P/REFERENCES OF DESIGN

DESIGN FICTION GRAPHIC NARRATIVES: DESIGNING WITH RATHER THAN FOR EXPERIENCES.

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ABSTRACT | The emergence of concepts such as pervasive computing, blended spaces, augmented and virtual realities, related here to technologies associated with so-called extended reality (XR), challenge many of the best practices associated with user-experience design (UX). In particular, the environmental qualities of XR technologies that require a strong synthesis of digital content with, and within, virtual and physical socio-spatial contexts challenge many aspects of product-oriented approaches to digital design. As interaction design (IXD) lecturers who have spent much of the last two decades focused on developing approaches and methods for teaching the design of digital products such as websites and mobile phone applications, we recognize that preparing students for future careers involving the design of XR systems requires reconsideration of theories and practicalities that have become entrenched over the recent past in digital design education and practice. Furthermore, as educators working in the Global South, we aim to engage with the constraints afforded by limited access to much of this high-end technology in a designerly manner. In response, this study addresses two objectives: firstly, to engage design students with technologies in a more systemic manner, focusing on interrelationships of socio-spatial temporal contexts and XR technologies, recognizing student's prior knowledge of UX while not being beholden to it; and secondly, to ensure a criticality in the resulting process towards design outcomes which extend beyond subjective speculation to incorporate evaluative reflection.

1. Introduction

As interaction design (IXD) lecturers who have spent much of the last two decades focused on developing approaches and methods for teaching the design of digital products such as websites and mobile phone applications within a user-experience paradigm, we recognize that preparing students for future careers involving the design of extended reality (XR) systems requires reconsideration of theories and practicalities that have become entrenched over the recent past in digital design education and practice. Here, we understand XR as a composite term for a collection of diverse digital fields unified by a focus on spatial computer interactions (Hillmann, 2021, p. 241). These include virtual reality (VR), augmented reality (AR), blended space design (BSD), as well as smart things and environment design.

Furthermore, within what we associate with the normative conventions of user-experience and service design practices, we have also begun to experience a lack of technique for adequately communicating and evaluating, high-level strategic thinking at the level of systems, services, and environments. This limitation, brought about, we would argue, by a product orientated legacy is a general concern for human-centred design practices highlighted by their struggle to address complex, large-scale systemic problems (Mani-Kandt, 2021). However, for XR design, due to its implicit focus on environmentally structured solutions, the need to ideate at a level detailing the value of systemic solution formation is a fundamental.

With these concerns and concepts as an initial point of departure, this study describes what we would refer to as the opportunistic design of a new teaching unit, positioned at the third year of a three-year digital media design program, taught in the Department of Multimedia at the University of Johannesburg. We refer to our approach as 'opportunistic' because while our essential responsibility was to deliver a unit that introduced students to XR broadly, and to IXD concepts and techniques relevant to XR, our recent teaching practices have begun to appreciate futures thinking. That is, design fictions (DFs) is broadly considered as a conceptual approach for projecting proposed complex design scenarios in accessible relatable, and evaluable forms. Furthermore, drawing on previous experiences teaching Internet of Things-themed projects, we have recognized the positive impact of visual storyboarding for the communication of complex, innovative solution systems. Lastly, while recognizing key differences between spatial and product-oriented design, we wanted to leverage student's prior knowledge of UX/service design research, analysis and strategic thinking and communication.

Consequently, and drawing on tacit and explicit objectives for the teaching unit, this study addresses two objectives: first, to engage design students with technologies in a more systemic manner, focusing on interrelationships of socio-spatial temporal contexts and XR technologies, recognizing student's prior knowledge of UX while not being beholden to it; and second, to ensure a criticality in the resulting process towards design outcomes which extend beyond subjective speculation to incorporate evaluative reflection. In this regard, the study articulates the key considerations that informed the design of the teaching unit, the application of the unit in the context of our experience teaching it, and a selection of reflections outlining a set of general insights and perspectives gained from these activities.

2. The Design Landscape of the XR Teaching Unit

This study, and its summative contributions, are contextualised within a taught unit of a third-year digital media design programme. As there are multiple conceptualisations of what digital media education can and should include, we will briefly provide an overview of the key design approaches and techniques that foreground the unit, and subsequently this study, from the perspective of how they are regarded in our programme.

First, our digital media programme emphasises a creative, socially aware approach to the design of digital services and systems. All students share a general digital media education that includes units dedicated to visual design, design thinking, critical design theory and professional practice but specialize in either

interaction design or digital arts. In this broad framing of the programme, the two module specialisations focus respectively on user experience design (UX) and filmic communication including but not limited to animation, motion graphics, video editing and video compositing. In respect to these two established specialisations, XR is recognized as an emerging set of design approaches and technologies that converge aspects of both interaction design and digital arts, and, it is anticipated, will become an ever more important focus in the education of future digital media professionals. Our UX approach, which all IXD students would have completed earlier in the year, is positioned as the design of interactive products and services that provide good experiences for their intended users. In the UX specialization, the notion of experience is informed by a range of critical, phenomenological and pragmatic theoretical perspectives but can generally be equated with systems and services that are enjoyable to use, are fit for purpose and enhance the everyday activities of the people who use them (Benyon, 2019). As exemplified in Table 1, the UX offering in the programme is structured on a generic design thinking process within a human-centred paradigm (Giacomin, 2014).

