

WHAT IF XR IS FULLY UTILISED IN DESIGN EDUCATION? PRELIMINARY RESULTS FROM A PARTICIPATORY DESIGN FICTION STUDY

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ABSTRACT

Combining Design Fiction with participatory design principles has been shown to improve the role of participants, from research subjects to research partners. By supporting the process with futuristic and strategic thinking tools, participants can become experts in their own experience. This research project explores how Extended Reality technologies can be integrated as a design tool in design education. In this paper, a methodology of using participatory design fiction to engage design students in speculating the future of design education in the context of emerging technologies is presented. A three-part workshop was conducted, which involved 68 Design MSc students. A total of 17 "actionable" future scenarios of design education in the context of emerging technologies were proposed at the end of the workshop. This paper focuses on one of the workshop activities, Sequential Backcasting and What If cards, and provided a preliminary thematic analysis of the results. This study contributes to the development of participatory design methodologies and offers insights into the potential role of Extended Reality technologies in design education.

Keywords: Design fiction, participatory design, design education, immersive simulation, extended reality technologies

1 INTRODUCTION

Design fiction (DF) enables designers and researchers to create speculative narratives and artefacts to explore potential futures. However, it requires specific skills and academic credentials [1]. Participatory and co-design involve individuals most affected by future technologies in shaping outcomes [2]. Participatory Design Fiction (PDF) and co-design studies are most effective when participants are treated as "experts" in their own experiences and research partners [3], [4]. This literature survey examines how participants' focus, diversity, and design method knowledge impact their involvement in DF studies. We also provide relevant research for context, focusing on co-design and PDF studies that engage users, stakeholders, and communities, specifically in educational and technology-future domains. In co-design research, marginalized users were provided with a safe and engaging space to share their experiences. Tseklevs [4] used co-design to define problems, develop DF scenarios with stakeholders, prototype, and test. Affinity mapping, small group discussions, and engagement with older citizens were utilized in two co-design workshops. Participatory design, user-centred design, and science fiction inspired and illuminated the values and imaginaries of vulnerable patients. Participatory design and co-design, within the DF framework, involve individuals most impacted by future technologies.

PDF enables public technology speculation. DF scenarios and guiding questions sparked discussions in multiple studies [5], [7]. Simplification of DF activities for the public is crucial, using short, simple, and relatable questions to encourage creative repurposing of existing technologies instead of inventing new devices [5]. These studies require active participation and facilitation. PDF scenarios are shaped by diverse stakeholders, including local policymakers, entrepreneurs, activists, academics, and graduate students participating in co-design workshops to brainstorm new uses of digital technology in public spaces [3]. Professionals and postgraduate students were the only multi-stakeholders [6] and [7]. Angheloiu [6] explored sustainable social innovation through speculative design and foresight.

Stimulus toolkits were used to study PDFs, and Mixed Reality Immersive DF and VR Immersive DF were employed [7]. These studies demonstrate the potential of PDF to engage diverse stakeholders in

envisioning future scenarios. Rapp [8] conducted a multi-year study involving psychology students without design or HCI backgrounds, using DF in higher education. The authors guided students in critically evaluating technology through traditional design phases and DF methods. Design students also explored DF [10, 11]. In [9], researchers addressed challenges related to emerging technology design and speculation, focusing on human skills to overcome technological dependency. Industrial design students were tasked with choreographing design challenges for emerging technologies. The second challenge involved technology-enhanced design creativity. In [10], 80 service design master students utilized DF methods and strategic thinking to promote divergent thinking about alternative futures and counter three pessimistic visions. Storytelling and music served as inspirations. Psychologists and designers have participated in DF studies, considering technological dependency and creative potential when designing and speculating about emerging technologies. DF and multidisciplinary methods effectively engage stakeholders in future speculation. However, design students rarely engage in speculation about new technologies and sustainable futures. This study addresses this gap by utilizing design students as "experts" to analyse and propose actionable DF scenarios, encouraging critical evaluation of their roles as designers and co-creators of design education futures.

2 METHODS

2.1 Phase 1: A pre-study: Expert Interviews

The preliminary investigation included semi-structured interviews with 24 design educators from six nations. The participants were academics and researchers in design and related fields, who are currently engaged in higher education and/or academic research, and who are familiar with XR and related technologies through research and/or education, preferably with practical experience. After completing an online screening questionnaire, experts were asked to participate in a one-hour online semi-structured interview. Each expert was tasked with reflecting critically on a brief future scenario in which XR is fully integrated as a design tool in design studios and discussing the broader implications for design education.

