EXPLORING FUTURES WITH WORLD BUILDING IN DESIGN EDUCATION: BUILDING AND APPLYING A THEORETICAL MODEL THROUGH ACTION RESEARCH

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ABSTRACT

EXPLORING FUTURES WITH WORLD BUILDING IN DESIGN EDUCATION: BUILDING AND APPLYING A THEORETICAL MODEL THROUGH ACTION RESEARCH

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Design students are often engaged with future contexts, as design education encourages them to explore different contexts and understand the implications of their activities. These explorations are done in what is called a fuzzy front-end in design, which stands for the chaotic but fruitful early phase of a design process. There are different apporaches used by design students to conduct research and increase immersion into the context in this phase. Approaches such as design scenarios, make use of fictional information in addition to factual, in order to increase immersion into context and help design students generate inferential insights. This creates both epistemological and practical challenges in terms of how to define and utilize fiction within the early phases of design. This study draws from the existing literature to utilize world building in this phase. Through action research, three workshops were conducted with design students to generate a theoretical model for presenting how world building is utilized in design education, contributing to the design literature. Furthermore, the toolset devised for use in these workshops is iterated throughout the study based on the insights from the theoretical model, and is presented as a practical contribution to the design education literature. Based on the results, this study presents a case for

how world building in design education is carried out in waves of speculation for creating textual reference worlds, and assessment for comparing these speculations with actuality through pragmatic concerns.

Keywords: design fiction, design education, world building, design for future, action research

ÖZ

TASARIM EĞİTİMİNDE DÜNYA KURGULAMA İLE GELECEĞİ KEŞFETMEK: EYLEM ARAŞTIRMASI İLE KURAMSAL MODEL OLUŞTURULMASI VE KULLANIMI

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Tasarım eğitimi, öğrencilerin farklı bağlamları keşfetmesi ve üretimlerinin bu bağlamları nasıl etkileyebileceğini düşünebilmeleri için onları sıklıkla gelecek bağlamları ile ilgili çalışmaya itmektedir. Bu keşifler tasarımın belirsiz önyüzü de denilen, kaotik fakat üretken bir erken tasarım sürecinde gerçekleşmektedirler. Bu süreçte tasarım öğrencileri pek çok farklı yöntemden faydalanarak araştırma yapar ve önceden tanımadıkları bağlamların içine girmeyi hedeflerler. Bu yöntemlerden biri olan tasarım senaryoları, gerçek bilgilerden olduğu kadar kurgusal bilgilerden de faydalanır. Bu sayede öğrenciler bağlamların daha çok içine girerek dolaylı çıkarımlar yapabilirler. Bu durum, kurgunun tasarımdaki tanımı ve yeri ile ilgili epistemolojik ve pratik sorunları beraberinde getirir. Bu tez, mevcut literatürden faydalanarak söz konusu erken aşamayı bir dünya kurgulama yöntemi olarak tanımlıyor. Tez kapsamında eylem araştırması ile üç çalıştay gerçekleştirilmiş ve sonuç olarak ortaya tasarım eğitiminde dünya kurgulamanın nasıl kullanıldığına dair bir teorik model çıkartılarak tasarım literatürüne katkı sağlanmıştır. Bununla birlikte, çalıştaylarda kullanılan araç seti, ça-

lışma boyunca geliştirilmiş ve son hali ile tasarım eğitimi literatürüne katkı olarak sunulmuştur. Tezin sonucunda tasarım eğitiminde dünya kurgulamanın, önce metinsel referans dünyalarını yaratan spekülasyonlar, sonra da bunları asli dünyadaki pragmatik endişelerle karşılayan değerlendirmeler arasındaki dalgalanmalar olarak tasviri öne sürülmüştür.

Anahtar Kelimeler: kurgusal tasarım, tasarım eğitimi, dünya kurgulama, gelecek için tasarım, eylem araştırması

To the loving memory of my father

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LIST OF ABBREVIATIONS

FFED	Fuzzy Front-End of Design
WBD	World Building for Designers (Toolset)
SCD	Speculative and Critical Design
HCI	Human-Computer Interaction
PCED	Personality Core Enabled Device (a fictional product category in "Secret Life of Objects" workshop)
POG	Principles of Generation

CHAPTER 1

INTRODUCTION

There is an increasing interest in the early stages of design, the so called fuzzy front-end in design (FFED), which focuses on defining better questions before designers attempt to answer them (Brentani & Reid, 2012; Koen et al., 2002). FFED involves embracing ill-defined problems and iteratively coming up with relevant insights that can be tackled as a design problem in further stages of product development. It is increasingly considered as a vital requirement of innovation in new product development, in which future foresight and anticipation are cultivated through ambiguity (Celaschi et al., 2011). Exploring and methodizing the FFED processes therefore are important research areas for understanding meaningful innovation and change in designing for the future. These methods and approaches has gradually expanded towards design education to improve students' abilities for anticipation in the early phases of design research (Wormald, 2011).

An important part of FFED is to set and understand the context. This is conventionally done through inquiries of the potential user and their environment, using tools such as rapid ethnographies (Rodgers & Anusas, 2008), cultural probes (Gaver et al., 1999), or empathy probes (Mattelmäki, 2006). These tools enable designers to learn excerpts from their user's thoughts, emotions and expectations; as well as the details of the actual environment for the potential design solutions. The aim is to increase empathy and understand the context better. Designers than concretize this information in material forms, using tools such as contextual maps (Stappers & Visser, 2007), design scenarios (Hasdogan, 1997), or personas (Pruitt & Adlin, 2006). This process of data gathering, and materialization creates an immersion into the design context. Context immersion allows the designer to empathize with people and anticipate changes

within the FFED, in order to generate insights.



Figure 1.1: Roleplaying activity in second year studio (2018).

My experience as a teaching assistant in an industrial design department helped me witness how students built context using generative research techniques in the early phases of their design processes. In Figure 1.1, second year design students from Middle East Technical University (METU) can be seen roleplaying as fishers on a boat. Their task was to design picnic sets for a specific use case, and they had chosen fishing as theirs. Roleplaying as fishers, the group of students tried to feasibly empathize with fishers in a city that is some 200 kilometers away from the nearest sea shore, making cardboard props and utilizing their backpacks as crates and boxes on the boat. This activity is nowhere near being a realistic simulation of the physical conditions on an actual fishing boat. However, the mere act of constructing an imaginary boat out of cardboard pieces is an inspiring session for gathering insights.

It is hard to define context immersion as research only, since scenarios, personas or even the probes require designerly contributions from their conductors. In the example above, students constructed a make-shift picnic table to roleplay and see potential

issues. This process represents exploratory research, a stage in design research in which designers inquire about the domain and generate a preliminary knowledge base about context; and generative research in which designers create artifacts to deepen their understanding of the need, desires and choices of people within these contexts (Hanington, 2007; Sanders, 2005). These approaches are meant to be less rigorous and less valid, "drawing [results] primarily from the future and the unknown, using imagination as the basis for expression" (Sanders, 2005, p. 9). They can be run in parallel when working with unfamiliar contexts to inform the FFED and generate early ideas within.

My narrower interest regarding context building in the FFED is about contexts which designers can not reach. In these cases, designers can create more elaborate representations for their generative research. Figures 1.2 and 1.3 show two different design scenarios, drawn for a fourth year design studio project in METU. In this project, students explored laundry solutions for the rural Africa, with Bosch Siemens Hausgeräte as an advising firm providing them with prior research on the subject.

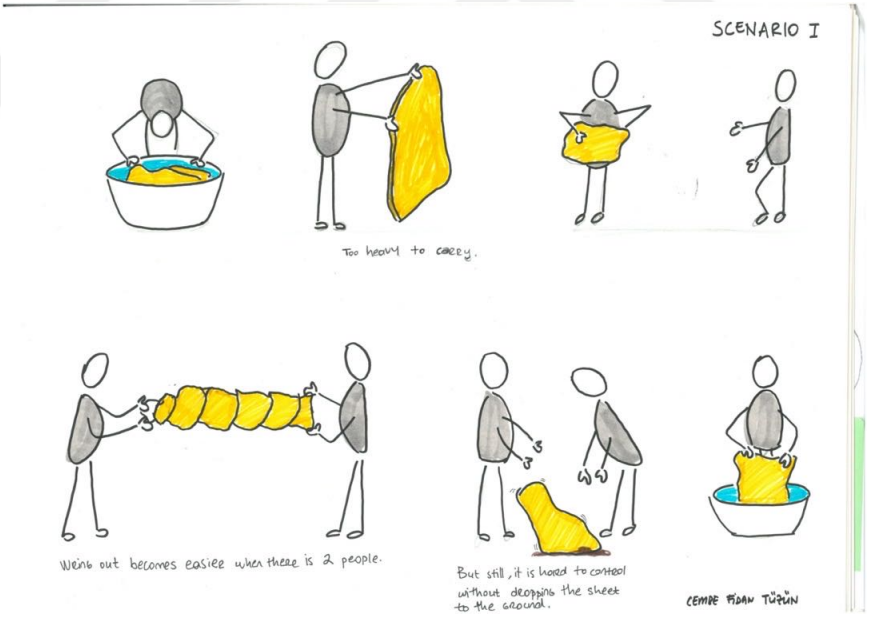


Figure 1.2: Scenario drawing from fourth year studio by Cemre Fidan Tuzun (2016).

Both design scenarios materialize information gathered from self-conducted online research and presentations from the advisor firm, providing factual information about the use context. The scenario on the bottom however focuses more on the backdrop,



Figure 1.3: Scenario drawing from fourth year studio by Aysenur Akaslan (2016).

drawing a more detailed setting, as well as providing narrative cues such as the time of the day, or the appearance of the character. While both scenarios present a similar narrative on the mechanics of how laundry is done, the second scenario builds a world around it.

1.1 Research Aim

As a design researcher, I became interested in the worlds designers build in the FFED. While methods like design scenarios and roleplaying encourage designers to build background knowledge, there are different approaches to the level and the amount of building. In the above examples, design students will wear wool caps to present more believable fisherman characters in their roleplay, or some students will draw richer backdrops for their design scenarios. My focus then was to explore how designers approached building these imaginary worlds around their context.

I utilize the concept of world building from media studies, in order to setup my research aim. World building is the process of generating complete and plausible imaginary worlds that serve as a context for a story (McDowell, 2015). It is an interdisci-

plinary subject which is explored in media studies (Ryan, 2005; M. J. P. Wolf, 2014), future studies (Zaidi, 2019), and psychology (Holland, 2009) to name a few. One definition which inspired me to connect it to what designers do in the early phases is from Eco (1985), who refers world building as "furnishing" (p. 3) a story so that a reader can not only empathize with it, but they can also imagine new stories within that world. This is similar to how designers can build richer context to generate new insights within.

Furthermore, I focus on designing for future within design education as the setting of my research for two reasons. First, I argue that design education is in a bigger need for the answers to my research questions. Unlike design practice, design education is very wide in its project domains. Students encounter different problem settings, both in local and in global scale, in preparation of understanding rapid and large scale future transformations they would need to tackle in practice. Therefore, exploring how they build context for the future and to support it using various methods will be a valuable contribution to design education and in turn increase the utility of this dissertation.

Second, my position during the bulk of this research as a teaching assistant in my university allowed me to conduct workshops and apply my tools with design students. This provided practical conveniences, especially in the last workshop which I had the chance to embed inside a real design studio course, enabling me to observe longer-term results. In addition, my personal familiarity to the processes of design education helped me to be better prepared for potential issues.

1.2 Research Questions and Approach

My aim is to explore world building in design education, by understanding and supporting it in the early phases of design. My main research questions are as follows:

1. How can a theoretical model describe and represent the world building process of design students when working with future contexts?

2. What are the properties of a toolset for openly enabling world building to be

used by design students when working with future contexts?

My overall approach for answering my research questions is based on action research. Action research is about taking action in the field and then generating knowledge by documenting and explaining the results and the motivations of the researcher (Robson, 2002). Action research is a popular approach in the education domain, since educational research benefits from iterative tool development and testing in real contexts. Action research is the preferred approach in this research too, for two reasons. First, my research question is about understanding a rarely documented phenomenon in the field through enabling it. Using action research gives me the opportunity to develop tools and observe their results, so I can explore both the phenomenon and my effect over it. Second, my position in the institution as a teaching assistant enabled practical involvement to education and allowed me to conduct workshops with design students using the infrastructure of the institution. The last of my three workshops took place as part of a design studio course, which enabled me to explore how my tool would operate in a real-life design project and observe its results. Action research approaches were suitable in these regards.

I developed a world building toolset called *World Building for Designers (WBD)*, based on my research on the convergence of FFED, design research and world building. This toolset was used in three workshops. The first two was organized by me, to provide a testing ground for the toolset, enabling me to explore its world building and its dimensions. The toolset was iteratively improved based on the insights from the process. The third was conducted within a design studio course and used in a real-world design education project. Results of these workshops both helped develop the final version of the toolset and extract data that I used to define world building done by design students about unfamiliar contexts.

As I started answering my research questions, I added sub-questions to further guide my study. As these sub-questions are generated during the research process, they include terminology to be defined further in the dissertation. The sub-questions can be seen in Table 1.1.

Table 1.1: Research questions.

1	**How can a theoretical model describe and represent the world building process of design students when working with future contexts?**	**2**	**What are the properties of a toolset for openly enabling world building to be used by design students when working with future contexts?**
1A	What are the elements of world building in design education based on relevant literature?	2A	How do these elements affect the world building processes in design education?
1B	How are these elements generated?	2B	How do different approaches used by design students to progress their generated worlds, affect the perception of these worlds?
1C	What are the different approaches in the world building process for sustaining certain narratives?	2C	How can pragmatic concerns of design students affect the world building processes, and how can the WBD toolset be finalized in light of these concerns?
1D	How do the properties of speculations affect the resiliency of narratives design students generate during world building?		
1E	What are the pragmatic concerns of design students for world building, and how do they affect the speculations and assessment made by the design students?		

1.3 Contributions to Literature

There will be two main contributions to the existing body of knowledge in design education. First, the answer to my first research question will provide a theoretical model of world building in design education. This model will be generated by layering four research outputs: (1) an interpretive literature review for transporting concepts of world building from media studies to design, (2) elements and their properties of world building, (3) processes of world building and (4) pragmatic concerns of world building. These layers will be weaved together to present a wholistic model of world building in design education, contributing to existing body of knowledge within design education literature.

The second contribution will be formed from the answer to my second research question. By the end of the dissertation, the WBD toolset will be finalized through the workshop insights. WBD toolset will be a contribution to the educational practice in design, which would be suitable for application in design education projects focusing on future contexts. As I will discuss further during the rest of the study, I argue that the early phases of design regarding future contexts may lack first-hand information and rather rely on speculations based on a varying degree of certainty. In these cases

personal convictions, motivations and beliefs can be as important as hard data.

The results of my research will both explain how these speculations come to be, and how they are later assessed by their creators throughout the design process. Therefore, the final goal of the WBD toolset would be to theorize the processes used by design students in projects involving disruptive technologies and future activities, and present potentials to improve them.

1.4 Structure of the Thesis

The overall structure of this dissertation is built on four components: literature review, methodological framework, workshops and conclusions. The literature review consists of Chapter 2 (p. 9), and Chapter 3 (p. 45). These chapters will present my theoretical background. The methodological framework will be presented in Chapter 4 (p. 61). In this chapter, I will present a theoretical background on the selected methodological approaches, as well as justifying my strategies. The workshops are presented in Chapter 5 (p. 83), Chapter 6 (p. 109), and Chapter 7 (p. 151). Each workshop chapter includes the design of the workshop based on the insights gathered from the previous one, the workshop setup and application, the data obtained from the workshop, an analysis of this data, and discussion the insights, including how the WBD toolset will be iterated the next workshop. Finally, the final discussion and conclusions are presented in Chapter 8 (p. 203). This chapter will summarize the entire work, present the final version my framework and WBD toolset, present limitations and further research suggestions.

CHAPTER 2

AMBIGUITY, SCENARIOS AND FICTION IN DESIGN

In this chapter, I will explore the existing approaches used by designers to make sense of unfamiliar contexts. I will first define the fuzzy front-end in design as a concept for embracing ambiguity in unfamiliar contexts. This will include categorizing design research as inspirational and informational. I will then explore design scenarios as an approach for unifying these two types of research in a meaningful way. Finally, I will explore design fiction as an approach for appropriating design scenarios to unfamiliar contexts.

2.1 Fuzzy Front-End in Design

Design is getting significantly more involved with the prior stages of product development in its chase for innovation and transformation (Brentani & Reid, 2012). The so-called *fuzzy front-end of design* (FFED) is the earliest stage of innovation, coming before new product development (NPD) and commercialization (Koen et al., 2002). It refers to the "experimental and often chaotic" (Koen et al., 2002, p. 6) phase where designers embrace complex problem domains and focus on defining the questions before the latter stages attempt to answer them. FFED can be further described as a collection of activities for informing and inspiring open-ended questions about understanding context, opportunities, technologies, information, etc. (Stappers, 2006). FFED is also expected to develop a critical point of view towards these questions. Instead of a linear process that aims at a continuous clarification of the problem at hand, FFED's chaotic nature embraces ambiguity as a resource (Sanders & Stappers, 2008). Figure 2.1 shows a typical visualization of the FFED in the design process.