Table 1. Overview of UX module.

RESEARCH	STRATEGY	IDEATION	PROTOTYPING	EVALUATION	KEY CONCEPTS AND THEORY
Secondary research Ethnographic research methods Ecology Maps User modelling Customer journey maps	Problem framing Experience models Strategy framing Strategy ideation Customer swim-lanes Customer journey maps	User journeys Sketching Interface flows Task-models	Interface flows Wireframes Design comps Low-res digital prototypes	Paper-protypes Expectancy tests Cognitive walk-throughs	Landscape of digital technology. Business by design Experience Human-centred Design

Second, and within the larger UX module design process, customer journey maps (CJs) (Følstad & Kvale, 2018) are defined as visual, typically schematic, representations of an archetypal journey, and the service environment in which the journey takes place, that an aggregate of users (customers) of a service would undertake as they move from their initial point of entry to the successful completion of their engagement with the service (Adaptive Path, 2013). Typically, CJs reflect the users' journey, across multiple interactions, touchpoints and channels. In this manner, CJs can be considered as a type of service blueprint (Polaine, Løvlie, & Reason, 2013, p. 91) that emphasize the 'front-end' relationship between customers and a specific service.

As noted in Table 1, CJs are applied in two differing ways in our taught UX process. The first application is to map current services or environmental contexts, typically highlighting 'pain-points' and other opportunities for design intervention. The second application is the use of CJs to project an envisioned service or systemic solution. In this application, CJs provide the service context for the subsequent development of potentially multiple, composite digital, non-digital and blended products and environments. A critical point that we identify in CJs used in this manner, is that they are the key conceptual pivot in the design thinking process that both account for the data-driven, but inherently subjective framing of the design problem, and the responding proposed strategic and tactical approach for resolving the design problem.1 It is this second interpretation of CJs that is the ongoing focus of this study. Third, as described in Section 5, students were tasked with engaging with the specific XR practice of blended space design (BSD). BSD can be understood as a spatial view of IXD and UX (Benyon, 2014, p. 1) concerned with the integration of physical and digital spaces to create novel ways for people to engage with the world around them (Benyon, 2014, p. 80).

[1] This consideration draws on Cross and Dorst's notion of problem-solution conjectures in the resolution of wicked problems (Designerly Ways of Knowing, 2006, p. 80).

Lastly, in the context of this study, 'design fictions' refer to designed artefacts that embody and communicate concepts as opposed to offering any utilitarian function. While the concepts of DFs has its precedent in the discursive design fields of speculative design (Dunne & Raby, 2013), (Tharp & Tharp, 2018) and design fiction (Bleeker, 2009),2 in this study, DFs are framed in reference to an emerging set of design research approaches including metrofitting, (Fry 2017), projective research (Geldof & Janssens, 2014; Figueiredo, 2020), and anticipatory design research (Morrison, 2018) that employ DFs to enquire into "putative and contingent" states to "reach for tomorrow's worlds today" (Morrison, 2018, p. 125). The central tenet of these futural approaches is not to predict a definitive future but rather to anticipate possible, plausible futures ultimately relating to concepts of "preparation, expectation, and valuing something probable" (De Smet & Janssens, 2016, p. 2762). Towards this agenda, these anticipatory practices employ DFs to suspend belief about functional and immediate contexts and to challenge audiences to think beyond their expectations and comfort zones (Morrison, 2018, pp. 123, 129), and, as such, expose and explore the implications of plausible near futures (Lindley et al., 2015, p. 58). Examples of DFs in these approaches include highly 'scientific' mappings of future environments (Geldof & Janssens, 2014, p. 8), web-page blogs for a genetically engineered cyborg narwhale (Morrison 2018, p. 134), and streetscape leporellos describing a community's ideal future smart neighbourhood (Fenn, 2023). However, the work that resonates most strongly with our intentions for our students is O'Keefe et al.'s (2020; 2021) 'design fiction storyboards'. In these works, the aforementioned authors utilize graphic storyboards in rich visual narrative sequences to articulate a 'speculative blended experience'. Key to the effectiveness of these near future narratives is the situatedness of proposed blended technologies within very relatable, social worlds, be they the experience of a tourist attending a garden show and being gifted a digital seed to 'grow' on their computer back home, or an audience providing real-time feedback of a standup comedian performances via their smartwatches 'laugh-o-meter'.

3. Methodology

The method of the study is premised on constructive design research (CDR) (Zimmerman et al. 2007; Forlizzi et al. 2008; Zimmerman & Forlizzi 2014; Forlizzi et al. 2014), a general methodology for practising research through design or in our case, research through design teaching. The research contribution of CDR is concerned with holistic practice, that is, how researchers have framed and responded to complex problems and how they have negotiated the various paradoxes, conflicts, and intersecting perspectives to create the 'right thing' (Zimmerman et al. 2007, p. 498; Zimmerman & Forlizzi 2014, p. 177). In the case of this study, the 'right thing' was conceived as the teaching unit described in 5. The Design Process. Following, Zimmerman and Forlizzi (2014, p. 185) we first provide a high-level description of the range of activities involved in the design process of the teaching intervention. This process description is followed by an evaluative discussion reflecting on the *Process, Relevance, Invention* and *Extensibility* (Zimmerman et al. 2007, p. 499; Forlizzi et al. 2008, p. 27) of the designed teaching intervention.