2.2 Phase 2: Extracting Future Scenarios

Future scenarios were identified by deductive and inductively analysing interview data. The scenarios were selected based on impact and uncertainty to avoid bias. Researchers and practitioners can bias scenarios [11]. The authors followed Woody Wade's (2012) approach by plotting the scenarios along the two axes of impact and uncertainty: predetermined elements, secondary elements, and highly impactful, highly uncertain elements (Figure 1). Scenarios with predetermined elements did not fit the stimulus toolkit's goal of creating realistic fictional worlds [11]. For example, XR providing immersive and interactive 3D elements in design studios was predetermined by academic literature and knowledge. The least impactful scenarios have been eliminated, regardless of uncertainty. The filtering process yielded 17 highly impactful, highly uncertain "What IF" statements that balanced utopian and dystopian scenarios.

2.3 Phase 3: Designing a PDF Stimulus Toolkit

A stimulus toolkit was developed from DF scenarios for use in PDF workshop sessions. The activities were designed to guide design students from a familiar to an unfamiliar context, progressively building their design thinking skills. The first activity only required basic design thinking skills, while the second activity combined design thinking with futuristic thinking and the third on added strategic thinking. An XR immersion session was included between the second and third activities. At the end of the workshop, the participants presented their final proposal of future actionable scenarios.

2.4 Phase 4: Identifying, Approaching and Recruiting Participants

The workshop execution plan was aligned with the start of the Design Futures module at Brunel University London. The study participants consisted of 68 Design MSc students, divided into three groups. Participation is voluntary, and participants were given sufficient time and the option to freely decide whether to participate.

2.5 Phase 5: Introducing Design Fiction (1 hour)

Designed as a part of their module weekly sessions, the students attended an introductory lecture on DF. The lecture started with defining DF and its relationship with other terminologies such as critical design, design for debate, design futures, discursive design and speculative design. As the students are from the design discipline, the difference between “traditional design” and speculative design had been explained. Then, the presenter introduced DF tools and methods by focusing on the most relevant to the coming workshop activities which are, Cover story or tomorrow’s headline, immersive DF, Backcasting, What If and Future Cone. The focus was on explaining the method of Backcasting as the participants’ knowledge of this method will be required to complete the main activity in the workshop. Recent examples had been discussed such as “The World We Made” book by Jonathon Porritt and the Galwad movie. The lecture ended by defining XR technologies in the context of the study so the researchers and the participants will move on from the same ground when doing the workshop activities. For this study, XR had been used as the umbrella term for AR, MR, and VR.

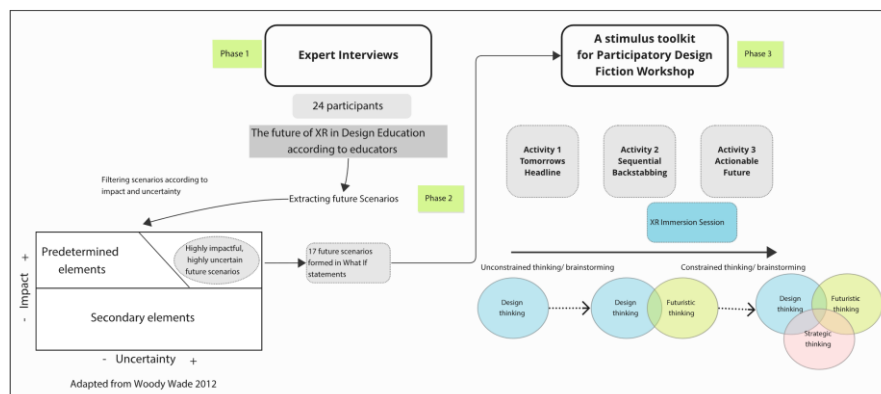


Figure 1. Study Framework

2.6 Phase 6: The Workshop (2 hours X 3)

The duration of each workshop session was two hours. The workshop had been repeated three times. The workshop started with reviewing the main concepts learned in the introductory lecture and then distributing Participants' Information Sheets and Consent forms. After reaching an agreement to take a part, activities began.

