JUXTAPOSE: AN EXPLORATION OF MOBILE AUGMENTED REALITY COLLABORATIONS AND PROFESSIONAL PRACTICES IN A CREATIVE LEARNING ENVIRONMENT

Darren Menorath[1] and Laurent Antonczak[2]
[1]*COLABxMINA (AUT), Auckland, New Zealand*
[2]*Auckland University of Technology (AUT), Auckland, New Zealand*

ABSTRACT

This paper examines the state of the art of mobile Augmented Reality (AR) and mobile Virtual Reality (VR) in relation to collaboration and professional practices in a creative digital environment and higher education. To support their discussion, the authors use a recent design-based research project named *Juxtapose,* which explores tensions between the digital and the analogue. Also *Juxtapose* explores the possibilities of interaction resulting from the use of multiple markers to create a playful semi-tangible object, whilst proposing a networked model of content creation in *augmented space*. In this paper, following a narrative and empirical base, the authors argue that their approach is very similar to Wenger's concept of legitimate peripheral participation leading to active participation within communities of practice and can be beneficial to redesign and improve some of the creative curriculum in higher education.

KEYWORDS

AR, VR, mobile, higher education, community of practice, prosumer

1. INTRODUCTION

Augmented Reality (AR) can be considered "the overlapping of virtual information in real space (…) mixing virtual objects generated by computers with a real environment, generating a mixed environment that can be viewed through any technological device in real time." (Redondo, Puig, Fonseca, Villagrasa & Navarro. 2014. p. 16). The project *Juxtapose* (Menorath, 2016) focuses on print-based AR which serves as one of the main components of Mixed Reality (MR), an umbrella term for "technologies that involve merging of real and virtual worlds" (Milgram, 1994. p.3). Because an *augmented space* (Manovich 2002) relies on the Internet to display and connect to others in an AR environment, this paper investigates Internet and creative collaboration, more specifically how communities provide one key aspect: a participatory model of creating art and design. This exploration opens up discussion around AR content and how it could potentially be made and whom it could be made by, and what AR practices may look like according to current creative and collaborative movements in relation to universities curriculum design. This paper is organised into four sections: the context; the methodology; the design practice, development and critical analysis; and the conclusion.

2. CONTEXT

This first section discusses Danvers (2003) idea that designing transformative learning environments involves cultivating a sense of supporting and encouraging student creativity. The topic of an augmented space and its relation to the theoretical context of everyone being able to create their own AR will be discussed in the second part.

Due to the lack of public knowledge and very limited course development around the creation of marker-based AR, many people think that integrating AR into everyday objects is complicated. By identifying these issues alongside the development of smart devices, AR companies such as *Layar Creator* (2009), *Qualcomm Vuforia* (2011), and *Augment Desktop* (2016) have created platforms and apps that allow anyone to quickly produce AR content. Free user-friendly AR tools that are available to the public, open up the opportunity for designers, students and Internet creative groups to take advantage of the technology and make it their own. *Juxtapose* [1], a design project which aims at concealing print-based and digital content, contributes to the movement of democratised AR by presenting an artefact that exemplifies simple AR techniques that anyone can do themselves.

Also, being a hybrid publication that merges print tangibility and virtual augmentation, *Juxtapose's* artefact raises some question about the way higher education curriculum are designed and, currently, lacking of opportunity to allow for cross-disciplinary delivery. Though this project looks specifically at print based AR publication, its technical function can be applied to any other content, including topic such as engineering or mathematics. This draw on Danvers' (2003) notion who argues that designing transformative learning environments involves cultivating a sense of supporting and encouraging student creativity:

> "Creativity thrives in an atmosphere that is supportive, dynamic, and receptive to new ideas and activities. The learning environment has to encourage interactions between learners in which: action and reflection are carefully counter-balanced… stimulating inputs and staff interventions interwoven with periods in which learners develop ideas and constructs at their own pace." (p. 52)

The concept of an *augmented space* could soon be a reality with the development of AR-based technologies such as Google's *AR smart lenses* (2014) and Microsoft *HoloLens* (2016). Cara Kahl (2009) identifies prosumers[2] (producer + consumers) needing to be addressed in the wider context of education, implying that, "Social groups play an integral part in establishing creativity. Their perception and evaluation processes may be hard to decipher in an increasingly networked world, but ignoring this complexity does not necessarily facilitate scientific comprehension of creativity". Developing a creative learning culture can be achieved by using an ecological approach to curriculum design that identifies the key components required to support the graduate outcomes of a course. According to Danvers concept of radical pedagogy (2003), an example of an ecological model of education is Cormier's (2008) rhizomatic learning for enabling self-determined learning communities (cMOOCs) based upon the analogy of the decentralised root structure of rhizomes.