4. Limitations of this Study

This study is primarily concerned with the methodological development of the teaching unit within the design contexts of XR, UXD and anticipatory DFs. As such, its focus is largely on our experience as researchers and educators aiming to contribute, through our teaching practice, theoretical knowledge on a novel design technique. As such, while this research involved design students in a classroom setting it does not focus on their experience, outside of reporting very generally on their response to the project.

[2] Although, they have earlier precedents in commercial conceptual designs, such as, for example, car shows, and avant-garde design movements such as Archigram and Memphis Design.

5. The Design Process of the Teaching Unit

In the second semester of the 2023 academic year, 46 third year IXD and digital arts students from the Department of Multimedia, participated in a 12-week module, the aim of which was to critically engage learners with XR technologies from a designerly perspective.

Two objectives were formulated which would provide the foundational structure of the course. Firstly, to expose and explore Design concerns to be found at the intersection of IXD and XR through the theory. This took the form of a series of lectures which provided a theoretical and philosophical backdrop to the socio-technological contexts of XR and a discussion of related IXD principles, methods, and models. The second objective was to facilitate a practice-based learner engagement using research-oriented design practices, with a futures focus, from a systemic / services perspective, rather than a product-oriented mindset.

As the focus of this research study, the remainder of this section provides an exposition and reflection upon this second objective including the research orientation and approach, process, and outcomes of the six-week student practical project.

5.1 Practice-Based Learner Engagement

In a developing economy context such as ours, access to both XR hardware and software, and the knowledge and skills resources required to facilitate authoring with XR technology, is limited. A challenge is thus presented in having students directly engage with XR technologies in the making of design solutions for the purposes of learning.

Historically in our department, when IXD has been taught through practical assignments at the third-year level, it has been with a product-oriented mindset where students will develop (product) design solutions within the general rubric of user experience design (UX). More recently, we have worked to integrate systemic and services-oriented thinking in the development of UX strategies which first require integrated multi-channel considerations using CJs, prior to detailing user journeys aligned to digital channels and digital product design. Additionally, storyboarding CJs has been featured in our teaching smart things projects.

The intent for the practice-based learner engagement with XR technologies was thus to further develop upon the use of CJ thinking with an emphasis on (probable) projective futures rather than merely mapping. Central to the development of this intent would be exposing students to David Benyon's taxonomy of spaces[3] and his work relating to the design of blended spaces in *Spaces of Interaction, Places for Experience* (Benyon, 2014) in the IXD and XR theory classes which would precede the student's practical assignment.

Building upon Benyon's blended experiences framework (ibid), the application of design fiction storyboards towards conceptualising speculative blended experiences by O'Keefe et al (2020; 2021); would serve to complete an initial framing of our intent for a practice-based learner engagement with XR technologies.

5.2 Approach

The research orientation was developed to underpin the practice-based engagement by students integrated research as making and research in making.

As making, design fiction served as the overarching design methodology for the student practical assignment with the requirement of designing an anticipatory concept for an 'extended blended experience'.

[3] Benyon's categorization identifies physical, digital, information, conceptual and social space.

This was alternatively expressed in the student assignment brief, as an 'extended reality experience' (XRE) that was to be 'anticipatory in its speculative thinking'.

The medium to be employed for the visualisation of the XRE concept was further required to take the form of a 'comic'.[4] The student assignment brief identified the summative deliverable as a 'graphic design fiction' and as such, a concept was to be considered as an object of design.[5] Here, the effort of research as making aimed to tell us something about how the future could or should be designed in general relation to an engagement with XR technology. In making, the XRE concept would function as a design product which would be iterated in various forms and at various times over the duration of the practical project, culminating in a user-centered evaluation of the concept expressed as a comic. This evaluative research in making aimed to tell students something about how their concepts could or should be designed for an engagement with particular XR technologies at play in their concepts.

5.3 Process

Students were required to conceptualise and communicated an XRE that enhances the experience of Halloween for tweens (9-13 years).6 Design criteria for the XRE included: the use of both physical and digital components; presentation of an African interpretation/styling of Halloween; inclusion of services, performances, locations, objects, software, broadcast media, etc. if necessary, and; highlighting the human experience as well as key technological attributes.

The XRE concept was to be developed by students, working in pairs, over six weeks progressing through a four-stage process identified as: 1. Ideate; 2. Extend; 3. Communicate; and 4. Evaluate.

The core of the process involved developing storyboards and comic visualizations, supported by the creation of CJs in a staged progression. In this way, the XRE concept was able to be iteratively developed while each of these activities/tools influenced each other's development. Table 2. provides an overview of this process including the time allocated to each design stage, a stage summary, activities, deliverables, and iterations upon the deliverables.