2.6.1 Activity 1: The Unbiased Design Futures Magazine (15 minutes)

The first activity aimed to stimulate brainstorming and discussion about the future of design education without bringing emerging technologies. It adopted the cover story or tomorrow’s headline brainstorming game where players pretend to be journalists for a fictional magazine "The Design Futures" 20 years from now. Participants were asked to report and sketch about a future trigger for change that will have a powerful impact on design education.

2.6.2 Activity 2: Sequential Backcasting & What If Cards (35 minutes)

The second activity combined design thinking with futuristic thinking. Each sub-group (3-5 students) had been given a What If a card containing one of the 17 DF scenarios. The activity was designed with inspiration from the six steps of Backcasting identified by Robinson (1990). According to Robinson, Backcasting is ‘an approach to futures studies which involved the development of normative scenarios aimed at exploring the feasibility and implications of achieving certain desired endpoints, in contrast to forecasting studies aimed at providing the most likely projection of future conditions [12]. Backcasting could give DF studies the kind of big-picture, all-encompassing view that is missing from DF. In this study, the authors took Backcasting methods one step further by using a new method called sequential Backcasting. In sequential Backcasting, the development towards one specific expected scenario is divided into a sequence of phases and we then find one logical path from where we are today to that expected scenario [14]. The participants had to place themselves in three phases, a) 2043: participants started by placing themselves in the future in 2043 and they analysed the What If scenario according to its pros, cons, and concerns. b) 2023: After undertaking scenario analysis, they described the present situation in relation to the What If scenario. The present situation was analysed according to four

perspectives explained in the results section. *c) 2033*: This is the intermediate phase where they had to think about critical milestones such as potential big events that will extremely accelerate or motivate the actualisation of the DF scenario. *Phase triggers*: participants had to identify triggers needed at present to reach the critical milestone/s or the intermediate phase. Then, they had to identify triggers needed from the intermediate phase to reach the final scene.

2.6.3 Immersion Session (35 minutes)

The immersion session aimed to provide ethnographic experiential futures which could lead to a more understanding of the potential of XR technologies in the design process and stimulate critical discussion about the future of design education. The participants experimented with four XR scenarios: integrating Augmented Reality tools, specifically Adobe Aero, in the current design process, 360 videos to empathise with the human of the future, interacting with 3D objects in Mixed Reality (using HoloLens 2 device), and sketching concepts using Gravity Sketch in VR (using Meta Quest 2 headset and controllers). During their experiments with the various XR technologies, participants were highly engaged. They asked questions and were involved in critical discussions regarding the advantages and disadvantages of XR in their current design process. Even after the immersion session had concluded, participants continued to take turns in experimenting with the devices while completing the remaining workshop activities.

2.6.4 Activity 3: Our Actionable Future of Design Education & XR (15 minutes)

The third activity integrated design, futuristic, and strategic thinking. Participants were asked to envision an actionable future of design education using XR technologies by answering guidance questions. In the end, participants presented their proposed "actionable" scenarios to the group.

2.7 Phase 7: Developing a Final Scenario

A final scenario of the future of design education will be developed according to the collected data by answering the question: What might the impact of XR technologies be if their potential is fully utilised in Design Education?

3 RESULTS

During the workshop sessions, 17 DF scenarios were analysed, and another 17 "actionable" future scenarios were proposed. The students demonstrated high levels of engagement and collaborated extensively to complete the assigned tasks. The preliminary results of the second activity were reported only. This paper presented overall data by answering a possible DF scenario: What if XR is fully utilised in Design Education? To answer the overall question, only broad themes from the collected data have been extracted. Pros, cons, and concerns of fully utilising XR in design education are shown in Table 1.

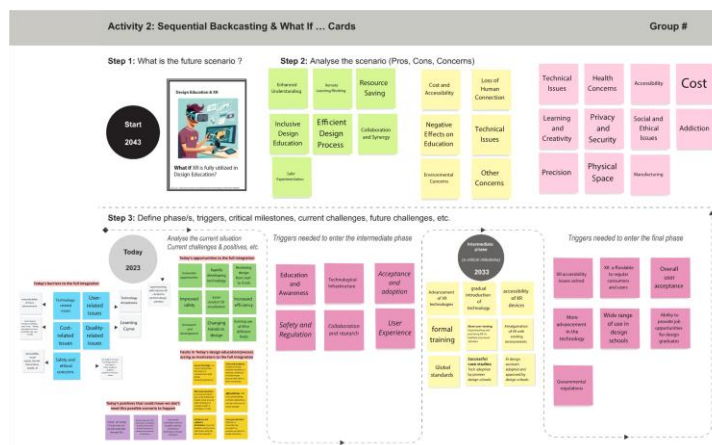


Figure 1. Preliminary results from activity 2

3.1 2023: Analysing the present Design Education (in relation to the future scenario)