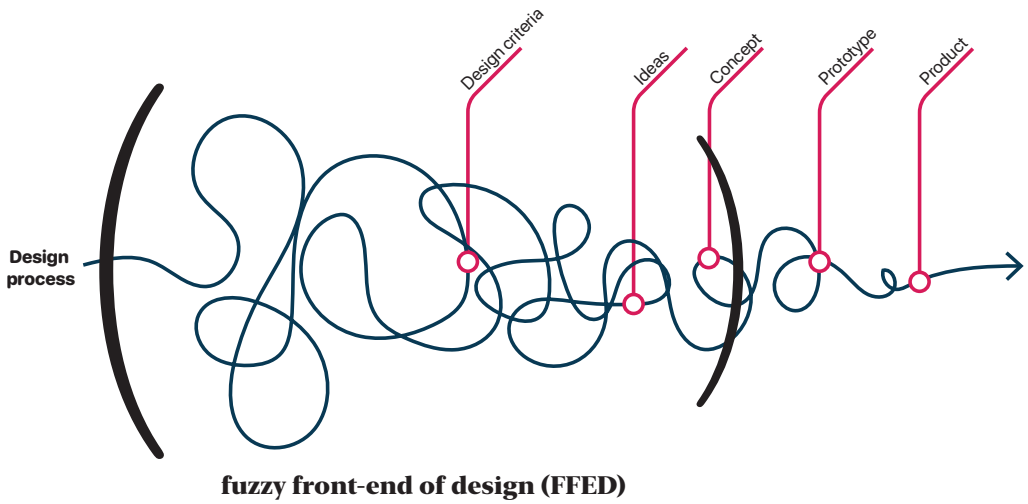


Figure 2.1: FFED in the design process (Inspired by Sanders and Stappers (2008)).

Apart from design and engineering, fuzzy front-ends have been a topic of interest in multiple domains, each bringing in its own set of priorities, needs, and expectations. Business management literature is concerned about how to integrate different stakeholders to extract their opinions and create value (Cagan et al., 2002; Zahay et al., 2004). Creativity studies make novel approaches to integrate arts and artistic experientialities into the FFED to foster idea creation (Dorst & Cross, 2001; Nissley, 2010; Styhre & Eriksson, 2008). Future studies use FFED to frame strategic foresight and trend scouting for understanding future transformations (Brandtner et al., 2015; Dufva, 2015; Rohrbeck, 2014).

While chaos and ambiguity are sought after properties of the FFED, managing, understanding, and navigating it is the end-goal for progressing through ideas from concepts to solutions (Gassmann & Schweitzer, 2014). This is especially a challenge in design education where a dialectic process of speculation and assessment that ends up with the final design is harder to ground because both the speculations and assessments are often black-boxed and not overtly communicated (Oak, 2000). Therefore, FFED in design education has to rely more on the processes and methods than actual tests and evaluations of its results through the real world.

Speculating and assessing are often described as dichotomies in literature. Stappers (2006) imagine the design process as a car's crash test. In this metaphor, where the

crash happens between the higher level and conceptual constraints such as strategy and research; and the lower-level and more physical constraints such as product conception and manufacturing (see Figure 2.2). FFED is described as the crumple zone of this crash test, as a continuous elaboration between these two tensions. Wormald (2012) argues that in the context of design education, FFED is a source of duality between abstract and concrete, tacit and explicit, design and non-design, idea and product.

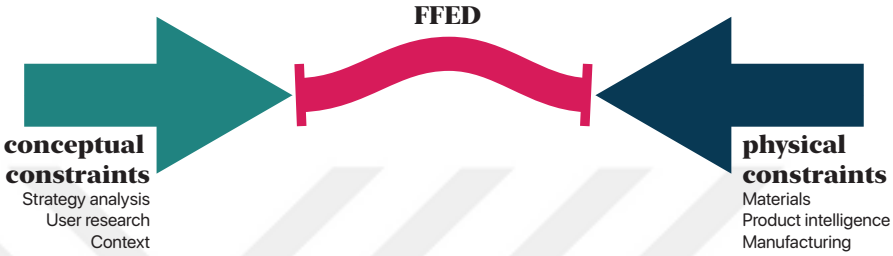


Figure 2.2: FFED as a dichotomy (Adapted from Stappers (2006)).

When designing for the future, FFED represents a phase in which "[...]gathers the many activities that inform and inspire the exploration of open-ended questions that will direct the project by assessing its valid baseline" (Rudkin, 2016, p. 3). Foresight about the future can be defined as a "practical and qualitative anticipation" which covers a wide variety of approaches (Loveridge, 2009, p. 12). Designing for the future, therefore, strives to build a narrative through the anticipation of the future and a practical understanding of today.

Forecasting is no doubt a political activity: anticipation is often a manipulation of today's knowledge using subjective and tacit approaches (Sardar, 1999). Combined with how I previously stated that speculation and assessment in design education can be unclear, it can be argued that whatever forecasting activity that takes place in the design studio is somewhat left undocumented. While the FFED is by definition an ambiguous and under-defined process, there is a growing need to establish more theory and definitions in design education about it (Wormald, 2012). In turn, other researchers and educators will be able to build on top of these theories to create accessible tools and pedagogies regarding the FFED and foresight.

In order to establish my theoretical framework, I explored how the aforementioned dichotomy between speculation and assessment is reflected in two relevant domains. First, I will present generative research as an approach to design research that embraces a similar dichotomy between informational and inspirational findings. Second, I will present design scenarios that enable a connection between these findings through storytelling. Finally, I will present design fiction, as a means of extending design's understanding of reality and using fiction as a tool for foresight.

2.1.1 Exploratory and Generative Research in Design

Design research is often theorized under three phases: exploratory, generative, and evaluative research (Hanington, 2007). Exploratory research is for constructing a knowledge base about the design context, in regards to people or things. Generative research aims to increase to focus on a particular part of the context, by further exploring user needs and desires. To accomplish this, generative research often involves participatory design activities to collaborate directly with potential users. Evaluative research is a latter stage where the intermediary output of the design efforts would be tested and compared with user expectations and iterated based on the results.

While evaluative research is relatively more established in the form of user tests, exploratory and generative research are more recently identified in the literature and are more similar and complementary to each other. Exploratory research is an open-ended process where design students are expected to conduct broad inquiries such as surveys or questionnaires, and increase empathy to the target context through rapid ethnographies (Rodgers & Anusas, 2008), culture probes (Gaver et al., 1999) or empathy probes (Mattelmäki, 2006). An expected result of this phase is an increased understanding of the "people and territory" in question (Hanington, 2007, p. 4).

Generative research is considered as an extension of exploratory research, employing comparable methods. It focuses further on users of the targeted context, enabling them to express their overt or concealed needs and desires through participatory means (Sanders et al., 2010; Sanders & Stappers, 2008). As the name suggests, it is not a passive process where designers gather findings, but rather an interactive process where the designers and the users generate knowledge. An overview of the three

types of design research can be seen in Figure 2.3.

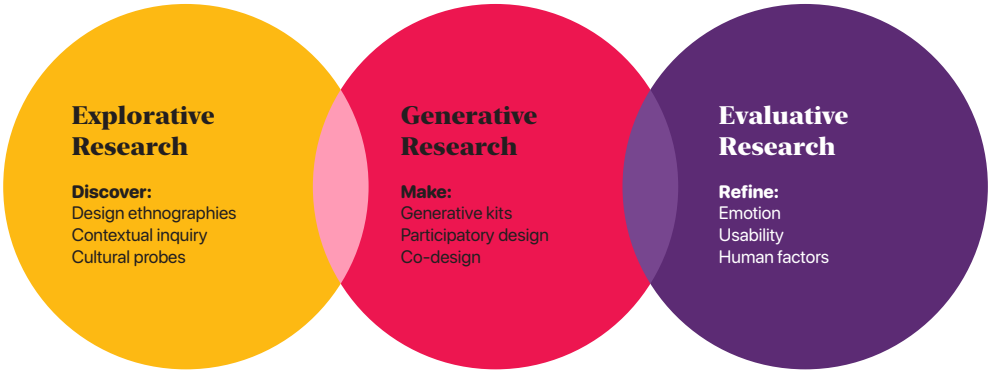


Figure 2.3: Three approaches of design research (Adapted from Hanington (2007)).

I argue that research being done for future contexts in design education stretches between both exploratory and generative research approaches. It is related to exploratory research because design students are "engaged in unfamiliar territory" to "forge an [initial] knowledge base"(Hanington, 2007, p. 3). This is the point of inquiry where the focus is broad, and the main aim is to familiarize oneself with an unknown context. It is also related to generative research because the research activity itself is not strictly rigorous, and the students often turn to generative activities like scenario building to enhance their immersion into the context. The knowledge design students use to generate such research artifacts draws both from real-world constraints and imagination through past experience. An example can be given as Akaslan's design scenario, presented in Chapter 1 (see Figure 1.3 on p. 4).

2.1.2 Informational and Inspirational Findings

Sanders (2005) theorize this distinction by identifying two types of research findings in generative research: informational findings and inspirational findings. A comparison between these two types of research can be seen in Table 2.1.

A similar understanding of research can be seen in future studies literature. Design and futures had an increasing collaboration through research in particular during the 2000s and 2010s (Candy & Dunagan, 2017). Drawing from and merging design and futures had been a point of interest in the literature within the context of future

Table 2.1: Comparison of informative and inspirational research (Adapted from Sanders (2005)).

Research that informs the design	**Research that inspires the design**
Usually conducted by researchers and social scientists	Usually conducted by designers
Uses scientific models and comply with reliability, validity, and rigor	Complies with self-created tenets like relevance, generativity, and evocativeness
Presents the results of planned analysis	Emphasizes experimentation, ambiguity, and surprise
Built upon the exploration of past events to deduct information about future	Draws from the future and the unknown through imagination and futures

transformations (Rudkin, 2016; Selin, 2015; Selin et al., 2015). Krippendorff (1997) emphasizes design's "need to search in the present for possible ways to move into desirable futures" (p. 94). Design enables futures to be "involved in prototyping, and staging futures experiences that use design, while also setting a context for it" (Candy & Dunagan, 2017, p. 137). Futures on the other hand enables designers to foresight with longer-term thinking and scenarios in their work about unfamiliar contexts. Design and futures feed each other in terms of materializing foresight so that they can be evaluated and generate insights from these concrete foresight.

For example, Rodríguez et al. (2006) define a framework based on interviews with designers who work with unfamiliar contexts. Their framework created a distinction between *description* and *experience* which are similarly defined as informational and inspirational findings respectively. The description indicates background information about the topic while experience indicates information deduced from the background information to trigger ideas for the project. The framework argues that this distinction disappears as the process goes on and the design concepts emerge (see Figure 2.4).

The combination of exploratory research in which design students conduct broad inquiries to engage with unfamiliar contexts and generative research in which they build material artifacts about these contexts through informational and inspirational findings is how I frame the FFED within design education in regards to future contexts. I take the similar frameworks seen in future studies as a supporting element for this argument.

The two types of findings are defined as distinct but synergistic in the literature. FFED

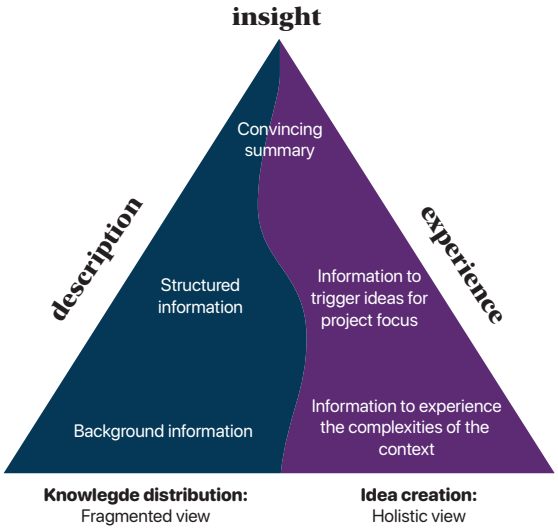


Figure 2.4: Description vs. experience in unfamiliar contexts (Adapted from Rodríguez et al. (2006)).

provides a union of inspirational and informational findings for the designers to *immerse* themselves in unfamiliar future contexts. Such immersion requires the designer to make sense of the unfamiliar context, by identifying what rises from the background information and triggers insights. This turns information into knowledge and knowledge into wisdom (Shedroff, 2000). This process is further researched under the title of sense-making. Sense-making is defined as building sensible and meaningful explanations towards experiences and data (Dervin, 1998; Weick, 1995). Sense-making necessitates creating a context for information, making it relevant for exploratory and generative research practices (Aaltonen & Barth, 2005): "If we are unable to place a piece of information in context, the meaning of that information is lost." (p. 45). Furthermore, sense making is inherently connected to storytelling (Aaltonen & Barth, 2005; Cunliffe & Coupland, 2012; Currie & Brown, 2003). People generate meaning and understand context through stories and narratives. Narratives serve two purposes in the FFED: (1) they are easier to tell and understand by people, revealing the relevance (or the irrelevance) of the arguments quicker, and (2) narratives are compatible with knowledge gaps that are inherent in the FFED which the reader can fill by themselves (Jones, 2016). In other words, narratives connect information and inspiration in the FFED. Hence, storytelling is a popular asset in the

FFED, such as design scenarios.

To summarize, I argue that the FFED requires designers to establish a balance between two interconnected layers: (1) an informational, contextual background (world) and (2) an inspirational, experiential foreground (insights). These layers can be connected through narratives like design scenarios. This relationship establishes the base of my theoretical framework which is presented in Figure 2.5. The black line drawn like a sine wave represents part of the chaotic design process faintly shown in the background. I use this black sine wave as a simplified way to show the vertical travel of the chaotic line. Therefore it does not mean that design is a linear progression, nor does it mean it utilizes informational or inspirational findings only once or in a particular order. Using this simplified schematic representation, I will visually present how the design process travels between inspirational and informational findings, in the following section. In the next section, I will explore the approaches in design scenarios.

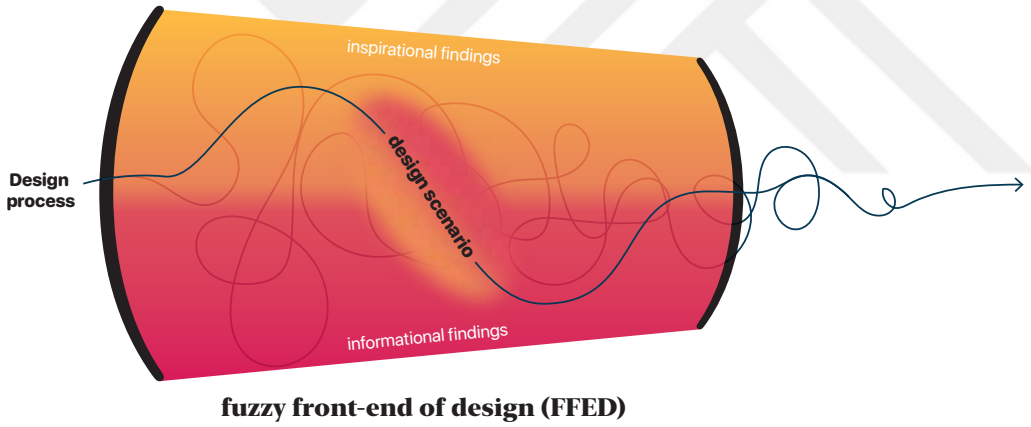


Figure 2.5: Schematic view of how design scenarios connect territories of the FFED.

2.2 Scenarios in Design

Design scenarios are stories with designated utilities. Scenarios in different forms and capacities are widely used in design (T. Brown & Katz, 2009; Cross, 2011; Hasdogan, 1993), HCI (Campbell, 1992; Carroll, 1995; Nardi, 1992), future studies (Swart et al., 2004), complexity sciences (Wilkinson et al., 2013) and strategic management

(Bradfield et al., 2005). Rosson and Carroll (2002, p. 1105) define them as narratives that describe a sequence of events using settings, actors and objects that lead to an outcome which is relevant to the usage context of these objects and the experiences of these actors.

While scenarios can simply be defined as stories or narratives, the wider understanding of using scenarios as a design approach is explored under the name *scenario-based design* or SBD (Carroll, 2000). Scenario-based design is positioned as an alternative to requirement based design; it emphasizes qualitatively defined experiences and implicit details of use, as opposed to requirements that focus on functional specifications.

Scenarios have a role of connecting different stakeholders with each other or stakeholders with context. Rosson and Carroll (2012) argue that scenarios create a medium for the context to meet with both users and designers. The context can be daily and familiar environments for the user, as well as new and unfamiliar technology, including imaginary technologies. Hertzum (2003) and C. T. Wolf (2019) define scenarios as a meso-level representation: linking specific, micro-level activities and overall, major goals. Finally, Fulton Suri and Marsh (2000) define scenarios as a link between the analysis of problems or issues with the synthesis of conceptual designs or ideas. Therefore scenarios can be considered as links between users, designers, context, and technologies.

Hertzum (2003) groups scenario-based design approaches into five categories. First, scenarios can define use-cases (Jacobson, 1995). These are detailed and encompassing descriptions of needs in current or future practices. In design education, this is applied in two stages: (1) problem identification where students try to imagine a problematic situation which would then indicate a design opportunity, and (2) idea presentation where students demonstrate their design solutions through usage in use context (Börekçi et al., 2016). Second, scenarios can be used in requirements planning in which they help establish the performance criteria of the product in its use (Kaindl, 2000). Third, scenarios are used in participatory design approaches where they help define issues or solutions in understandable forms for both users and designers (Bødker, 2000). Fourth, scenarios can be used as documentation where they help

familiarize or train users with the tasks defined by the designers (Keminsky, 1992). Fifth, scenarios can be used for evaluation where they represent tests for a system not specifically designed for them (Nielsen, 1995).