[4] Although 'comic' has in contemporary times been replaced with terms such as graphic novel etc., we use it here to contrast the visual literacies of comic art with the stylistic convention of storyboards.

[5] The XRE concept was required to be submitted for grading as an A3-sized printed comic.

[6] It is worth noting that Halloween is not a traditional South African holiday and has no established cultural practices.

Table 2. Overview of the Student Assignment Process.

	STAGE SUMMARY	ACTIVITIES	DELIVERABLES & ITERATIONS
IDEATE Week 1	Developing initial extended blended experience concepts (the XRE) using storyboard sketches	1. Storyboarding concepts at the detail level of stick figures and text boxes 2. Presentation of concepts for feedback	Storyboard (iteration 1) Storyboard (iteration 2)
EXTEND Weeks 2-3	Elaboration of narrative concepts in the analytic form of a customer journey	1. First draft customer journeys defining key interactions and channels for the XRE 2. Second draft journey enrichment *using Benyon's blended experience framework (2014) 3. Presentation of journeys for feedback 4. Final customer journey map deliverable	Customer journey map (iteration 1) Customer journey map (iteration 2) Customer journey map (iteration 3)
COMMUNICATE Weeks 4-5	Re-conceptualizing the customer journey as a graphical design fiction (comic)	1. Final hand illustrated storyboard for delivery 2. Creation of a first draft (70% complete) Comic for XRE concepts. ** 3. Presentation of XRE Comic for feedback	Storyboard (iteration 3) XRE Comic (iteration 1) XRE Comic (iteration 2)
EVALUATE Weeks 5-7	Audience evaluation of the graphical design fiction	1. Co-creation of evaluation tool with students 3. Evaluative-testing of XRE Comic 4. Submission of amended and final XRE Comic	XRE comic (iteration 3)

* Enrichment included consideration of ontology, topology, volatility and agency, and how they effect, and are affected by, channel correspondences as described in Benyon's Blended Experiences Framework (2014)

** At this stage, students were introduced to comics as a medium of communication

Concluding the student assignment project process, and this discussion of process, a user-centered evaluation of the XRE concepts was conducted using students to peer-evaluate the XRE comics. Prior to conducting the evaluation, a workshop was conducted, facilitated by the authors, where the evaluation of concepts, rather than a product by intended end-users, was discussed and problematized. Thereafter, students were engaged in an open session of brainstorming possible criteria for such an evaluation. Following the workshop, five criteria were taken forward for use in the peer-evaluation, where each XRE comic received feedback from five participants.

This evaluative research in making an effort constituted the last round of feedback and input into the iterative process of the development of the student's XRE concepts.

5.4 Outcomes

In total, 19 student teams received the initial assignment brief, and all went on to complete the design project.[7] All the student teams participated in the evaluative research and, with the exception of two student teams, all assignments were delivered on deadline. Table 3 presents the assessment criteria provided in the assignment brief and that was used in the grading of the projects.

Table 3. Assessment Criteria for Grading Student Assignments.

Quality of final design fiction narrative:	30%
Quality of final design fiction visualisation:	30%
Ability of customer-journey to communicate design concept visualisation:	30%
Timeously completed rough storyboard:	10%

Although a high degree of variation in quality was observable across the student teams, and across individual deliverables from across teams, all teams were able to develop and deliver XRE storyboards, CJs and XRE comics.

Three examples of student work from the design project are presented below: a storyboard (Figure 1), a customer journey map (Figure 2) and an XRE comic (Figure 3).

