownership of the photographed object, but that the hunger to do so can never be satiated. In Sontag's words: 'It means putting oneself into a certain relation to the world that feels like knowledge — and, therefore, like power.' (Sontag, 2008, p. 12) Whereas it was first the religious and rulers who determined the subjects of art, the development of the nation state shifted this role to the art academy. These institutes of civil edification were then forced to relinquish their role as protectors of good taste to the camera, which allowed individuals to determine for themselves what was worth photographing. The politics of an academy (in the sense that it dictates aesthetics) was unwittingly outsourced to citizens, who became image producers and consumers. The world became a supermarket of images. Just as for rulers and popes, power is addictive (or corrupting), and as despotic sovereigns our own autobiographies are the key determinant.

Our lust for images can only be satisfied by going hunting again and again, eliminating the need for solidarity with others. Although the camera emancipates us from authority, it reduces all others in our photographs to generic props in the concatenation of the eternal now. Whereas Bauman continues to label politics as the operator that outsources power and is therefore responsible for liquid modernity, it may actually be the disciplining by photographic and other devices that citizens adopted long ago, which would explain why

they find the development less problematic than Bauman. In other words: through the camera, we made our acquaintance long ago with the five features critically examined by Bauman. In this light, 'liquidity' is nothing more than a risky adventure in the eternal now of the hunting grounds of visual and illustrative reflexiveness? Where the cares of others are no concern of ours, because in the Kingdom of the Ego all are subservient, and all consumers like infantile Sun Kings?¹⁰ The 'Nikon' name, one of the largest camera manufacturers, is a combination of two brand names resulting from the merger of two Japanese companies. However, the slogan 'I am Nikon' that featured in the camera manufacturer's advertising campaigns constitute an ironic etymological coincidence, as in Japanese, *nikko* means 'sunlight'. Is the slogan 'I am Nikon' therefore surrealist cryptography for 'I am the Sun King'?

The portable camera, a representation of modern liquid times, suggests a freedom ideal: one that may be risky and uncertain, but due to the archetypal promises of commerce and adventure, one in which anybody capable of a little 'calculation' can emerge successful. (Flusser, 2007) Paradoxically enough (as with many modern phenomena) it creates an 'image' of others and the Other as outsiders, as objects. Cameras turn people and events into things, and it is in this sense that a comparable development is discernible in photography as in the modernity described by Bauman, from stability to liquidity. The first photographers – with objective, descriptive intentions and who were obliged to carry an entire darkroom with them – saw others and the Other as exotic and exciting, and took their portraits with a naive deference. In the Kingdom of the Ego, any others who stop behaving as a mere prop become a potential threat – others cannot, after all, incorporate or understand the 'rules' of the Kingdom of the Ego. In our own virtual realms, we can identify with rulers on the other side of the world, but not with vagrants or beggars. And whereas liquid modernity promises us (potentially virtual) castles through neo-liberal economic global politics, it simultaneously imposes a conceptualisation of the Other as a (real or potential) threat, and a battle where it is every man for himself. Because, as Lieven de Cauter seems to suggest in 'Metamodernity for Beginners': if everybody is a ruler, then nobody is.¹¹ And where there is no ruler – an authoritative power to which

an entire community is subject – there can be no Law, as he deduces from the writings of Hobbes and others. (Cauter, 2015, p. 104) Neo-liberal economic politics therefore contains within it, like some kind of conjoined twin, a neo-conservative policy that is aimed primarily at security. This Hobbesian natural state as a political guideline means that if nobody recognises the ruler, we live in anarchy (i.e. a state of exception). Or, if the ruler overthrows the rule of law, we essentially live under a dictatorship (state of emergency). Here, too, the doctrine of liquidity seems to apply. Both states – of both exception and emergency – are simultaneously active in the world, which confronts us with phenomena such as 'permanent relief' for refugees, and sites such as Guantanamo Bay for (suspected and other) terrorists. France and Turkey are in a state of emergency, as of course are large parts of the Middle East, Africa and Afghanistan.