Benyon and Macaulay (2002) who use a more fluid grouping based on how concrete scenarios are within the project they are used in. They define four categories that can overlap in some cases. User stories are fictional experiences of people describing what do, want, or know. Conceptual scenarios help generate new ideas and knowledge, in an attempt to identify the problem domain for the designer. Concrete scenarios enable prototyping the ideas within a context for evaluating the design ideas. And finally, use cases are used in the final implementation of the ideas as requirement lists.

Both Hertzum (2003) and Benyon and Macaulay (2002) use utility to define different types of design scenarios. While Hertzum focuses on the types of such utility, based on real-life usage as categories, Benyon and Macaulay use concreteness or how "formalised" (p. 398) scenarios are in context, to define categories.

I previously established how the FFED is setup with two synergetic components of inspirational and information findings which can be connected through narratives. To further support this theoretical framework, I created my own list of properties regarding design scenarios based on how they fit in this framework. As a result, I identified three features by which the design scenarios manipulate the synergy between informational and inspirational findings. These are focus, plausibility, and inventiveness.

2.2.1 Focus

The first group is *focus*. Nardi (1992) argues that scenarios should be focused on the problem domain, and be relevant for the business goals. She also associates simplicity with focus, arguing that scenarios should be short and simple enough to be remembered for the duration of a design project, rather than a lengthy and limiting list of requirements. Fulton Suri and Marsh (2000) further emphasizes focus by claiming that scenarios should focus on the task and not be "free dramatic license" (p. 155) for the designers. Rosson and Carroll (2012) also emphasize simplicity, by defining

scenarios as "lightweight envisioning of the future" (p. 1105) and that part of their strength comes from them being relatively quick and easy to produce, suitable for the early phases of design. On the other hand, Hertzum (2003) emphasizes a larger focus for scenarios, by arguing that they do not just state the interactions or tasks, but they define the larger context. He praises scenarios for "opening up the use situation and treating its myriad of mundane details as credible and important expressions of the real-world situations the system is to match" (p. 218).

2.2.2 Plausibility

The second group is *plausibility*. Campbell (1992), define scenarios as alternate possibilities, implying that scenarios should be as coherent as the current world. Nardi (1992) also emphasizes coherence, stating that scenarios should bring activities to life using vivid and coherent descriptions. She places special importance on ethnographic data: for a scenario to be believable, it must be firmly based on that. Therefore, any potential gaps in coherence can be resolved by going back to the said data. Fulton Suri and Marsh (2000) defines potential problems in plausibility, such as generating too simplistic or too optimistic scenarios. On the other hand, sustaining plausibility by data is not always a feasible approach. Not only there could be tendencies in designers to create scenarios based on their implicit assumptions (Hasdoğan, 1996), but there could also be a lack of ethnographic data for a particular scenario. In which case, Fulton Suri and Marsh (2000) recommend using the best available knowledge, stating that such scenarios will be "built upon less firm ground, but still be worthwhile" (p. 152). Later work in the domain increasingly defines plausibility as a separate notion than being relied on data. Briggs et al. (2012) argue that ambiguity is a resource in scenarios, rather than a liability, and that ambiguity should be actively pursued as a means of generating knowledge. Kirk et al. (2015) acknowledge that unbelievable scenarios are as valid as believable ones as provocative stories, given they are still coherent.

2.2.3 Inventiveness

These works imply that scenarios are not mere narrative representations of what is already known but can generate new knowledge. This ties into the third group: *inventiveness* . On a basic level, scenarios enable designers to learn from them through reflection (T. Brown & Katz, 2009). Rosson and Carroll (2012) articulate this further, by arguing that scenarios present implicit information embedded in concrete episodes of usage and that their narrative can take unexpected turns as they are being generated. Rosson and Carroll justify this by relating scenarios to narrative fiction. Much like how fictional narratives rely on their readers to assume unspecified background information and deduct what's novel (Haviland & Clark, 1974; Ryan, 1980). In other words, readers of narratives are capable of deducting new knowledge from narratives, by projecting their knowledge and observing the differences. This will be further explored in Chapter 3, but for now, I will note that inventiveness is an important reason for using them in the early phases of design, as a generative tool.

To summarize, scenarios can have different utilities and levels of concreteness. They utilize focus, plausibility, and inventiveness as mechanics of manipulating these utilities. And finally, they link together different stakeholders and context of use together to serve their utility. Iterating on Figure 2.5 (p. 16) in which I established the synergistic relationship between the informational and inspirational findings, Figure 2.6 shows how scenarios connect the two types of research in the FFED. Inventiveness pushes design scenarios towards inspirational findings. Plausibility pushes design scenarios towards informational findings. And focus narrows down the design scenario's breadth.

As seen in this section, design scenarios are expected to increase concreteness by using the best available knowledge, using focus, plausibility, and inventiveness. Existing literature on design scenarios focuses on user research as a baseline to build upon. Refocusing on my research question, however, I am interested in future contexts when the user research and informational findings can be limited. Design fiction on the other hand embraces futures and their foresight tools as a valid approach for establishing such baseline in design (Selin, 2015). In the next section, I will explore design fiction and report my systematic review of design fiction applications to iden-

tify a gap for my contribution.

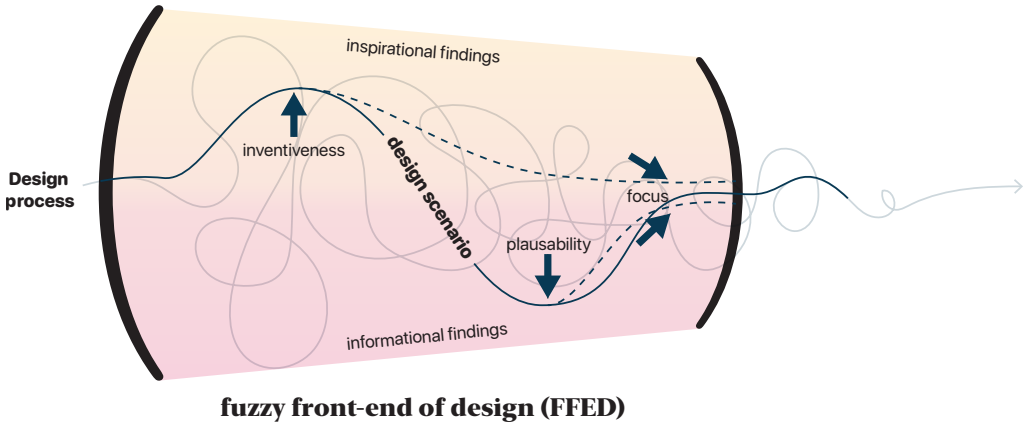


Figure 2.6: How properties of design scenarios affect the design process in the FFED.

2.3 Design Fiction

Design fiction is a domain of research and practice that "recombines the tradition of writing and storytelling with the material crafting of objects" (Bleecker, 2009, p. 7). Design fiction aims to create a temporary suspension of disbelief to a hypothetical scenario (Sterling, 2005) by using speculative, provocative and/or convincing artifacts belonging to that scenario, such as fictional writing (Ambe et al., 2019; Blythe, 2017), producing physical artifacts (Cheon et al., 2019; Lepri & McPherson, 2019; Lindley & Potts, 2014), or producing speculative prototypes (Blythe et al., 2016; Pierce & Paulos, 2014).

Design fiction is often grouped with speculative and critical design (SCD), which are defined as challenging the ethical practices of design within and exploring alternative values through speculative discussions (Dunne & Raby, 2013). The similarity between design fiction and SCD is based on how they all encourage anti-solutionist design approaches (Blythe et al., 2016; Coulton & Lindley, 2016). Like SCD, design fiction is not about predicting the future or solving a future problem, but rather extrapolating current issues to futures and generating insights for today. Design fiction's most important distinction from SCD however is its wide usage in research, especially

within the domain of human-computer interaction (HCI) (Ambe et al., 2019).

2.3.1 Development of Design Fiction

Although the domain is not unified both in terms of theory and practice (Lindley, 2018), roots of design fiction can be traced back to three complementary approaches from its early researchers. These are (1) using design in fiction, (2) using fiction in design, and (3) using design fiction in practice. The first item can be exemplified by developing products to be shown in works of fiction, such as movies. The second item can be exemplified by including fictional and imaginary elements is design processes, such as parts of design scenarios or personas. The third item can be exemplified by corporate vision videos, where companies showcase a fictional future on how their products would be utilized using diegetic prototypes. These three approaches will be explained in more detail below.

2.3.1.1 Using Design in Fiction

The earliest account of design fiction is found in Sterling's (2005) book titled "Shaping Things". As a science-fiction author specializing in steampunk, Sterling defines his work as "design fiction":

> "I've been writing "design fiction" for years now. Design fiction reads a great deal like science fiction; in fact, it would never occur to a normal reader to separate the two. The core distinction is that design fiction makes more sense on the page than science fiction does. Science fiction wants to invoke the grandeur and credibility of science for its own hand-waving hocus-pocus, but design fiction can be more practical, more hands-on. It sacrifices some sense of the miraculous, but it moves much closer to the glowing heat of technosocial conflict." (Sterling, 2005, p. 30)

Sterling (2005) compares the concept of "science" in science-fiction to design, arguing that design provides a more understandable or relatable context to the reader of his work. The "technosocial conflict" in his definition above refers to how disruptive technologies can affect larger social systems, through products. In other words, he claims that the large-scale and highly disruptive future visions of science-fiction is

less effective on the typical reader than exploring the implications of a mundane object they might already own. His example is a bottle of wine he has. While the wine itself is an old and longstanding product of human beings, modern design's relatively new, small but cumulative additions, such as mass-produced bottles, universally recognized warning labels, and corporate websites that offer extensive information on their wine significantly transformed what the product is. Therefore, Sterling claims, writing science-fiction is no longer about grandeur visions but rather design thinking, i.e. articulating implications of mundane changes in people's lives. This is the design fiction approach that I define as *using design in fiction*. It brings designerly ways of thinking into fiction, for creating more believable and more viable speculations. Two examples from film can be seen in Figure 2.7.



Figure 2.7: Designed objects in science fiction: Food tray of passenger spacecraft on the left (Kubrick, 1968), Voight-Kampff machine on the right (Scott, 1982).

2.3.1.2 Using Fiction in Design

In 2009, Bleecker (2009) published his essay on design fiction, following his work in Near Future Laboratories. He analyzes the earlier work of Dourish and Bell (2008), to argue that science can be read as a work of fiction. Dourish and Bell (2008) claim that previous research in the field of ubiquitous computing has parallel themes with contemporary science fiction work. Their argument is that "design-oriented research is an act of collective imagining", where collective-imagining is heavily influenced by several television shows that "form part of the cultural backdrop for many members of the research community". Bleecker (2009) then amps up this argument which is that design-oriented research is inspired by fiction, to how design and research is inseparable from fiction: "In this way design fiction is a hybrid, hands-on practice that operates in a murky middle ground between ideas and their materialization, and

between science fact and science fiction." (p. 8). This is the design fiction approach I define as *using fiction in design*. The argument is that fiction, both as a cultural backdrop and as an increased role of imagination in methods, has a profound role in design and design research. Bleecker (2009) then defines design fiction as building artifacts that belong half-way to the real world and half-way to the fictive world, with the aim of bridging the gap between them. An example given is The Star Trek Star Fleet Technical Manual, written by a Star Trek fan, Joseph (1975). The book includes detailed diagrams of the fleet ships, uniforms worn by fleet officials, and schematic drawings of various devices used by them (see Figure 2.8). Joseph combined his real-world scientific expertise as an aeronautical engineer to contribute to the collective imagining of science fiction, blurring the lines between them. Hence, his work which Bleecker (2009) considers as a design fiction, can be considered as using fiction in design.

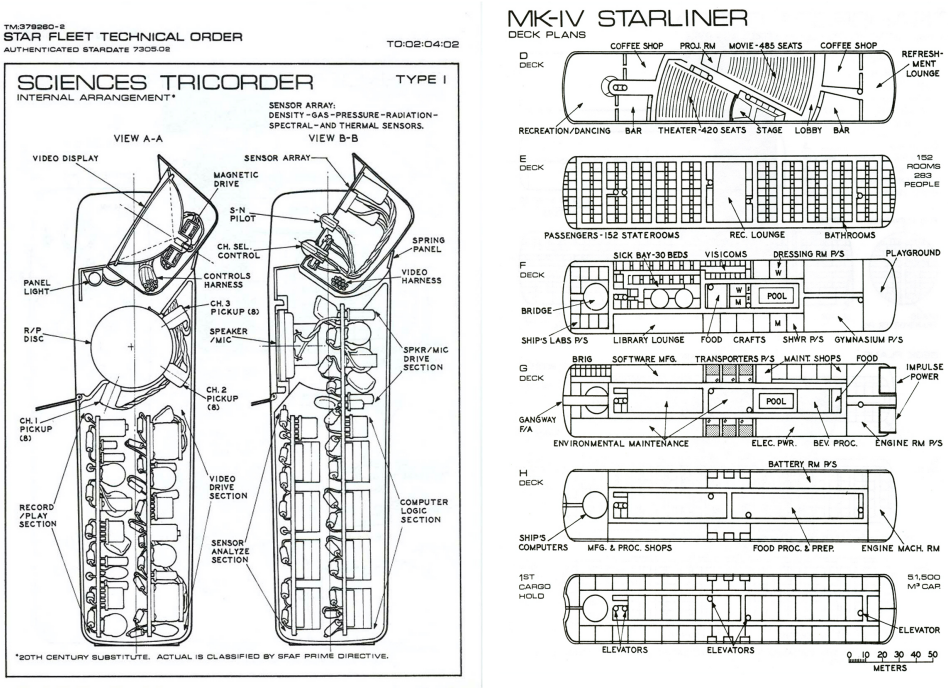


Figure 2.8: Section drawing of a tri-corder device on the left, deck plans of fleet star-liner on the rights (Joseph, 1975).

2.3.1.3 Using Design Fiction in Practice (Diegetic Prototyping)

Finally, Kirby (2010) paved the way for *using design fiction in practice*, by introducing diegetic prototypes. The word diegetic is employed by film scholars to compare a film's features by whether or not they occur inside the film's reality. For example, any sound effects, music, and visuals that can potentially be heard and observed by the characters inside the film, are considered diegetic elements. Any elements that can be observed by the audience, but not the characters are considered non-diegetic elements. Examples of non-diegetic elements in films are overlaid text, such as location markers or title cards, and soundtrack music. Although the origins of these comparisons are made in films, it can also be observed in other media as well. In video games, for example, interface elements that the player sees but the in-game character can not, are non-diegetic. The screenshot from the video game "Halo: Combat Evolved" seen in Figure 2.9 shows both diegetic and non-diegetic elements.



Figure 2.9: Diegetic (e.g. ammo counter on the gun) and non-diegetic (e.g. radar on the lower-left corner) elements in the video game, "Halo: Combat Evolved".

The ammo counter is represented as a small screen on the gun, can be observable by the in-game character, and is hence, diegetic. The radar and other interface elements placed on the corners of the screen are not observable by the in-game character but are for the player to use, and hence are non-diegetic.

Kirby (2010) argues that diegetic prototypes are objects designed as "cinematic depictions of future technologies demonstrate to large public audiences a technology's need, viability and benevolence." (p. 41). In this sense, diegetic prototypes take technologies or visions that are fictional, realize them as material artifacts and place them in context to communicate their implications and values to the audience. For example, the gestural interfaces shown in the movie, Minority Report (Spielberg, 2002) were a precursor to multi-touch interfaces that became broadly available to the public through smartphones some years later. Kirby (2010) through his work with film production teams established that these diegetic prototypes were more than props: they were designed and realized by interdisciplinary collaboration between engineers, designers, scientists, and artists to balance scientific fact, plausibility, believability, and storytelling.

Although diegetic prototypes were used to define an observation in the film industry, it became an umbrella term for defining the practical outputs of doing design fiction. All three approaches defined so far as the roots of design fiction (using design in fiction, using fiction in design, and using design fiction in practice), places an emphasis on practice (Lindley, 2018). In this context practice can be designing fictional products, analyzing fictional products, and discussing fictional products.

Like the gestural interface computers of Minority Report, diegetic prototypes are not the main points of their respective narratives but they reflect parts of the larger fictional world (Kirby, 2010). This allows diegetic prototypes to focus more on the implications of the central ideas. Near Future Lab's "An IKEA catalog from the near future" (B. Brown et al., 2016), a diegetic prototype, not only focuses on the central idea (connected and smart furniture) but also speculates on the company who makes them, names, and the jargon these products will entail, the marketing schemes, etc. (see Figure 2.10). This is a stark contrast with how design scenarios are expected to focus on the product at hand and the scenario exists to illustrate its functionality (Blythe et al., 2016).

To summarize, design fiction aims to create temporary bridges on the gap between fact and fiction, using designed artifacts. In the context of my research, this gap is apparent in the lack of ethnographic data when working on future contexts. Design



Figure 2.10: An IKEA Catalog of the Near Future (B. Brown et al., 2016).

scenarios emphasize the importance of going back to the informational research, the best available data when in doubt (see Section 2.2 on p. 16). Design fiction on the other hand is more flexible, in the sense that it encourages fiction to partially replace informational data. This temporary replacement allows designers to navigate further in the ambiguity of the FFED (see Section 2.1 on p. 9). This is not to say that design fiction completely replaces reality as the context of design. On the contrary, it enables designers to consider wider aspects of the context, by temporarily freeing them from ambiguity and doubt. Therefore, applications of design fiction are built to explore fictional contexts, only to bring back insights to the designer's real world.