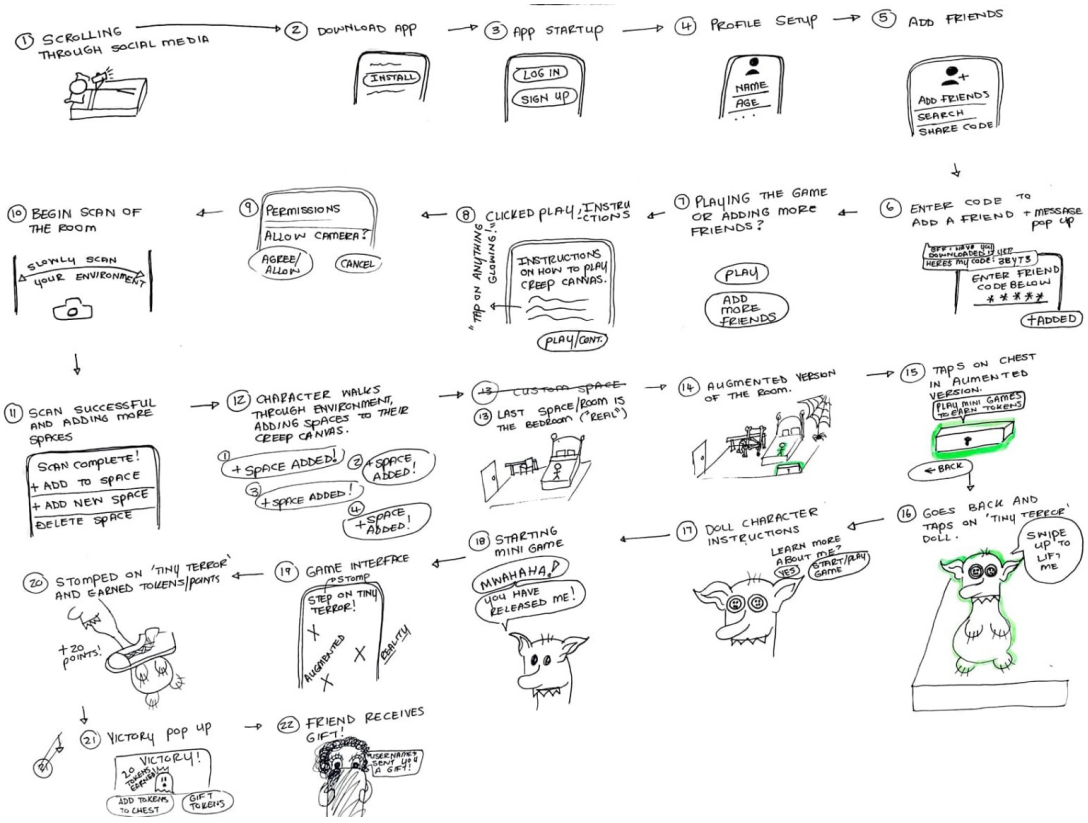

Figure 1. Example of a student group's storyboard. (Image: Sarah Davis & Devorah Hodes, 2023).

[7] The shift in language from 'student pairs' to 'student teams' relates to a small number of working groups being constituted by three rather than two students.

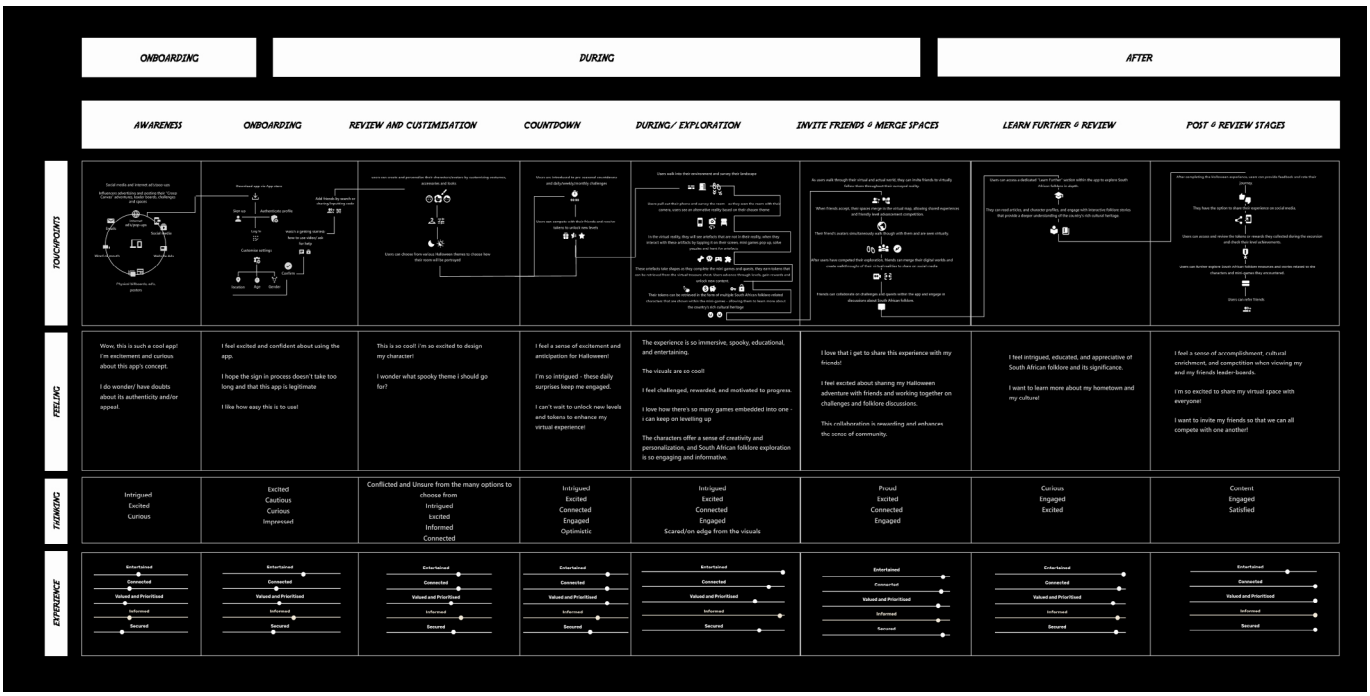

Figure 2. Example of a student group's customer journey. (Image: Sarah Davis & Devorah Hodes, 2023).

5.5 Reflection on the Teaching

Overall, we felt the project exceed our initial goals for the projected research effort and the various conceptual and theoretical threads converged in a rigorous yet enjoyable class to teach, and from all accounts to participate in as a student. At the end of the unit, students completed assignment feedback forms. The scope of feedback spanned both project objectives, the initial theoretical exploration of the subject matter and the practice-based learner engagement. Students were anticipated to have struggled more with the theoretical aspects of the unit however feedback was favourable overall.