However there are also less dramatic examples: cities are no longer protective zones, but have become concatenations of strongholds and border regions that separate 'inside' and 'outside'. They are fortifications (still according to De Cauter) of architecture and urban engineering, or speaking euphemistically: a 'villagisation' with distrust as its fundamental assumption. The forcibly-included public areas have been reduced to commercial spaces where vagabonds and beggars disturb our shopping experience. Because public spaces cannot be fenced in, cities are full of cameras that monitor our security. Or in De Cauter's words: These are the post-historic middle ages, where neo-theocracy – a form of capitalism characterised by almost feudal practices (farmers as the serfs of multinationals, and child/slave labour) – politics of fear, security and repression (i.e. violations of privacy and constitutional rights) and, of course, 'fortification' go hand in hand.' (Cauter, 2015, p. 194) Unifying De Cauter's metamodernity (which, although he uses different terminology, shares many similarities with Bauman's insights) with Sontag's analysis of photographs, photography and photographic devices, may mean that in the industrialised west, in the Kingdom of the Ego, we have internalised both states of exception and emergency: those who are not deemed to be *terrorists or refugees*¹² have become *tourists*. However according to Sontag, we are insatiable in the colonisation of the world around us, and we are tossed about on the waves of anarchy. We acknowledge no higher law, we operate devices and cameras: pocket-sized machines that allow us to hold court. At least this is the assumption of tourists and the promise of commerce, making us rulers of our own visual/other kingdoms, empowering us to transcend the rule of law and

¹⁰ It is probably no coincidence that the frivolous, early-20th-century work by the child of a wealthy family and amateur photographer Jacques-Henri Lartigue did not become part of the photographic canon until 1964.

¹¹ Cauter, L. d. (2015). *Metamoderniteit voor beginners, filosofische memo's voor het nieuwe millennium [Metamodernity for beginners: philosophical notes for the new millennium]*. Nijmegen: Vantilt.

¹² In modern open spaces, potentially the equivalents of mediaeval vagrants and beggars.

declare a state of emergency. Whatever I decide, the rest must follow. Welcome to the metamodern schizophrenia of the selfie photographer, who is simultaneously both *ruler* and *anarchist*.

Is this a sobering reality? Stiegler also emphasises how political disengagement permits technology to be dominated by the market. The contradictory implications of this neo-liberal market ideology for the collective and the individual mean that the ideology overpowers the other two elements, precisely because the technological and the intrinsic nature of technology are an accelerating impetus for innovation. It is under the banner/promise of freedom that that very same freedom is denied us. The cultural industry is what conditions our cognition, behaviour and ideas: 'The society of industrial temporal objects thus transforms our existences into a prefabricated series of clichés that we string together without perceiving very much.' (Stiegler, 2014, p. 99) In other words, we replace our own transience with that of the cultural industry, the adoption of which means we no longer determine how we perceive our time, but that we are governed by technology. This is the point where I believe technology becomes problematic. Because politics has surrendered itself to the market, as it were, all that remains for the government as ruler is power, almost compelling it to designate any 'other' as a threat in order to legitimise its role as protective authority for its citizens. (Cauter, 2015, p. 56) In this case, a curious paradox manifests: in the name of freedom and the emancipation of the individual that is reserved for the market, politics simultaneously develops an opposing (or perhaps even extended) free-market ideology, a perspective of that same individual as a natural state of 'every man for himself'. Do neo-liberal market ideology and neo-conservative power politics form an anti-humanist diptych?

3. CONCLUSION

My dear Luca and Zenne, these speculations are far from cheerful. But is there no escape? Where is the optimism I mentioned above? Lieven de Cauter offers us something (including a curious footnote by Kant) by permitting fictions as conditional possibilities.¹³ We must *pretend*. 'It may not bring about any collective freedom, but it does bring