To understand the state of art about these applications, I conducted a systematic review of the academic publications of design fiction applications. This study is done in order to familiarize me as a researcher to this relatively new domain and its effect on education while finding any insights on how to position my own research within. In the next section, I will present this review and its discussions.

2.3.2 Applications of Design Fiction in Design Education

I conducted a systematic literature review to find design fiction applications in design education. My focus was on practical applications to see how design fiction was put into use. Therefore I selected workshops, classes, or classrooms and design education as keywords, in addition to design fiction. The following search phrase was used in the Scopus database.

> TITLE-ABS-KEY ("design fiction" AND ("workshop" OR "class*" OR "design education"))

43 results were found in this search. One result was omitted due to an irrelevant connection to the search term (the term "class*" returned "classification"), one result was omitted because it was an entry for the proceedings book, 6 results were omitted because they were calls for workshops whom results were already represented as publications in other results, one result was omitted because it covered a workshop that was already covered in another result and finally 2 results were omitted because the papers were not accessible with reasonable effort.

The remaining 32 results were investigated for four practical information. First, I looked to see who generated fiction in these studies (p. 31). Second, I extracted the type of media used to generate fiction (p. 32). Third, I investigated whether or not a tool or toolset was defined for repeated use (p. 33). Finally, I characterized the utility of or the reason for the design fiction (p. 39). These results can be seen in Table 2.2 (For an explanation of asterisks in the *tools* column, see Section 2.3.2.3, p. 33).

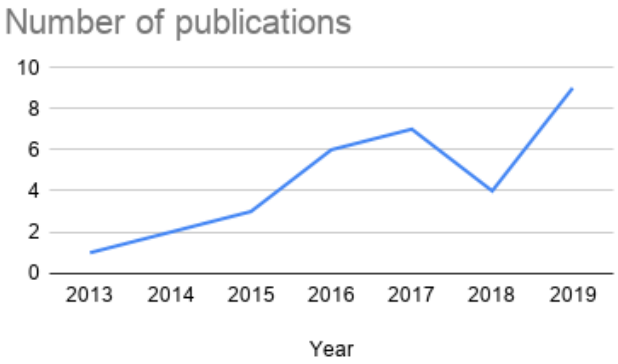


Figure 2.11: Number of applied design fiction publications over years

First, it should be noted that applications in design fiction are increasing over the years, showing that there is a growing interest in using design fiction as a design tool. The number of publications over the years can be seen in Figure 2.11. I will present my insights in the following subsections.

Table 2.2: Systematic review results for applied design fiction.

Source	Who Generates Fiction?	Media Used	Tools Proposed	Utility of Design Fiction
Yao et al. (2019)	Experts	Anything		Elicit expert opinion
Pargman et al. (2019)	Participants of a related conference	Diegetic writing	Fictional Abstracts	Elicit colleague opinion
Cheon et al. (2019)	Students	Descriptive writing, Physical mockups	Futuristic Autobiographies (FABs)	Improve design fiction
Ballard et al. (2019)	Experts, Participants of a related conference	Diegetic writing	Judgment Call: the game	Elicit colleague opinion
Berger et al. (2019)	Participants of a related conference	Story writing		Elicit user opinion
Green et al. (2019)	Experts, Participants of a related conference	Anything		Elicit expert opinion
Paniagua (2019)	Students	Digital mockups, Sketches		Educate students
Ambe et al. (2019)	Users	Story writing		Elicit user opinion
Hirskyj-Douglas and Lucero (2019)	Participants of a related conference	Sketches		Elicit colleague opinion
Huusko et al. (2018)	Researcher(s)	Sketches	2030- An Ecosystem Odyssey	Elicit colleague opinion
Ishizawa et al. (2018)	Experts	Sketches		Elicit expert opinion
Blythe et al. (2018)	Researcher(s), Participants of a related conference	Descriptive writing, Story writing	Imaginary Design Workbooks	Elicit colleague opinion
Dailey et al. (2018)	Experts	Diegetic writing		Elicit expert opinion
Bell (2017)	Researcher(s)	Digital prototype		Communicate own argument
Sturdee (2017)	Researcher(s)	Diegetic writing		Communicate own argument
Rostami et al. (2017)	Experts	Diegetic writing, Physical mockups		Elicit expert opinion
Zhu et al. (2017)	Experts	Sketches, Digital prototype		Elicit expert opinion
Tsekleves et al. (2017)	Users	Sketches		Elicit user opinion
Candy and Dunagan (2017)	Participants of a related conference	Physical mockups, Digital mockups	Experiential Scenarios*	Elicit colleague opinion, Improve design fiction
Ringvold and Digranes (2017)	Students	Sketches		Educate students
Coulton and Lindley (2016)	Researcher(s)	Diegetic writing, Digital mockups, Physical mockups	Game Vaporware*	Elicit colleague opinion
Rapp et al. (2016)	Participants of a related conference	Story writing		Elicit colleague opinion
Rozendaal et al. (2016)	Participants of a related conference	Physical mockups, Diegetic video		Elicit colleague opinion
Buie (2016)	Participants of a related conference	Sketches, Physical mockups	Board Game	Elicit colleague opinion
Blythe et al. (2016)	Researcher(s), Users	Physical mockups, Roleplay		Elicit expert opinion
Gilardi et al. (2016)	Researcher(s)	Diegetic video	Design Fiction Film Making	Improve design fiction
Elsden et al. (2015)	Participants of a related conference	Anything		Elicit expert opinion
Prost et al. (2015)	Users	Story writing		Elicit user opinion
Graham et al. (2015)	Experts, Fiction writers	Story writing, Descriptive writing, Diegetic writing	Getting writers involved*	Elicit expert opinion
Linehan et al. (2014)	Participants of a related conference	Verbal discussion	Alternate endings*	Elicit colleague opinion
Forlano and Mathew (2014)	Experts	Descriptive writing, Sketches, Physical mockups	Design Policy Toolkit	Elicit expert opinion
Markussen and Knutz (2013)	Students	Story writing, Physical mockups		Improve design fiction

2.3.2.1 Creators of Design Fiction

The first parameter explored was the type of participants who created the fiction. I categorized five types of fiction creators used in the publications: experts, participants of a related conference, researchers, students, and users. The first type of creators is experts. These are people who were actively sought for their expertise on the workshop topic and the workshop aimed to gather their insight. Green et al. (2019) invited people experienced in virtual reality systems to their design fiction workshop, with the specific aim of exploring the ethical issues in future virtual reality applications. Dailey et al. (2018) generated a fictional curriculum for crisis management, by inviting experts in the topic to their workshop.

The second type of creators are participants of related conferences. They are not selected by their narrow expertise towards a topic but are selected due to their availability. Pargman et al. (2019) ran a workshop in the 10th Nordic Conference on Human-Computer Interaction, where participants discussed the future research dimensions through fictional abstracts. Hirskyj-Douglas and Lucero (2019) conducted a workshop during the Student Interaction Design Research (SIDeR) Conference in 2018, where conference participants designed diegetic prototypes for dog to dog interaction.

The third type of creators are researchers of the publications themselves. Gilardi et al. (2016) create a design fiction film to establish a methodology for future researchers and practitioners. Coulton and Lindley (2016) design a fictional game and its assets to start a discussion around drone regulations in cities.

The fourth type of creators is students. Studies in which students created fictions are configured for education purposes. Markussen and Knutz (2013) ran a class in which graphic design students generated diegetic prototypes. Paniagua (2019) presents long-term work where they applied design fiction in a graduate design program.

Final type of creators is users. These are people who are not designers and are not professionally related to the researchers, but they are the people who are explored for gaining user insight. Prost et al. (2015) ran a study where people wrote fictional sto-

ries based on their home energy consumption, to understand their ideas for decreasing it. Tsekleves et al. (2017) worked with elderly people in a retirement home to gather user opinion on assistance devices, using stories and diegetic prototypes.

This part of the review reveals that design fiction applications are conducted within education where students create fiction. However, they are underutilized compared to other types of creators and that there is a gap in the literature regarding using fiction in the education context.

2.3.2.2 Media Used for Design Fiction

The second parameter explored was the media used for fiction creation. The most popular medium was text, followed by sketches and mockup making. Three types of text usage were identified in the publications: story writing, diegetic writing, and descriptive writing. In some works, participants were asked to write stories with characters, settings, and events. Berger et al. (2019) asked their participants to write stories around home automation in a fictional future house. Ambe et al. (2019) asked elderly users to write stories about tracking devices they might need to use in the future. I define these as *story writing*.

In other works, researchers asked participants to write text as if it was a part of the fiction. I call these *diegetic writing*. Pargman et al. (2019) asked their participants to write imaginary abstracts for a fictional future conference in their field to spark discussion. Ballard et al. (2019) created a game where participants wrote imaginary user reviews for future products.

And finally, in some work, researchers demanded *descriptive writing*, i.e. annotations or written descriptions that are neither stories nor diegetic. Blythe et al. (2018) created imaginary sketchbooks of future designers using a made-up language then asked participants to describe what these sketches could mean using annotations. Forlano and Mathew (2014) had their participants fill in their opinions about smart city systems on a toolkit they designed, based on a fictional urban policy.

This part of the review reveals that text is the most popular type of media used to create fiction within design fiction applications. There are however different approaches

within text creation: researchers planned their approaches through what they considered best fit for their participants and problem domain. Story writing in particular was conducted with expert help in multiple cases. Graham et al. (2015) conducted a workshop for exploring the future urban planning approaches, included professional science fiction writers in the workshop to aid urban planners write stories. Ambe et al. (2019), while conducting a workshop for exploring elderly users' points of view, selected participants that have experience with fiction writing before. Diegetic writing on the other hand was used with a combination of (1) tools, designed by the researchers to help participants or (2) the familiarity of participants towards the media used. Fictional abstracts for example relied on a website designed by the researchers as a guide to write them, and the participants' familiarity with how abstracts work (Pargman et al., 2019). Fictional curriculum facilitated by Dailey et al. (2018) also rely on the expert participants' familiarity with curriculum design. To summarize, diegetic text writing was chosen as a medium that is suitable to be used in a tool, given the participants are familiar with the particular type of text.

2.3.2.3 Tools Used in Design Fiction

The third parameter I explored in this systematic review is the tool usage. Some researchers developed tools for their research that was or could potentially be developed iteratively for future use. These are (1) fictional abstracts, (2) futuristic autobiographies, (3) judgment call: the game, (4) 2030- An ecosystem journey, and (5) imaginary workbooks. I will explain these tools in detail in the upcoming paragraphs. There are also approaches that I did not classify as tools, because their application is not described in enough detail to be repeated by other parties. These will be explained under the name, other approaches. These approaches are written in the *tools* column of Table 2.2 (p. 30) but are marked with asterisks to separate them from the more defined tools.

Fictional abstracts in Pargman, Ringenson, et al. (2018). Fictional abstracts are proposed to be used as a reflective tool for speculating on future research practices. They are positioned by the authors as a tool for acknowledging and negotiating an open future rather than predicting and narrowing it down. For the workshop, fictional ab-

stracts are defined as "250-word statements lifted from fictional research that could be published in 2068." (Pargman, Ringenson, et al., 2018, p. 2). Fictional abstract are built on previous work done under the name imaginary abstracts (Blythe, 2014; Blythe & Buie, 2014) with applications in other conferences (Baumer et al., 2014; Penzenstadler et al., 2014). While the fictional abstracts in these prior work are a product of closed co-creation sessions or expert products, Pargman et al. (2019) created open guidelines and published them online for the participants to use when creating their abstracts (Pargman, Eriksson, Comber, et al., 2018).

> *MY LIVER AND MY KIDNEYS COMPARED NOTES: USER ACCEPTANCE OF COLLABORATIVE RECOMMENDATIONS FROM INDWELLING MONITORS, by Michael Muller || IBM Research*
> "Indwelling organ monitors can now be connected via personal ArterioNets. Using a temporary implant, we provided an external server where the output of each organ monitor was processed. In that server, we simulated enhanced inference engines that could one day be included inside each organ monitor. Our server also provided simulated ArterioNet communication protocols for data aggregations among the simulated inference engines. This architecture permitted an exploration of future inference networks built on top of ArterioNets. We computed simple health recommendations to users, using our servers' simulations based on each user's own organ monitors. While most users were skeptical, many users proposed additional features that could lead to greater acceptance and compliance with such recommendations." A fictional abstract from Baumer et al. (2014, p. 766).

Apart from examples, the guidelines mention six characteristics of good fictional abstracts:

1. Genre adherence: Fictional abstracts should adhere to the style and tone of academic writing, however intentionally subverting some stylistic elements encourage speculative thought.

2. Specificity and allusion: Fictional abstracts would not explain a commonly known "past" event in detail, but rather reference it in subtle ways. An example given in the guidelines is that the phrase "9/11" would be used in a real text for referencing September 11 events, instead of a full description of them. This should also allow the reader to fill in the blanks and speculate more.

3. Scoping: A fictional abstract should focus on one problem at a time, rather than using too many fictional concepts.

4. Pros and cons: Fictional abstracts should refrain from a full utopia or a dystopia, as they are not as fruitful for speculation.

5. Intentional omissions: Intentionally omitting certain details is a good way to call attention to them and create a debate around them.

6. Concrete research: Fictional abstracts should refer to concrete research as much as possible and refrain from general statements, be it fictional or not.

In the end, fictional abstracts are a tool that offers examples, good practices, and a genre that the participants are familiar with.

Futuristic autobiographies (FAB) in Cheon et al. (2019). FABs are described as a tool for using fiction to elicit data from participants. In their original work, Cheon and Su (2018) use it to understand the values and perspectives of roboticists, arguing that they reflect them in their robotic designs too. The tool is applied through one to one interviews, where a short fictional prompt is given to the participant, written on paper (see Figure 2.12).

Futuristic Autobiographies (FABs) Prompt

It has been a long time after you graduated [the name of university]. One day, on the way to your home from work, you came across a communal "shared robot" around your neighborhood. Usually you don't take notice of the robot, but today you decided to engage with it. Then, you ended up renting the robot for a while. To date, the robot has involved with several happenings of X, Y and Z, and a significant event Q, which made you feel little bit anxious. Before you signed the rent agreement, you made sure to look through policies and obligations regarding the uses of robots. (X,Y, Z and Q could be something that you can imagine)

Figure 2.12: Futuristic autobiographies prompt (Cheon et al., 2019, p. 204).

These prompts describe a future scenario for the participant to imagine themselves in. For example, one prompt says that the participant had a moment in their daily experiments with a robot in 2026, which made them cry. Then, follow up questions are asked to reveal what values, like what that moment was or why that moment happened in that year. The tool was only applied by the researchers, who generated

the prompts themselves. Hence, no guidelines were produced for generating prompts for other studies. However, four high-level features were written in the publication:

1. Expeditious: Interviews were designed to last 30 to 60 minutes, so 5 to 10 minutes were allocated per prompt. Therefore, FABs are to be short, around 100 words each.

2. Captivating: FABs are supposed to be interesting for the participants. Authors argue that plausible and relevant contexts establish this. For robotic researchers, a popular robotics award or funding application processes were given as examples.

3. Open-ended discussions: Some specific details, like robot models or specific years, were purposefully omitted from FABs to keep answers open for further discussion.

4. Focus on values and ethics: FABs were intentionally designed to touch ethical friction points, established in prior literature, to explore the participant's stance on them.

Although FABs are presented as a tool that can be used in different contexts for value eliciting interviews, there are no detailed guidelines for other researchers to create their own prompts, other than the high-level features mentioned above.

Judgment Call, the game in Ballard et al. (2019). Judgment Call is a board game, meant to be played by product teams in the industry to explore ethical issues around their applications with artificial intelligence. The game comes with a deck of cards and the publication clearly describes its application. Teams start by identifying a real or fictional product scenario that they want to explore. Next, they identify stakeholders in the scenario and write them up on designated cards. During the actual gameplay, each player draws one card from three decks: (1) a stakeholder card which identifies a stakeholder, (2) a rating card which identifies a star rating from one to five, and (3) an ethical principle card, which describes an ethical principle about artificial intelligence previously defined by the researchers. Then the player uses this set of three cards to write down a fictional user review, by stakeholder, giving the star review, using the ethical principle (see Figure 2.13).