Internet communities provide some models and context in order to create AR content in the situation of an augmented space. Cyber communities such as *Vaporwave* (Menorath, 2016) provides a model of how Internet communities function and create AR content in the context of an augmented space. This participatory model of content creation presented in the *Virtual Plaza* identifies how individuals will gravitate to Internet forums as a form of collective guidance and inspiration with AR opens up a public participatory design space that disrupts traditional boundaries between creator and consumer, academia and industry. In fact, *Juxtapose's* design model incorporates some aspects of *Vaporwave*'s model, such as using social media platforms to enhance members' connectivity and exchange, whilst highlighting the growing use of a *prosumer* model in today's sub-cultures. Hence, the scholarship of technology-enabled learning (SoTEL)[3] which improve teaching, its effectiveness evaluation, excellence aspiration, and to make sure that all learners can get pertinent and relevant results, as explained Frielick in *Education Review* (October 2016).

Furthermore, Cormier (2008) has proposed an ecological model for enabling self-determined learning communities. Pachler, Bachair and Cook (2010) have also linked the concept of an ecology of resources model for enabling learner-generated contexts via mobile learning. Within our framework for creative curriculum design, *Juxtapose* uses an ecology of resources based upon mobile social media to facilitate triggering events for cultivating participants creativity.

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[1] Menorath, D. (2015). Juxtapose: An exploration of the technical and aesthetic potential of print-based augmented reality design. Auckland: Auckland University of Technology.

[2] A term coined by Futurist, Alvin Toffer meaning "one who is both producer and consumer" (Ritzer, Dean & Jurgenson 2012. p.2).

[3] Retrieved from http://www.educationreview.co.nz/magazine/october-2016/researching-teaching-the-importance-of-sotl/

3. METHODOLOGY

Due to the complex nature of the technology development, the authors employed an empirical and heuristic form of research which allows a systematic approach to the practice-led research, and that utilises a rinse-and-repeat method supported by a phenomenological framework. The broad framework for all design-led research is analysis and synthesis, based on the authors interpretation of the tacit, explicit and new knowledge gained through case studies and practice. However, the collaborative element of such projects needs to be clearly defined, then students experience of being active members within an authentic professional global community of practice can provide new learning experience for most of participants, including professionals or amateurs.

The authors also highlight the need for establishing a significant level of trust among the participants of global collaborations that takes time to establish. This trust can be nurtured through the use of mobile social media both asynchronously:

> "Design projects must ultimately pass through three spaces: Inspiration, Ideation, and Implementation (…) Projects will loop back through these spaces—particularly the first two— more than once as ideas are refined and new directions taken" (Brown, 2008. p. 4).

This refers to Puentedura (2014) who developed a simple framework that identifies four levels of educational technology adoption: SAMR framework (Substitution, Augmentation, Modification, Redefinition). Cochrane et al. argue that the SAMR framework aligns with a conception of three levels of creativity: replication, incrementation, and redirection. Within an educational context using new technologies, for example modifying activities and assessments to involve student-generated projects and the learning experience by using new technologies to redefine practice, the SAMR model is one that can usefully be applied to the design of mobile AR/VR learning activities. In contrast mobile AR projects can involve the "incorporation of student-negotiated projects that harness the geolocation services of smartphones to create an AR environment for mobile content production and sharing, thus representing a redefinition of previous teacher-delivered content and teacher-directed assessment and course activities" (Cochrane et al., 2016).

4. DESIGN PRACTICE, DEVELOPMENT AND CRITICAL ANALYSIS

4.1 The Software Used

The current issue with most AR software is the unfamiliarity of the user interface (UI), and the availability of resources such as software tutorials. *Juxtapose* is created with Qualcomm's software development kit (SDK) *Vuforia* (2011) because it provides a plethora of information and guides on how to use their product, whilst having a Unity[4] SDK option, allowing users the flexibility to create both simple or code-aided AR. *Juxtapose* is sitting on the cusp of coding, programming (hard science) on one side, and designing user experience, creative interfaces (soft science) on the other side. As of this moment, AR is predominately taught in creative technology labs such as MIT's Media Lab[5], AUT's CoLab[6] and Georgia Tech GVU[7]. While the artefact lacks in coding and interactive components, *Juxtapose's* hybrid publications serve as a precursor that encourages other *prosumers* to take print-based AR beyond the conventional and to encourage higher education to allow more permissibility in-between faculties, schools and departments.