After analysing the future scenarios, participants returned to the present and examined design education in relation to emerging technologies from four perspectives: Today's barriers to full integration, today's opportunities to full integration, faults in today's design education/process acting as motivators to the full integration and today's positives that could mean we don't need this possible scenario to happen. All extracted themes are presented in Figure 3.

Table 1. Pros, cons, and concerns of full integration XR in Design Education

What if XR is Fully Utilised in Design Education?		
Pros	Cons	Concerns
<ul style="list-style-type: none"> • XR technology's immersion feature has the potential to improve the comprehension of design concepts. • Exposing design students to immersive virtual user scenarios could provide them with realistic and detailed insights about user needs and perspectives, resulting in more empathic and effective design solutions. • The ability of XR technology to make learning and working more flexible and accessible. • With the advancement of the metaverse and social VR concepts, it is anticipated that global student collaboration will benefit. Participants anticipated that this degree of collaboration will enhance design synergy. This could lead to inclusive design education in which XR is used to expand design education to underprivileged students and communities. • Resource conservation: Participants considered how using XR as a tool for design could save time, energy, and overall resources. • The integration will make extermination safer because students will be able to experience dangerous or unpleasant situations to comprehend users. 	<ul style="list-style-type: none"> • Accessibility to XR may be an issue. According to [13], XR platforms have significant hardware and software accessibility issues that must be resolved. • Participants identified cost and device usability as additional obstacles. • XR can limit face-to-face interaction, thereby diminishing opportunities to form real-world social bonds. • XR technologies in design education can also be hindered by negative effects on education, technical issues such as device breakdowns, power and connectivity issues, and software errors, as well as environmental concerns such as a lack of resources and an increase in carbon dioxide emissions. 	<ul style="list-style-type: none"> • Technical, health-related, and accessibility concerns predominate in XR technologies. • Among the technical concerns mentioned are bugs, dependability, safety, and the hardware learning curve. • Vision, headaches, the senses, and a sedentary lifestyle are causes for concern. Accessibility concerns are primarily driven by the expense of the technologies. • Could XR be a source of distraction, and what is its impact on the creativity of students? • Concerns such as privacy, security, and social and ethical issues are applied to the context of design education from other general contexts. • Concerns regarding the use of XR for manufacturing in the design process and how this could affect the precision and accuracy of the final prototype.

3.2 2033: Critical Milestones to Achieve

Several milestones must be met by 2033 to fully integrate XR technologies into design education. These milestones are organised into actionable themes in Figure 3.

3.3 Triggers Needed Now & Triggers Needed in 10 Years

While we cannot predict the future, we can work to create conditions that increase the likelihood of a positive outcome [13]. Several immediate triggers are needed now and in 10 years to achieve critical milestones in fully utilising XR in design education. Examples of triggers needed now to motivate the full integration of XR in Design Education are, educating design students on XR technologies' capabilities, promoting its value, sensitising the public to its effects, raising awareness through XR

training and experimentation and including safety triggers and regulations that must be addressed before the full integration. This includes virtual and real-world boundaries, a good management system, safe AI, and supervision to fix AI errors and improving user experience by focusing on graphics, resolution, and design process engagement. In ten years, other triggers are needed such as, having successful case studies of using XR in the design process in top design schools and overcoming XR accessibility issues for a wider adoption in higher education institutions.

4 CONCLUSION AND FUTURE WORK

This study proposed a systematic approach to planning and structuring a DF study in higher education context. It aimed to actively engage design students as experts in speculating the future of design education in relation to using XR as a design tool. Although the educational impact of the present systematic approach was not intended to be evaluated or measured, we argue that design students' participation in futuristic debates on emerging technologies would make students consider the consequences of their design choices and help them become experts in their own experience. In addition, being engaged in immersion sessions where XR is used as a design tool can help design students imagine future scenarios and workflows. After analysing all findings, a final scenario will be proposed about the use of XR and related emerging technologies as a design tool in design education.

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