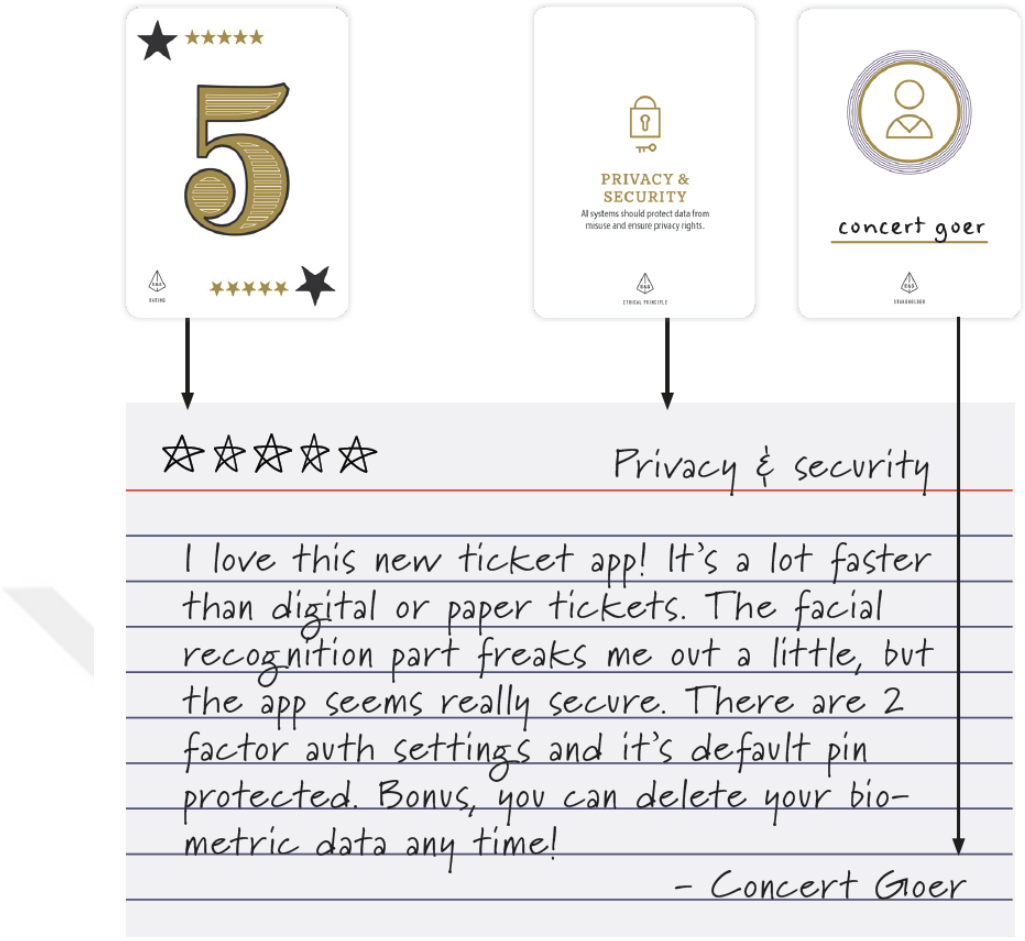


Figure 2.13: Example game play from Judgment Call: The Game (Ballard et al., 2019, p. 429).

Researchers identified three features for the tool:

1. Creating discursive space: Researchers argue that the tool creates a safe discussion space for ethical considerations, which can be hard and uncomfortable conversations in business settings.

2. Increasing empathy: Researchers argue that discussing issues from the eyes of stakeholders enables a broader understanding of their implications.

3. Being expeditious: The game takes one to two hours to play and the researchers argue that this increases its utility in the business environment where time is limited.

Judgment Call is the most well-defined tool in this review and is ready to be applied in different contexts. However, this also means that its assets, especially the deck of ethical considerations are created within the researchers' own organizational values: in this case Microsoft. There are no guidelines for other researchers or practitioners to create their own assets, but game mechanics can easily be reapplied.

2030- An Ecosystem Odyssey in Huusko et al. (2018). In this work, researchers attempted to explore the future of maritime industries and how it will be transformed by autonomous systems. The tool is a card-based game, in which workshop participants ideated on fictional scenarios and tasks presented in these cards. The content of the cards was prepared by grouping the results of a prior step in the research: interviews with maritime industry experts (see Figure 2.14). The structure of the tool then was to gather future insights of industry experts, grouping them into distinct fictional scenarios and enabling different stakeholders to articulate them. While the tool was specifically designed for this individual research, the researchers mentioned that the fictions they established for the participants were deemed as a limitation by them. They suggest that a less defined approach for the fictions would be more engaging for the participants.

Imaginary workbooks in Blythe et al. (2018). Imaginary workbooks are based on interpreting "found" notebooks of a fictional designer from an unknown time and world, using an imaginary language for annotations. The researchers prepared a three-section imaginary workbook for their workshop, each section having a theme for organic, mechanical, and cellular designs with gibberish annotations (see Figure 2.15. This was photocopied for each participant in the workshop to decipher and translate in their own understanding. After this session, the participants were asked to create their own imaginary workbooks, but this time, for a country and time other than theirs. The outcome of the study, argued by the researchers, is to challenge the norms and defaults of the participants by introducing them to and then asking them to create foreign objects. While the approach can theoretically be repeated, there is no attempt in this work to describe how the initial imaginary workbook can be designed by other researchers.

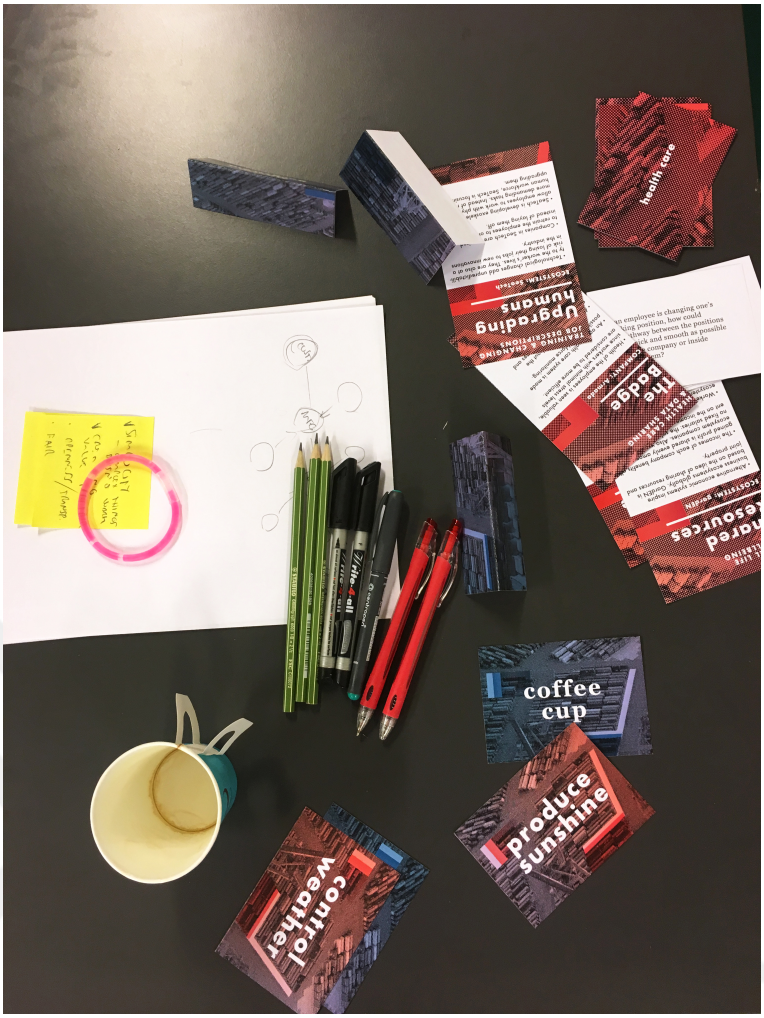


Figure 2.14: Materials used in the workshop including design fiction cards (Huusko et al., 2018, p. 237).

2.3.2.4 The Utility of Design Fiction

The fourth parameter explored in the review was the utility of the design fiction. Six utilities were identified: (1) eliciting expert opinion, (2) eliciting colleague opinion, (3) eliciting user opinion, (4) improving design fiction, (5) education, and (6) communicating own argument.

Some work used design fiction to elicit expert knowledge. Yao et al. (2019) brought together experts on data privacy to elicit themes and ideas from them in a workshop, using design fiction activities. Ishizawa et al. (2018) conducted a workshop where developers of three alternate reality systems came together and conducted a workshop

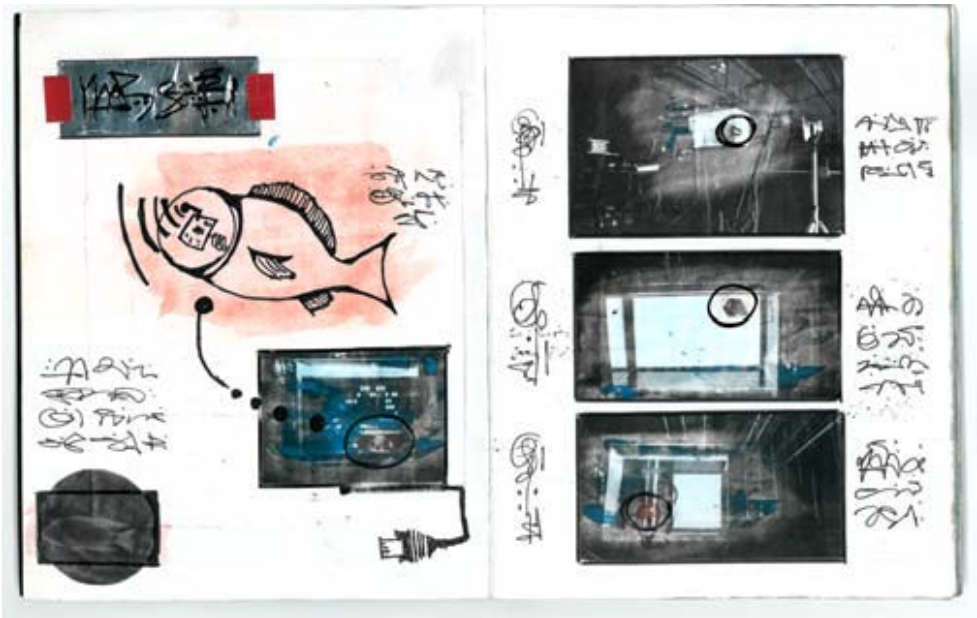


Figure 2.15: Example page of an imaginary workbook (Blythe et al., 2018, p. 233).

amongst themselves to explore further implications of their own products.

Other work used a similar direction but instead of summoning experts in a particular domain, they worked with colleagues from similar domains. Pargman, Ringenson, et al. (2018) and Candy and Dunagan (2017) all conducted workshops around using design fiction, with participants from the conferences they were conducted in. Participants were fellow HCI researchers for the former and futures researchers for the latter.

The next group of works used design fiction to elicit information from the users. Tsekleves et al. (2017) conducted workshops with elderly people in a retirement home to elicit their opinions and values on tracking and assistance systems. Berger et al. (2019) organized a similar work with random households about their appliance usage and energy consumption.

The next group of work aims to improve design fiction, by evaluating and developing the theory. Cheon et al. (2019) conducted a workshop using their *futuristic autobiograhies* tool, but their primary aim was to explore and theorize how participants negotiated with each other within their groups as they generated fiction. Markussen and Knutz (2013) also generated dimensions of fiction that were utilized within their

workshops to inform further design fiction researchers.

The next group of work was aimed at education. Ringvold and Digranes (2017) worked with primary school students and conducted design fiction workshops to identify the soft skills they would need to possess for further design fiction education. Paniagua (2019) recites her long-term experiences in CENTRO Advanced Design Institute in Mexico City and evaluates the roles of design fiction.

The final group of work aims to communicate the author's own arguments, using design fiction. Bell (2017) creates and then explores a future about data ownership to define hypothetical stakeholders and their roles. Sturdee (2017) creates a fictional board game manual, to illustrate a potential outcome of her research topic of shape-changing interfaces.

2.3.2.5 Discussing the Results

To summarize the results of my systematic review on design fiction applications, I will present three insights: (1) design fiction applications are mainly focused on exposing and communicating colleague and expert opinions, (2) creating toolsets that can be applied by other researchers is lacking overall, but gaining traction in the last two years of the scanned frame, and (3) writing is a popular practice for fiction generation within the applications in three different forms. I will now describe each insight in more detail.

First, design fiction applications are mainly focused on revealing and communicating colleague and expert opinions. However, these opinions are not treated as constraints of design, but rather to diversify a discursive space within the problem domain. While some work focuses on revealing the opinions of users or experts, but a substantial body of work focuses on revealing the opinions of colleagues (See Section 2.3.2.1 on p. 31). This implies that understanding designer's own afflictions while conducting work in unfamiliar contexts is equally important in understanding the values of other stakeholders. Therefore, self-speculation and assessment are considered important phases in the FFED.

Second, toolsets that are defined enough to be used by other parties is a lacking as-

pect in design fiction work. While several of the reviewed work establishes some approaches, only five of them were identified as toolsets that can be used in other contexts (see Section 2.3.2.3 on p.33). It is also noteworthy that these tools appeared in work published in 2018 and 2019, the last two years of the review. I argue that the lack of well-established tools in design fiction is a gap in the literature and it is lately being identified by other researchers in the field.

Third, text is identified as a popular medium used in the reviewed work. I identified three different uses: story writing, diegetic writing, and descriptive writing (See Section 2.3.2.2 on p. 32). The popularity of this medium implies that it is accessible for different groups of participants and these three different types can be utilized for different purposes. Next, I will summarize my overall findings from this chapter.

In this chapter, I investigated three titles in their respective sections: (1) fuzzy front-end in design, (2) scenarios in design, and (3) design fiction. In the first section, I identified the early phase in design where designers conduct research to establish a synergistic combination of informational and inspirational findings. Informational research lays down descriptive knowledge about the problem domain's background. Inspirational research identifies inspiring and triggering knowledge which can be used as insights. Designers tend to connect relevant knowledge through narratives.

In the second section, I explored design scenarios as narratives in design. I presented how they were grouped by their utility in the literature which is closely related to how concrete they are and which stakeholders they attempt to link together. Later, I identified three features mentioned by the practitioners and researchers: focus, plausibility, and inventiveness. These mechanisms manipulate how concrete scenarios are, and therefore affect their utility. A common understanding in the literature however is that design scenarios rely heavily on user research. It means that they have to be focused on the problem domain at hand and not be derived from imagination. On the other hand, ambiguity and gaps in knowledge in design scenarios are somewhat encouraged, because they enable designers to be inventive and imaginative to be immersed in these contexts.

For future contexts though, design fiction tips this balance more towards the unknown. In the third section, I explored the design fiction literature, which focuses on gener-

ating concrete and plausible scenarios, through suspending disbelief to alternate realities, rather than ethnographic research. In other words, design fiction creates a connection between inspirational and informational research. A review of design fiction applications in the literature revealed that the "toolification" is lacking but also promising. It also revealed that these tools are fit for eliciting designer's own afflictions and implicit knowledge. As a result, I argue that a design fiction tool would be useful for design students to navigate through the FFED and would be a contribution to a gap I identified in the literature.

CHAPTER 3

FICTIONAL TRUTHS AND WORLD BUILDING

In the previous chapter, I explored three domains: (1) the fuzzy front-end in design, (2) design scenarios, and (3) design fiction. Fuzzy front-end of design represents the chaotic early phases of design activities during which design students use exploratory and generative research approaches in order to gather informational and inspirational findings. Through these findings, design students can immerse into future contexts for which direct exposure and user research may be lacking. The remainder of the chapter explored two relevant and existing approaches in creating such immersion: design scenarios and design fiction.

In such practical approaches, it is suggested by the literature to separate factual information from the imagination and rely on factual information as much as possible (see Section 2.2.2 on p. 19). Design scenarios are expected to be based on informational findings, such as first-hand observations or user research data. Then the designer should be inventive and inspirational to enrich the scenario with imagined context (see 2.2.3 on p. 20). Based on these findings, I created a schematic visualization, representing the FFED with distinct areas for inspirational and informational findings (e.g. see Figure 2.6 on p. 21).

After completing the literature review presented in the previous chapter, I had a further interest in understanding the relationship between the design student and imagined contexts. While the literature favors informational data in the FFED, it is also clear that design students are expected to create and use fictional details in their early design processes. It is possible to categorize the particular bits of knowledge used in a design scenario as factual or fictional (corresponding to informational and inspirational findings described in Section 2.1.2 on p. 13). However the resulting design

scenario as a whole, is harder to define in terms of its fictionality.

A design scenario can be considered as a work of fiction, since the narrative it describes did not necessarily happen. However after being created in the FFED, it will trigger design ideas and it will be used to assess those ideas. Some of these design ideas would then be potentially realized in the actual world, and part of their justification would be the design scenario. In this sense, the design scenario is not just a work of fiction, at least not like how a novel would be. It is part of a real world artifact. Therefore, I identify a challenge in defining the FFED in terms of fictionality.

In this chapter, I will focus on how fact and fiction can be defined and utilized within the FFED in two sections. The first section (Section 3.1), explores fictionalism and possible worlds theory to frame the FFED from a fictionalist point of view. Later in this section, I conclude that the FFED as a whole can be described as a world building activity. The second section (Section 3.2), explores relevant literature on world building. I first present a theoretical framework to finalize my definition of FFED as a world building activity.

3.1 FFED as a Work of Fiction

In this section, I will focus on the theoretical aspects of what fiction is and how fiction relates to facts. My aim is to explore the theoretical discussion over how fiction is defined, and what these definitions imply for the FFED. As I illustrated over design scenarios, it is hard to separate factual contributions in the FFED from fictional ones. Going back to the example scenarios given in the first chapter (see Figure 1.2 and 1.3, p. 3), they are holistic representations of baselines created by their authoring design students. Akaslan's design scenario paints a vivid setting, has a character and describes a narrative. She has not been to this setting herself, nor the character she drew is a real person; but she combined informational findings (advising company's presentation, online videos, etc.) and inspirational findings (a fictional town, a character, etc.) to create an artifact. I can assume that when this was presented to a studio instructor, they had not immediately dismissed it as being false or fictional. Instead, they must have suspended their disbelief and treated the artifact as real, in order to

discuss its implications. The same process happens for the author: Akaslan probably did not present her design scenario as an account of real events. She suspended her disbelief for the sake of having a factual baseline to rely on, as she developed design ideas for it.