[4] Unity is a 2D/3D game developing platform that is highly flexible in terms of platform compatibility.
[5] http://fluid.media.mit.edu/projects/smarter-objects
[6] https://colab.aut.ac.nz/
[7] http://www.gvu.gatech.edu/research/labs

4.2 Process of Design

Correspondingly, the challenge for higher education is to adopt a different learning and teaching model and to open up conventional and predominant Learning Management System (top-down, teacher/lecturer-centred) for more flexible and interaction for the participant/contributors. This can be done with more emphasis on fostering a global localisation community of practice and reassessing current practices.

This form of cyber participation will be a key aspect in the future creation of AR/VR in an augmented space. Nevertheless, it is important to note biases present in the different social platforms and how themes specific to the platforms affect the popularity of the design. From observation and experience, the authors identify a serious lack of degrees structured in ways to incorporate this kind of approach also.

During the production of the zines and AR content, there was a re-occurring issue regarding the tensions between publication and smart device, due to different ways each medium display information. *Juxtapose* embraces and explores this tension between screen and book by using glitches as part of the experience. This kind of mindset, called heuristics approach in academia, is not often supported, nor taught in curriculum, especially outside of creative ones. Because of their constantly changing nature AR and VR are challenging higher education paradigm, alike pointed by Sir Ken Robinson in his TED Talk (2010) *Changing education paradigms.*

Juxtapose as a project could have benefited more from programming commands in its AR content on *Unity*, and was restricted due to the limited knowledge of C# from both authors. As a graphic designer, coding languages such as C# was not taught during their different time of studies in Applied Arts (France) or Art and Design (New Zealand). Although Cochrane et al. argue that the creation of mobile AR environments is relatively simple, this investigation suggests that future graphic designers incorporate disciplines outside of their conventions, such as programming and AR. Michael Rock adds to this notion in Albinson's, Giampietro & Leslie's (2011) book, *Graphic Design: Now in Production* stating: "The true investment is the investment in design itself, as a discipline that conducts research and generates knowledge—knowledge that makes it possible to seriously participate in discussions that are not about design" (p.18).

This point is not in contradiction with earlier statement praising AR/VR simplicity. It openly and precisely addresses the dichotomy of achieving quickly some basic results and struggling while dealing with more complex content, or formal aspects. At this point of the discussion, it is important to acknowledge the potentials of AR/VR and the crucial that could play education is enhancing SoTEL and fostering multiple fields perspective.

5. CONCLUSION

In this paper, the authors presented and contextualised the possibility of indie-based hybrid products development and more specifically through *Juxtapose* which exemplifies the possibility of AR/VR and content being created and dictated not only by designers, but also by various empowered creative groups, by *prosumers*. Research conducted for *Juxtapose* looked into three key aspects that could potentially play a part in customised AR for a broad public in the near future: AR mode of creation (*Vaporwave*), the democratisation of AR software and design tools that encourages a possible participatory design space, and the tension between physical and virtual (smart device and image marker/AR, the smartphone, and print).

This investigation led the authors to three conclusions relating to the technological and educative aspects of AR/VR: the use of AR in conjunction with *Vaporwave*'s model of creation opens up notions around a participatory design space that disrupts traditional boundaries between professional and amateur/creator and consumer/professional and students; this investigation also suggests that AR as creative medium plays an integral role in graphic design development, enriching those who incorporate it into their practice and it as a profession as well as in any curriculum development in higher education; lastly, AR is one of many mediated reality technologies that will shape the way information will be communicated in the future. Designers/students must be ready to explore this medium, collaborate with others and create immersive works that redefine current AR norms. This investigation concludes by suggesting that teaching AR in graphic design schools can help enrich the profession and could potentially be further explored and developed in the future. The authors agree with Maeda (2016) who argue that "we must consciously invest in education to develop a more hybrid perspective on creativity in the 21st century: Technology x Business x

Design." and that designing creative learning environments involves not only facilitating student creativity, but also modelling creative pedagogical practice. It is also important that higher education foster more collaboration between academia and industry by correlating students' daily experiences and transfiguring them into a new learning environment, a mixed reality space full of opportunities.

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