Students are taught a number of units which focus on storyboarding and general visual design in the first and second years of their studies, however, comics as a communication literacy and visual storytelling format, do not currently feature within the curriculum of the digital media design undergraduate programme. To the student's credit, almost all teams were able to translate their storyboards and CJs into a competent comic format, but for future editions, teaching the formal elements of comic design should be factored into the structure of the unit in a considered way.

Lastly, the manner in which the user-centred evaluation played out in the design project was arguably light touch. While the workshop conducted was felt to be of significant value and peer-evaluation not without its benefits, [8] the evaluation was felt to lack the full force of feedback which can be experienced when garnered from detached participants.

[8] A notable benefit of peer-evaluation considered by the authors, is how participants might come to reflect more critically upon their own concepts and designs through the act of evaluating those of their peers.

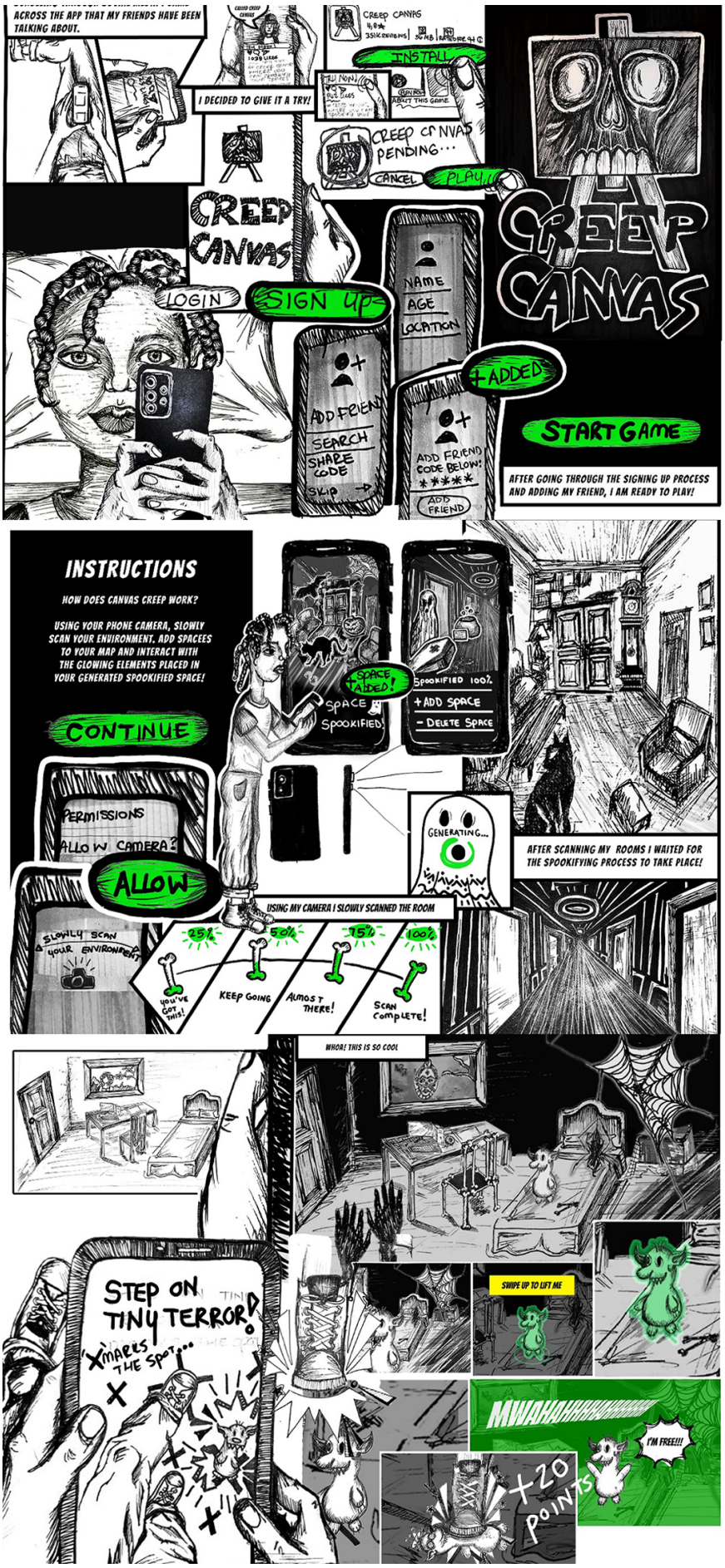

Figure 3. Example of a student group's final graphical design fiction (XRE comic) (Sarah Davis & Devorah Hodes, 2023).

6. Discussion

The discussion to follow draws upon the rich descriptions and reflections offered on the unit's enactment provided in the prior section, 5. The Design Process of the Teaching Unit. Three discussions will now be presented which, in line with the CDR methodology, have emerged through consideration of the criteria of Process, Relevance, Invention and Extensibility (Zimmerman et al. 2007, p. 499; Forlizzi et al. 2008, p. 27).

6.1 The Value of Narrative Design and Visualization in the Design of Concepts

When the design fiction storyboards, CJ maps and XRE comics are presented in the context of a process description they appear as stand-alone artefacts created in a fairly linear, step process towards a final design outcome: the XRE comic. This process narrative fails to capture two important aspects, or perhaps aspirations, of this teaching and research effort.