This requires the design scenario to be in an intermediary point, in between fact and fiction. In conventional truth-functional logic, a statement can either be true or false. "If I had designed this pen, I would have made it thicker" as a statement does not work by this definition, because I did not design this pen, and therefore the rest of the argument is false by extension. In contrast, modal logic works with such counterfactuals by the addition of possibility and necessity (Ballarin, 2017; Chellas, 1980). By this definition, I can imagine the possibility of me designing the pen, and then the possibility of me designing the pen thicker. Modal logic separates the truth value of a statement from its use value. The pen is still not designed by me; hence, the statement is still not true but I am making a point by communicating how I think the pen should be thicker. Therefore, the statement has utility. Modal logic provides a temporary state in which an argument is accepted at face value, in order to be communicated.

3.1.1 Possible Worlds

The way modal logic expects a temporary acceptance of a statement, regardless of its truth value represents an ontological challenge. A statement being "possibly true" is not compatible with people observe reality. Philosophers use the concept of *possible worlds*, to frame possible truths within their own separate worlds (Sainsbury, 2010). The essential idea is to replace the absolute view of truth or falsehood, with truth or falsehood within a possible world. In this view, there is a possible world in which I designed the pen and made it thicker. Therefore, my hypothetical statement of "If I had designed this pen, I would have made it thicker", is merely a reference to that possible world.

Possible worlds theory allows modal realities to exist in their own complete and consistent worlds. Therefore, for every modal reality, a different possible world exists. Lewis (1986) proposes that if a modal reality does exist in a possible world, then the possible world itself must also exist. This view is called *modal realism*, and suggests

that all possible worlds exist and are real. What makes the world we inhabit special is only the fact that we inhabit it. Lewis (1986) explains this distinction by using the concepts of *actuality* and *reality*. All possible worlds are real and they form the reality, while the world we inhabit is the actual world.

The metaphysical questions about possible worlds, especially the Lewisian view in which all possible worlds are real, are not as important since the main point is to provide an ontological structure to modal realities (Sainsbury, 2010, p. 71). As an example, design scenarios make references to possible worlds in which the designer makes speculations. Akaslan's design scenario (Figure 1.3 on p. 4) refers to a possible world where the drawn woman washes clothes in a town at dusk. When discussing this scenario with an instructor, both parties assume the reality of this possible world. The subsequent design process works on the assumption that the findings in the FFED are real. Therefore, the design process simply refers to a possible world as it progresses, until and if the artifact produced at the end becomes actualized.

3.1.2 Fictionalism

Modal reality emphasizes a statement's use value, over its truth value. *Fictionalism* is an approach which applies this principle to any given discourse, claiming that at least part of every argument should be regarded as fiction (Eklund, 2019; Rosen, 1990). Being a fictionalist about an argument is to accept its utility at face value, but to be agnostic about whether or not it is the truth.

Two typical examples for fictionalist approaches will be given. The first example is how van Fraassen (1980) argues that scientific theories which describe unobservable entities, such as sub-atomic particles, should be evaluated by their explanatory powers rather than being true. If a scientific theory adequately explains an unobservable phenomenon, it will have a use value within its domain. Through this use value, it is no longer important whether one believes this theory to be true, but it is important that one accepts this theory to be empirically accurate.

The second example is the specific domain of mathematics. Field (1980) claims that mathematics's value is not being a true account of reality and there is no use arguing

whether the abstract concepts it proposes such as numbers are real or not. But since these abstract concepts have merit to explain reality, mathematics should be accepted at face value and appreciated.

Design, as a general practice of creating artifacts, has a similar but different relationship with fictionalism. On the one hand, design does not deal with an abstract set of entities like mathematics. On the other hand, the artifact to-be-designed does not yet exist but has to be treated as real during the design process, in order to be worked on. Design philosopher Galle (1999) explores design from a fictionalist point of view and argues that a *design representation*, whether it is text, models, drawings etc. can be regarded as a fictional entity, a possible version of the finished artifact.

> "Assuming one cannot literally describe or depict a thing that does not somehow exist, the task is to find a way in which the fictional, unrealized, as-yet-unproduced artifacts in question can be said nevertheless to exist. Doing so amounts, it would seem, to admitting possibilia (possible entities), in one form or another." (Galle, 1999, p. 70)

Galle's (2008, p. 26) later work explores the relationship between design and fictionalism further, by introducing the concept of a story world, which he calls *story of design*. In his argument, a design representation early in the process is not true, since it is not yet realized. However it is true in relation to a larger story of design, or at least, that would be the designer's intention. Story of design is the cumulative and consistent body of knowledge, both externally and internally devised. Galle (2008) gives the example of an architectural design process of an opera house and its balcony. The architect justifies the balcony's design, by claiming that it is consistent with the story of design. The story of design in this case is that all the audience in an opera house must have a clear line of sight towards the stage.

The truth value of this claim can easily be tested, since this is a geometric representation. Drawings or computer models would verify whether there is a clear line of sight from the balcony to the stage or not. In verbal representations however, such as the narrative in a design scenario, it is harder to verify whether it is consistent with the story of design or not. In this case, other logical consistencies with the story of design would be sought after. The story of design in this case is more tacit, and more in line with Cross's 2006 designerly ways of knowing.

> "Before a proposal can be tested, it has to be originated somehow. The generation of design proposals is therefore the fundamental activity of designers, and that for which they become famous or infamous. Although design is usually associated with novelty and originality, most run-of-the-mill designing is actually based on making variations on previous designs. [...] The designer is thinking of the whole range of design criteria and requirements set by the client's brief, of technical and legal issues, and of *self-imposed criteria* [emphasis added] such as the aesthetic and formal attributes of the proposal." (Cross, 2006, p. 16)

Accordingly, designers assess their ideas through criteria that is both externally sourced (e.g. technical constraints, legal frame) and internally sourced (e.g. self-imposed criteria). Overlaying Cross's tacit criteria with Galle's story of design, I argue that designers create a story world and assess their speculations through that world. A story of design is created in the design process, since design problems often don't offer "all the necessary and sufficient information for their solution" (Cross, 2006, p. 18). By this definition, the story of design then temporarily takes the place of the actual world, providing a test bed for the designer to assess their ideas in terms consistency and declaring them true if so.

To summarize, fictionalism and the theory of possible worlds provide an philosophical basis for the FFED. Its value is not being a true representation of the phenomena it describes, but rather two-fold: (1) it has use-value and (2) it should be consistent with the story of design which it is a part of. These points are expanded below.

1. From a fictionalist point of view, the FFED should be evaluated not by its truth-value, but by its use-value. It is not important whether the town in Akaslan's design scenario is real, or the character drawn is based on a real person. It is however important that both Akaslan and any other stakeholders who viewed her scenario had accepted it as a useful description.

2. By Galle's (1999, 2008) account, this usefulness can be evaluated by comparing its consistency in regards to the story of design. The story of design both encapsulates prior design work and external constraints, and the designer's reflective and internal constraints. Passing these constraints, a speculation is considered "true", in relation to the story of design.

Assessing the use-value through consistency implies a comparison: one can only evaluate the consistency of something in relation to something else. In the context of the FFED, such an evaluation can be done between fact and fiction: by asking whether a fictional detail is consistent with the factual information. This is corroborated by the literature on design scenarios. Therefore, an important question to ask is how one can extract the utility from FFED from a comparison of consistency between fact and fiction.

While it is possible to compare fact and fiction, (i.e. informational and inspirational findings), the two concepts are not mutually exclusive (Sainsbury, 2010). Fiction can not be defined as not being, or not being represented as fact. A piece of scientific work that had been since disproved is not factual anymore, but it is also not considered fiction. Likewise, there is often factual information in fiction: realistic descriptions of locations or historical figures are commonly found in novels. While fictionalism provides a philosophical ground for framing intersections of fact and fiction, it is not useful for ontological clarity; i.e. specifically defining what fiction is. The next section will present relevant discussions on how fiction is defined in the literature, and what this implies for my study.

3.1.3 Fictional Truth

Currie (1990) defines a work fictional, only if it is a product of a fictional utterance. The fictional utterance in this case is one which is produced with distinctively fictive intentions. By this definition, the disproved scientific work can not be considered fictional, since it was never produced with fictive intentions. However it does not sufficiently cover the design scenario. While the design scenario contains fictive details, it is not necessarily created by fictive intentions alone, since it aims to describe situations from the actual world. But the same can be said for novels set in the actual world: fictive intentions are rarely expressed overtly (Van Looy, 2005). Novels often don't start by telling their reader which exact parts of the text are fictional. Novels are established as fictive bodies of work, and a reader would automatically assume the fictive intention while reading one. I argue that design scenario as a medium creates the same understanding between the author and the reader.

Walton (1990, p. 35) defines this as mutual suspension, a *make-believe* where both the author and the reader of the fiction is aware of the fictive intentions. His example of a make-believe is a game played by children in the forest, during which they decide to pretend that tree stumps are bears. This decision and its declaration is called a *principle of generation*. With this generation, every time one of the children sees a tree stump, they are supposed to imagine that it is a bear. In this example, the tree stumps are *props*. In Walton's terminology, a prop is a real object that stands for something else in the fiction. Tree stumps can be likened to bears by children within their game, but they do not exist for this purpose. Therefore he regards them as props in this example. Props provide a connection between the real and the fictional.

Props and principles of generation come together to create a *fictional truth*. A fictional truth first prescribes the reader to start imagining and suspend their disbelief. Props then offer the reader references of imagination. Within the children's game, tree stumps being bears is a fictional truth. At no point the children playing the game will actually think the principle of generation is true and that the tree stumps are actual bears. But they will imagine this is as the fictional truth. The children will scream and run from a newly discovered tree stump beneath a pile of leaves, accepting it as a hidden bear.

Props are important in my argument, because they provide a reference point in the fiction towards reality. Toon (2012, p. 39) gives an example from Well's (1898/2005) War of the Worlds novel. In the novel St. Paul's Cathedral has a large hole on its side after the alien attack. St. Paul's Cathedral is a real object in the world, and Wells was not claiming that the real St. Paul's Cathedral had a hole. In the novel, the cathedral was used a prop: an object from the real world, prescribing imagination on the reader's end about being damaged, standing in for a representation in the novel.

By this definition, the design scenario as a medium, is the principle of generation. First, it allows its author to be fictional (i.e. inventive, see Section 2.2.3 on p. 20) and it prescribes its receiver to suspend disbelief and accept it as real. Second, it includes props to offer references. In Akaslan's scenario, there is a backdrop of buildings and a town square defining the setting. The setting is not the central point of the scenario (i.e. focus, see Section 2.2.1 on p. 18), and it is certainly not drawn as a realistic

representation of a real town. However in this scenario, the backdrop "stands for" a town: they are props. They help build the fictional truth for the main narrative, that is, a woman doing laundry. In this section, I explained how fictional truth is formed by the principle of generation and props. Together, they build the connection between fact and fiction; enabling a consistency between them.

3.1.4 Objectivity of a Fictional Truth

The concept of a fictional truth provides a structure to the FFED. I previously described the FFED as an ambiguous combination of fact and fiction, and I now describe it as props that represent fact and infer to fiction, through a principle of generation. In this section I will discuss the properties of representation and inference. More specifically, I will present arguments that explain how properties of inference and representation affect the acceptance of a speculation.

Toon (2010a, 2010b, 2012) and Frigg (2010a, 2010b) use Walton's fictional truth to explain scientific models as make-believe. The argument is that scientific models, theoretical or physical, stand as representations of the real world phenomenon they explain. By this definition, a scientific model provides props which prescribes the reader to imagine its implications, hence it creates a make-believe. Theoretical models, like black holes in space, prescribe imaginings via describing unobservable entities (see Section 3.1.2 on p. 48). Another example would be a physical model of a DNA helix. While the model is made of steel rods and plates, as a prop in a make-believe, it prescribes its viewer to imagine it in a microscopic scale made from completely different materials and bonds. An analog would be a design prototype, that stands for the actual artifact.

What separates this fictional reading of a scientific theory, from a pure work of imagination like a novel, is not about the contents of the model since in both cases they are made of props that prescribe imaginings. Toon (2012) claims that the principle of generation creates a distinction: it describes specific ways in which the props would work (p. 65). In Walton's (1990) game of make-believe, not all tree stumps stand for bears. An invisible stump that is buried in the ground does not represent a bear which is buried in the ground. It simply does not exist in the fictional truth. Therefore, there

is an objective truth within the scope of a fictional truth and this scope is only as wide as its usefulness requires. The tree stumps that serve as props are only the ones which are visible and within the children's line of sight.

> "An oddly shaped stump might prompt one of the participants to imagine a wolf and not a bear, but unless the game is changed, the proposition that there is a wolf before them is only imagined, not fictional. Fictional truths therefore possess a certain kind of 'objectivity'." (Toon, 2012, p. 35)

This means the fictional truth requires an inner-consistency. Only then, the fictional truth can provide inferences, i.e. new knowledge and this in turns enables one to *learn* from a fictional truth (Phillips, 1999; Poznic, 2016). The fictional truth will create new knowledge that will enable its participants to learn more about it.

In Chapter 2, I concluded that each speculation made in the FFED pushed the designer to a fictional realm, later to be assessed through a factual one. The process of the FFED represented a balance between these two acts. In this section, I presented the challenges of defining a clear ontological separation between fact and fiction. They often exist together in intertwined states: conventional fiction like novels can include factual information; while conventional facts like scientific models include fictional entities. By this understanding, being fictional is not an antithesis of being factual. Rather, it creates a possible world, a modal reality where parts of the actual world coexist with the fictional speculation. Therefore, each speculation creates a holistic possible world.

About assessing these speculations through the actual world, I presented fictionalist views of Galle, in which he defines a story of design. The story of design represents the actual world, but it also includes tacit knowledge and internal constraints of a designer, formed via prior work. Therefore it refers to fictional entities, in the sense that parts of it are accepted for their face-value.

Through these discussions, I reframe my schematic view of the FFED in Figure 3.1. Instead of defining inspirational and informational findings as two areas of the FFED (see Figure 2.6 on p. 21), I define possible worlds and design reality. Therefore, I conclude that the FFED is a world building activity. Each speculation and each assessment contributes to world building. Without a clear separation between entities

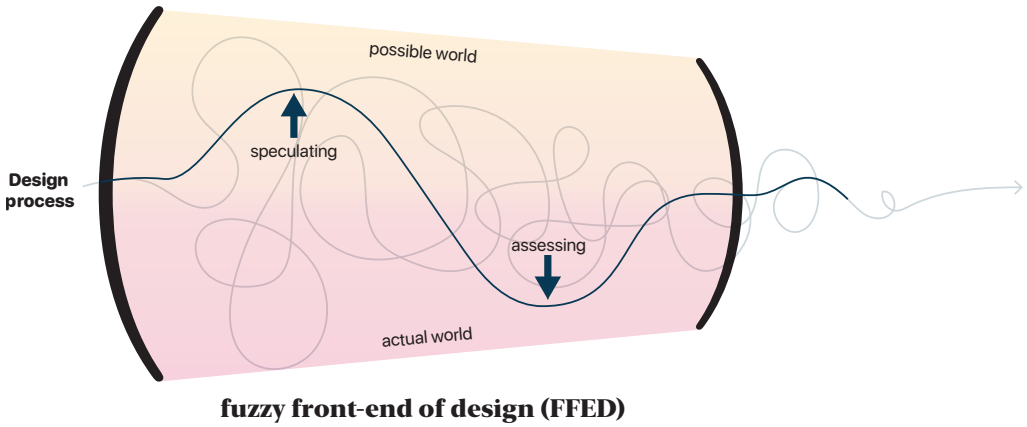


Figure 3.1: Schematic view of the FFED using possible worlds theory.

of fact and fiction, the importance shifts towards understanding the softer relationships between these entities, rather than the defined processes of design scenarios such as fiction making (inventiveness) or fact checking (plausibility). Instead, I focus on world building to better explore these ambiguous relationships. In the next section, I will present my findings about world building from related literature.

3.2 World Building

I concluded in the previous section that FFED in its entirety can be regarded as a world building session, generating a possible world for the designer to work with. In this section, I will present the literature regarding how world building operates, both in terms of creation and in terms of perception.

World building has seen a surge of interest both in academia and in practice, not only due to the increasing body of knowledge dealing with its ontological use (as discussed in Section 3.1.1), but also its widespread use in media studies (Ryan, 2017). Storytelling is increasingly about the art of world building, as authors create exhaustive and consistent contexts that support the narrative they want to tell, which in turn supports even more narrative (Jenkins, 2006, p. 114). In other words, “storyworlds can be defined as the worlds evoked by narratives, and narratives can be defined in turn as blueprints for world-creation" (David Herman, 2009, p. vii). But fictional worlds

are not just context for narratives. They provide a playground for the reader, as well as the author: fictional worlds enable an experiential and imaginative experience for readers (Herman, 2009a; Kennedy, 2016; Mochocki, 2016). M. J. P. Wolf (2014) and Ryan (1991) and Ryan and Thon (2014) provide practical aspects of how fictional worlds are built using different media for readers to engage with.