relief. The plan is therefore an *as-though*: we act as though there is a plan that we can implement, but if we let the plan go, only tyranny and chaos will reign.' (Cauter, 2015, p. 140) This means that for De Cauter's sake, we must be able to imagine cosmopolitics, *as though* it were a possibility. Returning to the Body, Book and Button model, it would mean that, according to Stiegler, they cannot be viewed independently of one another. The above implicitly reveals that although 'the Button' and 'the Book' compete with one another, they seem to forget about (or at least neglect) the Body as a medium. This is where Bauman's metaphor may break down: in traditional hunter-gatherer culture the body was sacred, as was that of the opponent, be it animal or human. It is the introduction of the device that denudes the body of its spirituality, objectifying it. Such a view may, however, be too dogmatic an interpretation of his metaphor. For Bauman, too, gives us implicit hope: we must *taint* modernity with *ambivalence*, eliminating its ability to become dogmatic or misleading.

This paper aims to emphasise this disproportionality in cognition and media, and ideally also propose the reinstitution of the body as an earthly sacrament. De Cauter harks back to a plan such as was made possible by Utopia: a possibility of linear and historic writing, not as extremism, but to 'act as though' it is possible. Bauman implicitly gestures to the *artistic*, by proposing the *ambivalent* as a strategy. Applying these two pieces of advice (ambivalence and 'acting as though') to the Button, we find some solace in media philosopher Vilém Flusser, whose 'playing' against the camera is seen as an argument for experimental photography. (Flusser, 2007, p. 84) But Flusser, too, points out photography as illustrative of a world dominated by devices. The 'bureaucratic machine' is no coincidental term. Contemporary research methods, too, are a product of machine-based thought: find the information, follow the instructions/method and the correct answer will emerge automatically. In short: follow the programme. In scientific research, this therefore means implementing the method as purely as possible.¹⁴ Again, the Button is taken as a *pars pro toto* for our post-historic liquid metamodernity, of which our institutes are just as much a part as a 35-mm camera.

¹³ 'We do not know what things are like for the inhabitants of other planets and their environments. However, if we are to properly bear our natural responsibility, we can pride ourselves on the fact that we occupy no meagre rank among our neighbours in this residential building we call the Earth. Perhaps every individual among them can fully realise their purpose in life. But not us: only our species can have such hope.' Ibid. p. 138

¹⁴ In his work titled 'Cosmopolis: The Hidden Agenda of Modernity', Stephen Toulmin conducts a comprehensive analysis and reconstruction of this phenomenon using influences from Isaac Newton and René Decartes. Toulmin, S. (1990). *Cosmopolis: The Hidden Agenda of Modernity*. New York: The Free Press.

All three media – the Body, the Book and the Button – offer us specific opportunities to grapple with our existence in the world, our cognition. All three, however, also have the tendency to overpower our own cognition and existence, resulting in a lack of freedom. Are we walking a tightrope over a ravine? Luuk and Jan, visual artists as freedom fighters, teach us that this is possible, however. I wrote the above in my role as a guardian, a father wishing to offer guidance to his children in the contemporary jungle of post-history. But if ‘pretending’ and ‘playing against the device’ are to constitute the escape clause, then the lesson you have taught me, Luca and Zenne, is that we must pretend with utter abandon. Passionate¹⁵ make believe, and deadly serious play! I took this lesson to heart in the writing of my Master’s thesis.

If I wish to escape the discipline of (in this case) research methods, I must, in any case, *act as though* it is possible: this thesis is therefore tainted with *ambivalence* and *plays against* the camera. It offers no absolute answers (in that sense, the attempt is a *failure*) however it investigates alternatives to *criticism*. In other words, it goes in search of new possibilities for a criticism of discretisation that originates from discretisation itself. This experimental, ambivalent Master’s thesis is the result of ordinary fundamental research on the one hand, and a deadly-serious parody of it on the other. But Luca and Zenne, please do not mistake this paper for an artistic act of defiance. Among the three categories of refugee, terrorist and tourist, it is of course the product of a *tourist*.

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¹⁵ It is with some hesitation that the word ‘passionate’ was chosen here, given its connotation with the unilateral popular usage referring to individualistic ‘exuberant expression that takes heed of nothing and nobody’. Here, ‘passionate’ is used in its original sense of both ‘fervent’ and ‘with suffering’.