First, the role of the use of CJs should be understood and enacted towards enriching both the design fiction storyboard and visualization, not just the latter as the process suggests. Second, there is a particular way in which the DF narrative and the DF narrative visualisation aim to operate in relation to one-and-other both in their making and in what and how they communicate the final XRE concept.

Figure 4 provides an alternative to the process narrative by offering a visual description of the conceptual model intended for the construction of the XRE concept. In this view, both the storyboard (*1.1*) and the comic (*1.2*) are foregrounded and sit in connected relation to each other. The CJ map (*2*) is positioned as a background to both the storyboard and comic, while further acting in support of their relationship. Lastly, all three elements (*1.1*, *1.2* and *2*) are presented as parts which aim to constitute a whole larger than their sum, being the XRE Concept (*3*).

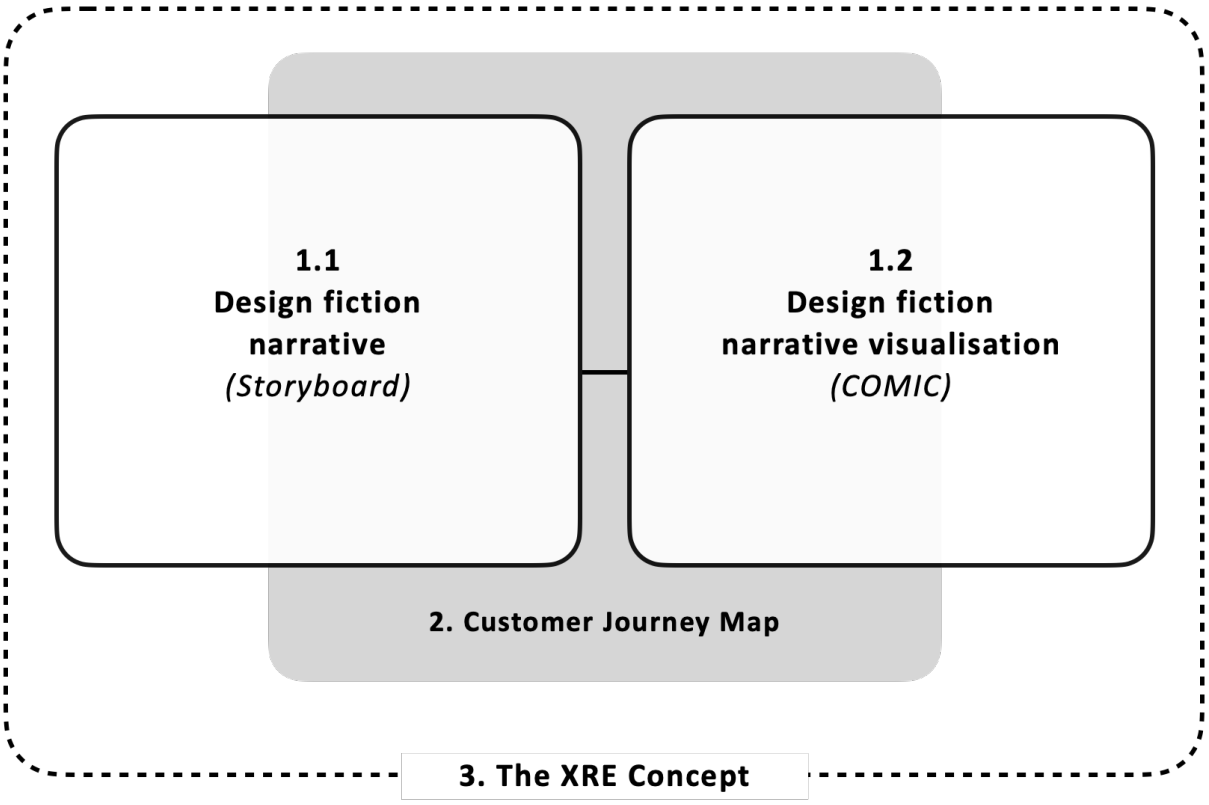

Figure 4. Conceptual model of the Extended Reality Experience Concept.

Although these parts were delivered at different stages in the process, they remained distinct deliverables required by the student assignment brief, and each received an equal weighting of 30% in the assessment criteria.9 As such, student's work produced over the course of the design project was graded as three equally weighted deliverables which, when tallied, constituted a grade given for their design of an XRE concept. Alternatively, if storyboarding and CJ mapping had been viewed as necessary activities, but ones which ultimately were throw-away aspects of the final deliverable (that is, the comic as XRE concept alone), then the weighting of the assessment criteria would have reflected as much.10

The reader will also have observed the introduction of a new set of terms to identify and describe the storyboard (1.1) and the comic (1.2) in Figure 4: Design Fiction Narrative and Design Fiction Narrative Visualisation, respectively. These terms denote a literal and functional relationship between two artefacts and / or two aspects required for the making and communicating of the XRE concept. Further understood as storyboard and comic, two individuated and very distinct kinds of artefact and forms of communication, force consideration and crafting of their relationship to support a mutual dependence towards a higher order of making.