This is why I am interested in world building for this study. It is not only a theoretical explanation of the designerly practice of combining fact and fiction, but it is also a practical approach, applied by an increasing number of authors and researchers within the domain of media studies. Therefore, one of my aims is to import and adapt knowledge from world building into design. This section will be presented in two subsections. In the first one, I will present how fictional worlds are received by readers. In the second one, I will present how fictional worlds are constructed by authors. For the remainder of the text, readers represent any person who makes sense of a piece of fiction and authors represent any person who creates one. In a design context, an author can be a design student who generated a design scenario and a reader can be a tutor viewing it.

3.2.1 Three-World Structure

Possible worlds theory establishes a possible world for every modal reality (see Section 3.1.1 on p. 47); hence, it defines two types of worlds: actual and possible. However, in systems like the FFED where factual and fictional entities exist together, this distinction is not enough to categorize the discourse. For example, a FFED process will define a possible world through research findings. Most findings will be factual, therefore the possible world will be similar to the actual world. From then on, the designer is expected to think within this possible world, by generating concrete problems and proposals to solve them. At this point, the designer centers themselves within the possible world, making it their actual world for the design process.

Ryan (1991) defines this as *recentering* and uses it to frame a three-world structure to better categorize the worlds. These three worlds are (1) actual world, (2) textual actual world, and (3) textual reference world.

Actual world is where the author of the story world resides and it is the real world which we live in. The possible world that is created by the author's speculations is the textual world and is divided in two. *Textual actual world* is the center of the system and represents the author's speculation. *Textual reference world* is external to what the textual actual world represents. In other words, textual reference world is the rest of the textual universe, that the textual actual world does not describe.

I will illustrate this system using Akaslan's design scenario. Akaslan as a designer lives in the actual world and her FFED activities creates a textual world. The scenario she drew, showing a woman doing laundry in the town center at dusk is the textual actual world. Anything that belongs in this textual world but is not represented by this scenario would be designated as the textual reference world, from which the design scenario shows a single scene from. From the designer's perspective, this textual universe is no longer a possible world, but it is an actual world where every design proposal will be treated as a possible world. The designer recenters themself to this possible world, converting it to their textual actual world.

Akaslan's design scenario also infers to a bigger world: there is the rest of the town, the rest of the day, and the rest of the people in this town that the scenario does not explicitly covers. These establish the textual reference world. Although it is not explicitly told by the author, readers can make their own assumptions regarding the textual reference world. For example, I assume that the town is bigger, but has a similar look to the drawn section of it. Ryan (1980, 2004) defines the assumption of similarities between textual reference world and the actual world, unless explicitly told otherwise, as the *principle of minimal departure*. Just because Akaslan did not draw the entire town, I do not assume that the rest of the town is substantially different.

The difference between what is explicitly told as the textual actual world and what is inferred from it as the textual reference world represents gaps in worldbuilding. A narrative does not explain its entire world, much like a map would not describe every detail of its territory (Herman, 2009b). This is specifically important in the case of design scenarios, for which designers are told be economical and focus at the problem at hand (see Section 2.2). The principle of minimal departure suggests that the textual reference world which is left out of explicit representation is filled by the reader, to

be as close as possible to the actual world they know. Ryan (2005) states that "when readers construct fictional worlds, they fill in the gaps [...] in the text by assuming the similarity of the fictional worlds to their own experiential reality" (p. 447).

A three-world structure has three implications for my study. (1) There is a textual universe created within the FFED, which is referred to by speculations, such as ones within design scenarios. (2) These speculations are only partially explicit, they create a textual reference world which is not explicitly described by the author. (3) These speculations will be assessed through this partially explicit textual world, of which the reader assumes the non-explicit parts from their own experiential reality. Therefore what Ryan (2005) defines as the reader's own experiential reality is important in this context. Figure 3.2 represents my schematic view of the FFED, using the three-world structure. In this model, the two world representing the fictional and the factual sides of the FFED blend together at the end as the textual actual world.

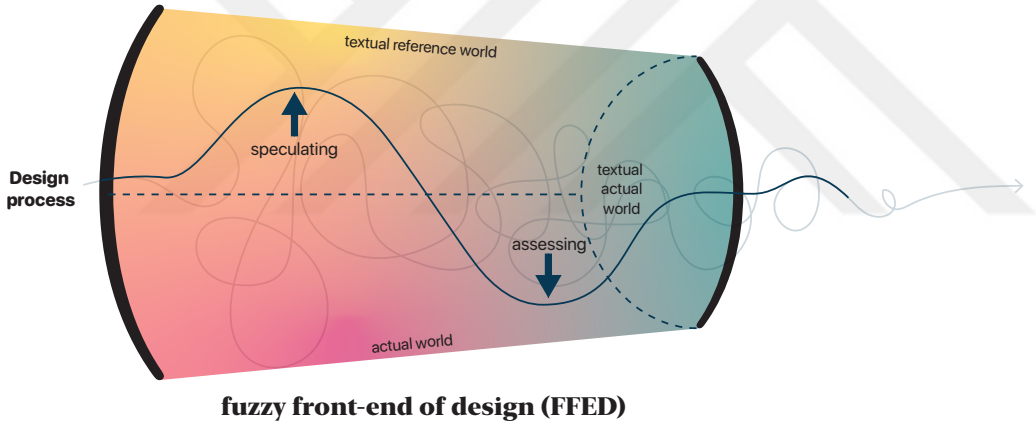


Figure 3.2: Schematic view of the FFED using the three-world structure

3.2.2 World Building in Practice

Fictional worlds represent a sandbox in which authors can "prototype increasingly detailed interactions between different elements in the world" (McDowell, 2015, p. 32). In this sense they are live with coherent details outside of the narrative their author tells, so that it is possible for readers to create their own inferences from such interactions as they observe narratives.

World building has strong roots in literary fiction and before the academic interest, it had been discussed by authors and poets (M. J. P. Wolf, 2014). Multiple authors had published book-length studies and essays about the examining how fictional worlds are created (e.g. Carter & Gallardo, 1973; Gillett & Bova, 1996; Tolkien, 2008). Tolkien is known for generating a vast and detailed fictional world in which he tells multiple stories, cutting through different times, characters and geographies.

While Tolkien generated the vastness of his world through text, late twentieth century witnessed a use of different media formats to establish vast fictional worlds. Kinder (1991) identifies a transmedial approach to package "figures" as networks, such as fictional ones like the Teenage Mutant Ninja Turtles or the Simpsons, and actual ones like Michael Jackson and Madonna. These networks “must cut across several modes of image production; must appeal to diverse generations, classes, and ethnic subcultures” (p. 122). While Kinder does not specifically talk about fictional worlds, her concept of transmedial networks resemble fictional world building in contemporary media.

Years later, Murray (1998) foresees interactive websites as rich companions to television shows. These websites are entry points to the larger fictional worlds of these shows, allowing readers to observe side stories of minor characters from the main story. Manovich (2001) compares these fictional worlds to databases which the authors create. Readers are users of these databases: they are "traversing a database, following links between its records as established by the database’s creator" (p. 227). Jenkins (2006) coins the now popular title *transmedia stories* for narratives told through different media. Each medium tells a part of the story, ideally a part it is well-suited to tell: a story can start via a film, continue through a book and then further explored in video-games. Each of these media can be an entrance point for the fictional world for the reader.

These developments in media and literary fiction for generating vast fictional worlds had implications for research as well. Utilizing science fiction worlds had been a topic of discussion in future studies: science fiction narratives that tell cautionary tales about consequences of a trend, what-if scenarios that explore implications of specific changes, literalized metaphors which shine a light on a lesser known phe-

nomenon through a better known one, and explorations of new technologies are all examples which can support future studies researchers (McDowell, 2015). World building is regarded as a bridge between using existing information and generating new knowledge through an experiential immersion:

"Although science fiction may inform it also produces an emotional experience in the reader. The future is felt, as well as imagined and considered. This emotional dimension often translates into inspiration." (Lombardo, 2006, p. 8)

Based on these insights, I argue that world building is not only a theoretical frame that can be used to define a FFED, but it can also provide practical means for developing processes. As argued by Zaidi (2019), world building is a potential approach that can blend design and foresight, which I consider as a valid approach for working with future contexts in design education.

"The concept of world building in science fiction marries elements of foresight and design, and offers opportunities to enrich both practices. By understanding the many ways in which science fiction is used throughout society and borrowing from its world building processes, we may harness new insights on how to design emotionally resonant futures that inspire real-world action." (Zaidi, 2019, p. 22)

In Chapters 2 and 3, I presented a theoretical background for answering my research questions. First, I explored what the FFED is and how it can be represented as two layers: factual and fictional knowledge. I argued that narratives such as design scenarios provide a way to bridge these layers together. In this chapter, I presented more theoretical discussions on how fiction is defined. First, I presented how the FFED can be looked from a fictionalist perspective through which I argue that a hard separation of factual and fictional information is not necessary to evaluate utility. Instead, a consistency can be sought after. Finally, I present world building as a practical approach. Future studies is given as a domain which utilizes world building for research and that world building is considered as a gap in literature regarding design. In the next chapter, I will present my methodology for my field research.

CHAPTER 4

METHODOLOGY

This chapter presents the general methodological approaches and concerns of the study, as well as the planning process of the workshops. Particular details of methodologies used in the application and the analysis of individual workshops will be presented in their respective chapters. As mentioned in Section 1.2 (p. 5), I have two main research questions to pursue and I will use an action research approach to tackle these two questions together.

4.1 Research Map

My overall approach in this research is presented as a map in Figure 4.1. The four layers represent my aim, my strategy to accomplish this aim, my approaches in data collection and data analysis, and finally my guiding research philosophy for the entire process.

4.1.1 Aim

My aim in this study is to build a theoretical model for how world building is situated in design education as a process in the FFED. I follow the definition of Achinstein (1962) for theoretical models to establish my work through four processes:

1. I will provide assumptions about world building in design education, based on my understanding of prior theory and the results of my empirical studies.
2. I will give a description of how world building in design education works,

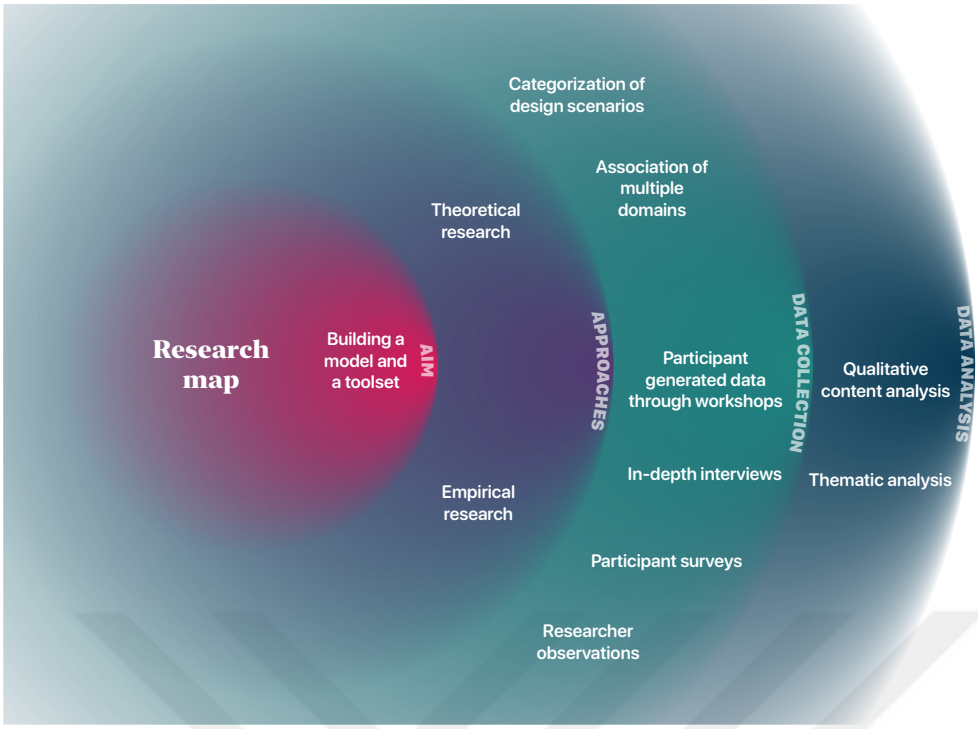


Figure 4.1: Research map of the study.

through explaining the local results based on my empirical studies.

3. I will establish a utility for the theoretical model, by describing how world building in design education can be utilized within design education.

4. I will use analogies to explain world building in design by utilizing concepts from different domains and visualizations.

4.1.2 Approaches

I have two approaches in this research plan: a theoretical research and an empirical research. The theoretical part of my research is an involved literature scan, in which I associated different theoretical domains to create my framework, and defined my own categories. A summary of what I generated from my theoretical research can be found below.

My main research strategy is to conduct an empirical study. As mentioned before, I generated a theoretical framework before my empirical studies which defines world

building through overlaying concepts from different domains. World building as I framed it, is not an overt concept in design education at the time of this dissertation. Therefore, I had two options. The first option was to take up an ethnographic strategy to observe existing processes in design education, and interpret the results through my theoretical framework to see how these processes can be translated as world building. The second option was to take an action research strategy to generate conditions and trigger world building, by integrating my theoretical framework to my cases from the beginning.

I preferred the second option and took action research as my main strategy. I present what action research is and what it implies for my studies later in this chapter in Section 4.2, but in this section, I will discuss the two general reasons for this decision: positionality and pragmatic utility. First reason was my positionality: I was a research assistant at the time of my empirical studies and I was actively involved in the decision making and application processes of the design studios for several years. It would be a challenge to mentally strip myself out of this role, and any prior engagements with how design studios operated in my institution, in order to conduct a more ethnographically inclined study. Action research embraces the involvement of the researcher in the target context, to the point where more inside information is required for a better perception of the problem at hand: "action research takes its cues–its questions, puzzles, and problems–from the perceptions of practitioners within particular, local practice contexts." (Argyris & Schön, 1989, p.612).

The second reason for taking up action research is my aim. As mentioned in the previous section, my aim is to build a theoretical model for world building in design education and a purpose of building theoretical models is defining utility. Practical utility is an integral part of action research, as it draws needs from real-world contexts and attempts to fulfil them (Rapoport, 1970). While the practical utility is not the main aim of this study, it is nonetheless a way to demonstrate how my theoretical model can be utilized in context. This is also why I establish my strategy as action research and not a case study: while the two are similar, action research is more concerned with returning practical insights to the researched context (Blichfeldt & Andersen, 2006).

4.1.3 Data Collection

I conducted four types of data collection in my study: (1) data generated by design students through workshops, (2) workshop and post-workshop observations, (3) post-workshop questionnaires, and (4) post-workshop interviews. I will briefly describe the strategies employed in each point of data collection.

The empirical part of this study is planned to be applied as workshops. For each workshop, I designed and iterated each version of my WBD toolset based on insights gathered from the analysis of the workshop before. This analysis was done on the data generated by the participants during the workshops. In addition to that, I observed the participants in terms of time usage and collaboration during the workshops. After the workshops, I applied evaluation questionnaires to get an overview of what participants thought about the different phases of the workshop and gathered additional feedback through open questions. After the third workshop, in-depth interviews were conducted with consenting participants to further understand how they conducted world building.

The first two workshops were conducted by me, while the third one was conducted by a colleague to observe its application by third parties. Each workshop was recorded by action cameras, as well as photographs and written observations. Data generated by the participants, in the form of filled exercise sheets and accompanying sticky notes were photographed on the site and archived.

4.1.4 Data Analysis

I conducted qualitative content analysis and thematic analysis of the data collected throughout the study. Qualitative content analysis was the chosen method for analyzing the data generated by the participants in the workshops. A separate but continuous analysis strategy was used for analyzing the data from each of the three workshops I conducted. Details of my methodology are described later in this chapter, in Section 4.3.

Each workshop's qualitative content analysis was considered in conjunction with

my insights on observations, and results of the workshop evaluation questionnaires. These summative insights were then used to contribute to the theoretical model of world building in design education, and to iterate the WBD toolset for the next workshop.

For analyzing the interviews conducted after the third workshop, I employed a thematic analysis. After refamiliarizing myself to the data by going over the interviews multiple times, an inductive analysis was conducted to extract similar themes from the interviews, using my theoretical model as a lens. In other words, I used the interview data to understand the practical aspects of world building from the participants' point of view.

To better illustrate the overall organization of my research, Figure 4.2 presents a schematic view of how the workshops and their analysis procedure is structured, and Table 4.1 presents the three workshops in more detail, showing their properties together with what I planned to accomplish in each of them.