This act of relabelling and (minor) distancing from a specification of artefact type, at least in the first instance and in the context of the conceptual model diagram, intends to open a door to a discussion and body of theory better suited to support the kind of relationship desired for the storyboard and comic in aid of concept design.11

Lastly, in this view, the CJ may come to be understood more deeply as a third part of a whole which allows for a broadened reach into solution possibilities at systemic 'scales' while also operating as a conceptual bridge between the DF narrative and the DF narrative visualisation. This becomes achievable without having to sacrifice the value to be found in a design object/product as an output of design in research and as research.

6.2 The Value of Design Fiction Graphic Narratives to the Communication of Systemic Solution Propositions

Reflecting upon the teaching engagement, a further insight regards the nature in which the graphic language of the comic narrative compliments and extends CJs. The foremost example of this is the ability of the artefactual presence of the graphic narrative to directly communicate the embedded role of the novel technology in the social fabric of peoples' lived experiences in a directly accessible manner. In contrast, the abstract schematic nature of the average customer journey can be unintuitive, particularly to a non-design audience. As such, graphic narratives allow for considerations of human experience, such as sensing, emotions, understandings, cultural dispositions, behaviours, and activities to be utilised as material in the creative process of design. From a pragmatic frame of reference, this allows for the meaning of the design to emerge through the communicated engagement between 'user-characters' and technological solutions. In this way, we argue, graphic narratives allow for designing with experiences rather than only designing for experiences. Tying these two concepts together, the relatable artefactual presence allows for the significance of the suggested experiences to be easily evaluated with audiences to ensure they resonate.

[9] The remaining 10% was reserved as a partial grade contribution for the timeous completion of a rough storyboard at the end of the Ideate Phase in week 1. The rationale being the necessary sequencing of the production of the storyboards, customer journey map and comic for the effective development of an XRE concept.

[10] For example, the storyboard and customer journey map could each have been weighted at 20% and the comic at 50%.

[11] The theory of 'message-content' and 'message-form' proposed by Tharpe and Tharpe (2018, p. 166) in their discussion of the design of concepts by way of objects, which intend to engage those with whom it encounters in critical dialogue over a particular subject matter or meta-discourse (Tharp & Tharp, 2018, p. 169) is the most likely candidate for future exploration given parallels observable between DF narrative and message-content, DF visualisation and message-form and their respective inter-relationships.

In a related point, the concreteness of graphic narratives, as opposed to the abstract nature of CJs, provides discursive positionality on how best to implement design strategy and tactics. By suggesting the application of these factors in 'real' world scenarios, these narratives prototype an approach that can be agreed upon, evaluated for impact, challenged, or discarded. Whether evaluating proposed experiences with target audiences and clients or within the design team, the value to testing the impact of solutions at a strategic level, prior to detailed product design, is of value.

6.3 The Value of Customer-Journey Thinking for Anticipatory Design Research Fiction

The application of CJs in anticipatory design research activities demonstrates a reciprocal value to that discussed in section 6.2. While CJs are well known to provide a method for the structuring of composite elements as a systemic response, they do so by foregrounding the designerly act of synthetically resolving that which is required to shift from what is, to what could be (Hobbs & Fenn, 2013, p. 200). From this perspective, CJs make visible the transformation of knowledge, facts and findings from prior research activities to futural narrative scenarios such that the 'synthetic integrity' of otherwise tacit strategic / design thinking may be interrogated by the traceability afforded by designing CJs (Ibid).12 Binding design fiction graphic narratives to an explicit and rigorous data-driven development of design strategy, as embodied in CJs, adds credibility to the design effort in general, and in particular, can help to negate any perception of conceptual weakness that might be implied by stand-alone graphic narratives.

7. Conclusion

This study explores, through teaching practice, how the converging theory and practices of UX and anticipatory design research can enhance an introductory XR teaching unit focused on the meshing of emerging technologies into the fabric of the human world. Through our experience of conceptualizing and teaching the unit, we discovered the following:

- Integrating CJs, and design fiction narratives in the form of storyboards and comics allow for highly structured, richly conceptualized and emotively communicated articulations of XR solution environments.
- Design fiction narrative visualisations are a powerful communicative modality for experience-led design.
- Design process associated with UX and service design, in which knowledge and facts are explicitly modelled into strategic design solutions, embodied in customer journeys, ensure design fiction narrative visualisations are based on rigorous research methods.

Looking to the future, again, since most of the research reported on, or generated herein, is derived from qualitative data capture, greater consideration of mixed methods designs would stand to extend and enrich the teaching and learner experiences, as well as the design work of students, the author's evaluation of course outcomes and possibly industry. Section 5. The Design Process of the Teaching Unit, in particular sub-sections 5.3. Process, 5.4. Outcomes and 5.5. Reflection on the Teaching, and all of Section 6. Discussion, relate.

Additionally, research in this area should include better understanding students experience of the course and more developed approaches for user-evaluation of their comics. Lastly, and on a somewhat practical note, in the next iteration of this unit, students will be exposed to the language and design of comics in a more formal manner.

[12] Also referred to as a 'Golden thread' by the authors (Hobbs & Fenn, 2013, p. 200)

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