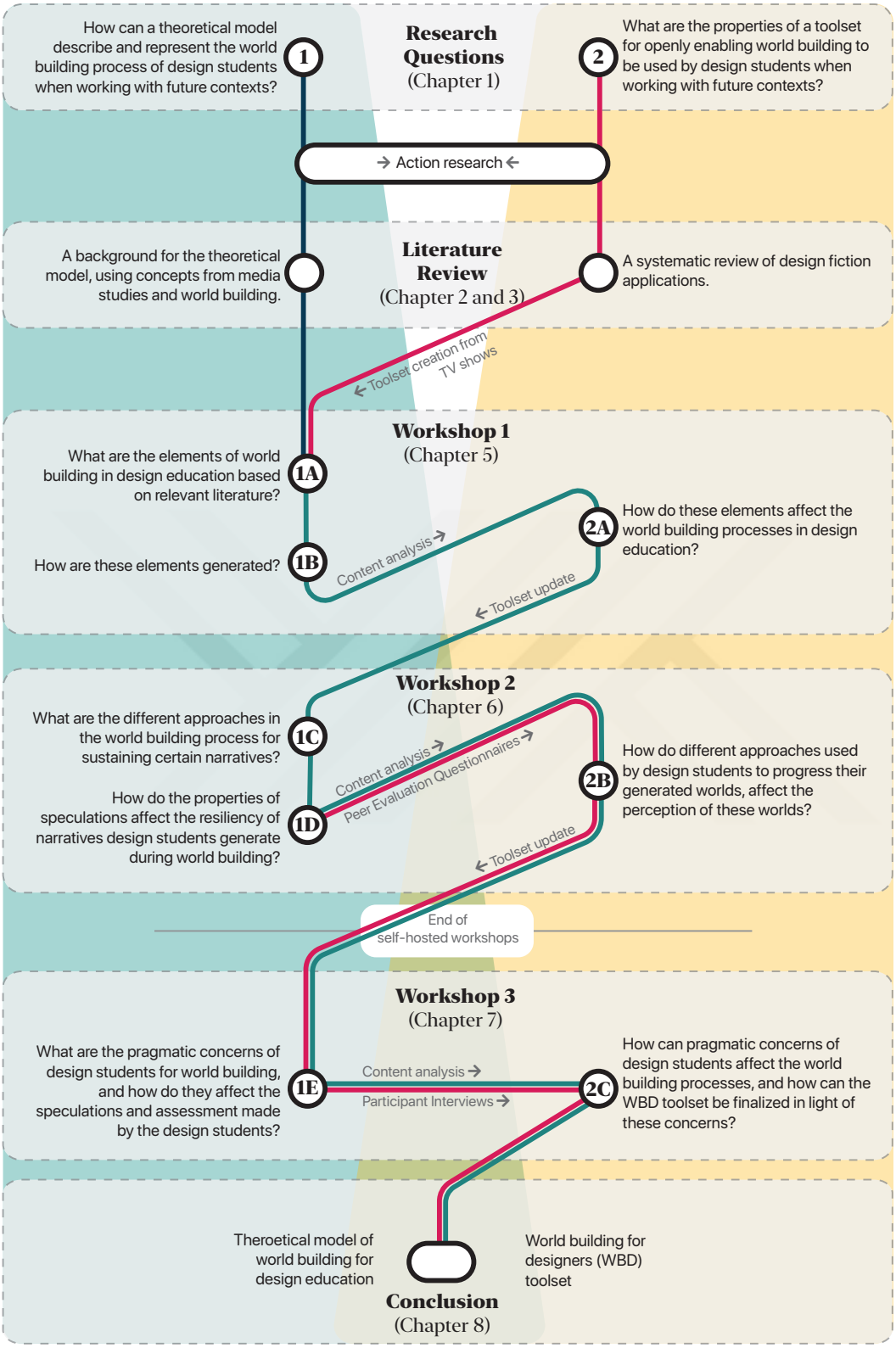


Figure 4.2: Research flow of the study.

Table 4.1: Comparison of workshops conducted as part of this research.

		Workshop 1: Secret Life of Objects (Chapter 5)	Workshop 2: Organic Design (Chapter 6)	Workshop 3: Future of... (Chapter 7)
Workshop Information	**Date**	February 2019	October 2019	November 2019
	Duration	Half-day	Full-day	Full-day but research phase was completed as home assignment
	Place	METU, Ankara	METU, Ankara	METU, Ankara
	Type	Self-organized	Self-organized	Within undergraduate level design studio course: ID 401
	Number of Participants	14	10	31
	Participant Profile	Undergraduate and graduate level design students	Undergraduate and graduate level design students	Undergraduate level design students
	Conducted by	Myself, helped by colleague	Myself, helped by colleague	Colleague alone, using application guide
WBD Toolset	**Research Phase**	None. The theme of the workshop was given in detail.	The theme was left broad and participants conducted online research on workshop day.	The theme was broad and given by the studio tutors. Research was done before the workshop but participants organized their research findings on workshop day.
	World Building Phase	Each world building exercise was projected to the group and participants answered them on sticky notes. All exercises were timed.	Each world building exercise was distributed to participants on printed pages, designed with main and follow-up questions. Exercises were given one at a time and timed.	Each world building exercise was distributed to participants on printed pages, designed with main and follow-up questions as well as visual templates. Some exercises were given one at a time and timed, others were given all together and participants picked which ones to fill at their own pace.
	Reflection Phase	Diegetic prototyping: Participants developed an artifact from the worlds they built.	Diegetic prototyping and peer evaluation: Participants developed an artifact from the worlds they built, and evaluated each other's world by believability.	World overview: Participants conducted PEEST analysis on the worlds they built, generating political, economic, environmental, societal, and technological highlights.
Research Goals	**Main aim**	Defining speculations	Sustaining speculations through assessment	Centering and utilization
	Research Questions	(1A) What are the elements of world building in design education? (1B) How are these elements created? (2A) How do these elements and their properties affect the WBD toolset?	(1C) How are arcs created and sustained through the world building process? (1D) How do prop properties affect the resiliency of arcs through the assessment? (2B) How do different types of arcs and arc combinations affect the perception of the generated world?	(1E) What are the real-world constructs for world building in design education, and how do they affect speculation and assessment? (2C) How do these constructs affect world building processes, and how can the WBD toolset be finalized in light of these results?
	Workshop Approach	Stimulate world building using the WBD toolset with a well-defined future topic.	Stimulate world building using the WBD toolset with a broadly defined future topic.	Integrate world building to a real-word design education project using the WBD toolset.
	Collected Data	Data generated by participants, researcher observations, participant feedback	Data generated by participants, researcher observations, participant feedback, peer evaluation	Data generated by participants, participant feedback, in-depth interviews, researcher observations (project jury)
	Analysis Approach	Qualitative content analysis	Qualitative content analysis	Qualitative content analysis, thematic analysis

4.1.5 Study Approach

The underlying approach of my study can be defined as non-positivist and interpretative, because I conducted qualitative research; dealing with gathering non-numerical data for generating descriptions, meanings and concepts in various levels of detail (Babbie, 2014; Berg & Lune, 2012). For inferring meaning out of empirical data, qualitative research often uses inductive strategies in which researchers study the local practice and knowledge, rather than testing grand theories (Geertz, 2001). Although each work is local and possibly isolated, they can nevertheless be studied and adapted in other cases if well documented, resulting in useful knowledge (Flick, 2014). Therefore, the results of my dissertation are situation-specific, yet well documented so that other researchers can gauge its applicability for other contexts.

In this section, I presented my research map and explained the decisions I made regarding my methodology. In the next two sections, I will present the relevant literature on two approaches mentioned in my research map: action research and qualitative content analysis.

4.2 Action Research

Action research is often used as an umbrella term to cover multiple approaches but in broad terms, it is about taking action in the real world and then, explain to others what and why the researcher did so (Robson, 2002). Here, 'action' refers to the particular steps one takes in various contexts, including "personal, social, organizational and political contexts", while 'research' refers to how one design the action and later find out ways how to design it better (McNiff, 2015, p.12). Action research puts the involvement of the researcher in the local setting to its core: it is done "by or with insiders to an organization or community, but never to or on them" (Herr, 2007, p.3). Being critical and self-reflective is vital, since the value created by the research is self-determined. Hence, action research is often carried out by practitioners for looking into themselves and their practice, for the purpose of changing it.

Origins of action research can be traced back to group-dynamics research carried on

by Kurt Lewin. Lewin's 1946 work on US minority groups not only coined the name action research, but also established an early form of systematic change-feedback-reflection cycle. Lewin's work was adapted by organizational development studies in the 1950s and 60s, stripping the work from its emancipatory roots, generating controlled experiments and aiming for quantitative results, in line with the time period's more positivist approaches.

In late 1980's and early 90's, prominent figures of action research attempted to position it in relation with positivist approaches. Argyris and Schön (1989) define this as a dilemma, or a fundamental choice social scientists have to make: they would either prioritize the rigor of positivist science or the relevance of action research on their local setting.

Action research, like other non-positivist approaches, gained a higher level of acceptance in applied sociological fields, such as education, social work, nursing, organizational development and criminology (Herr, 2007). However on a fundamental level, the concerns of Argyris and Schön remain valid: how do the practitioner-researcher generate and validate knowledge by themselves, within the organization that they are a part of? More precisely, how does a researcher guard themselves from non-reflectively producing the current best practices in their field? These questions are even more vital in the setting of a doctoral dissertation, in which there is the expectation of generating new knowledge. To steer clear of these potential issues, I will examine four dimensions of action research deemed important: positionality, defining rigor, generalizing theory and addressing bias.

4.2.1 Positionality

Positionality refers to two aspects of consideration in action research (Anderson et al., 2007). As we are talking about practitioners conducting research on their own practice, positionality can refer to the professional position, or the title the researcher has within the organization. On the other hand, it can also refer to the researcher's position regarding the research question in the context of the organization, such as their stakes on the outcomes of the research. These two aspects often are tangled together, and must be acknowledged early on, as the researcher is devising their plan.

Herr (2007) categorized a spectrum of positionalities, based on the researcher's status within the organization, summarized In Table 3.3.

Table 4.2: Positionality of the researcher (Adapted from Herr (2007)).

	Positionality of Researcher	**Contributes to:**	**Traditions**
1	Insider (researcher studies self practice)	Knowledge base, Improved/critiqued practice, Self/professional transformation	Practitioner research, autobiography, narrative research, self-study
2	Insider in collaboration with other insiders	Knowledge base, Improved/critiqued practice, Professional/organizational transformation	Feminist consciousness raising groups, Inquiry/Study groups, Teams
3	Insider(s) in collaboration with outsider(s)	Knowledge base, Improved/critiqued practice, Professional/organizational transformation	Inquiry/Study groups
4	Reciprocal collaboration (insider-outsider teams)	Knowledge base, Improved/critiqued practice, Professional/organizational transformation	Collaborative forms of participatory action research that achieve equitable power relations
5	Outsider(s) in collaboration with insider(s)	Knowledge base, Improved/critiqued practice, Professional/organizational transformation	Mainstream change agency: consultancies, industrial democracy, organizational learning; Radical change: community empowerment
6	Outsider(s) studies insider(s)	Knowledge base	University-based, academic research on action research methods or action research projects.

My positionality on this research is expected to fall on a range between (1) and (2) based on the table. At the time of the fieldwork, I was working as a research assistant at my institution, often taking the role of teaching assistantship in design studio courses. Hence, I am an insider in this context. The reason why I expect this research would not be confined to the first category, is that the students who would participate in my workshops can also be considered insiders. Considering what benefits my participants would receive at the end, can help establish an equal ground for power relationships within workshops, which in turn would help me decrease my bias towards

caring about supportive data only, despite the utility my participants are getting.

Apart from the emphasis on my participants' positionality, I will also consider the advantages and disadvantages of my own. As a practitioner of multiple years in the institution where I will conduct my research, I employ a certain level of tacit knowledge, both in macro (how studio courses are conducted, relationship between tutors and students etc.) and in micro (how typical scenario building processes are run in the studio) scale. This tacit knowledge, that separates the first two categories of positionality from the rest, comes with both logical and epistemological issues (Herr, 2007). Logistically, there is an advantage: my experience in the process means that I would not have to carry on additional ethnographic inquiries, trying to familiarize myself to the institution, to the social contexts and to the current state of affairs. However, there is an epistemological disadvantage: the tacit knowledge brings its own bias, prejudice and assumptions.

4.2.2 Rigor

Defining rigor is an important part of every qualitative research plan, as the validity of the outcomes cannot be ensured beforehand by research design, as is in quantitative research methods; and potential threats to rigor have to be determined to be dealt with later (Aurini et al., 2016). Validity refers to how "well grounded" a study is (Ritchie et al., 2014, p.270). Validity is relative in qualitative research which means: both what constitutes validity and any potential threats to it, have to be defined in the context of any particular research plan (Maxwell, 2005). Since there is no guarantee beforehand that dynamic and flexible methods like action research will provide valid output, such descriptions and caveats are the only resource for supporting rigor: they increase the researcher's attention to issues and give readers a basis for evaluation.

I will describe three dimensions of validity criteria which I deem relevant for my project: Outcome validity, process validity and dialogic validity [1]. *Outcome validity* refers to the pragmatic results of action research, or more clearly the existence and the critique of them. Heikkinen et al. (2012, p.5) defines this criterion as workability,

[1] I omitted certain validity criteria from the literature I used, which are more geared towards emancipatory aspects of action research, conducted in communities. For a comprehensive list, see (Herr, 2007, p.55).

in the sense that the research "produces some useable practices that, in one way or another, can be regarded as useful". Although this criterion is mostly used in relation to emancipatory studies, for empowering disadvantaged groups; Watkins (1991) generalizes it, claiming that many action research projects stop after implementing a single-solution strategy to the diagnosed problem, regardless of how well the solution works. While it is hard, or irrelevant for the study, to 'measure' how well the solution works, being concerned about the outcome validity during the project ensures the researcher to be critical of the results and reflect on them, forcing the researcher to continuously reframe the problem and the action. This continuous reframing and reflection can improve the quality of the research.

Process validity is how and to what extent the reframing and reflection are done, and whether it can be sustained for the duration of the study (Herr, 2007). It is important both to ensure the outcome validity and for enabling better peer review. To ensure process validity, triangulation can be employed. Denzin (2017) categorized four types of triangulation which would increase rigor in qualitative research. First, data collection methods can be varied, such as employing different methods for initial theme generation and the following in-depth inquiries. Second, researchers can be increased. Multiple researchers can increase the trustworthiness of the data, both in collection and analysis. Third, data sources can be triangulated, by increasing their number and origins. Finally, theoretical frames can be increased, to investigate the same data from different theoretical lenses, in exchange for decreased unity in the findings.

Together with triangulation, Stringer (2013) adds prolonged engagement and persistent observation to the list of items that aids process validity (he uses the term 'credibility' in his work). Prolonged engagement asks for "extended opportunities" (p. 92) for the participants to search, reflect and reveal their experiences within the activities of action research. Persistent observation necessitates that each participant, with the obvious inclusion of the researcher, records the process. This increases the richness of the data by triangulating its source, as well as increasing the involvement of the participants in the process.

Dialogic validity adds rigor to the study by the inclusion of continuous and cyclic peer review (Newton & Burgess, 2008). As much as the circumstances allow, the

process should accommodate debriefings done by peers who are familiar with the context on some level. This ensures that the study is not veering into a spiral where the researcher is only pursuing his own idea of a successful outcome. I will revisit these criteria in the last chapter to evaluate my research process regarding each one (Section 8.3, p. 223).

4.2.3 Generalizing Theory

Generalizing theory, also called external validity, refers to the strategies taken in research design to make sure results are applicable elsewhere, representing common knowledge. While generalization is often deemed not possible as a result of an action research, since the findings are only applicable to the particular participants, in their particular setting with the particular activities performed (Stringer, 2013); some scholars named distinctive types of generalizations that could be applied to action research.

Stake (2010) mentions two types of generalizations, formalistic and naturalistic. First, he frames the knowledge that could be generalized as an outcome of internal conviction (as in, internal to an organization), as opposed to an external cause which would bring its own set of rules and expectations. He further frames this internal need of change as a mixture of personal understanding (a desire to reveal and comprehend what constitutes the problem and a reflective action to solve it) and voluntarism (personal beliefs and convictions about the problems and how to approach them) At the end, the study would output a mixture of knowledge, suitable for formalistic and naturalistic generalization. Formalistic generalization aims to contribute to a grand explanation about the subject, often with careful sampling to provide external validity. Naturalistic generalization on the other hand provides insight to the same situation: more in- depth and personal narratives are provided about the participants and the study are provided.

The result is what Stake (2010) calls vicarious experience, a knowledge that arose from a particular setting but one that potentially taps into the existing tacit knowledge of other practitioners. It is unique but similar and ordinary (see Figure 4.3 for a schematic view of generalization in action research).

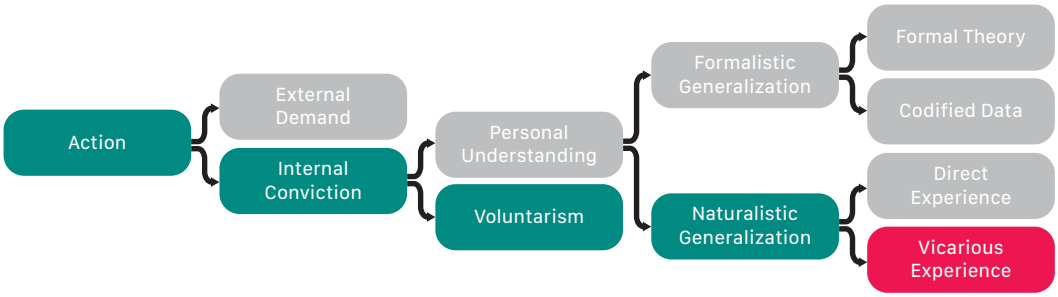


Figure 4.3: Types of generalization in action research (Adapted from Stake (2010).

Vicarious experience and naturalistic generalization are similar to what other scholars call transferability (Herr, 2007). Instead of conventional generalization where statistical means are employed, transferability asks for the researcher to both disclose the context as much as possible and provide rich descriptions of events taken place during the study, so that another researcher or practitioner can figure out similarities to their own context for repeat. Therefore, transferability is an invisible pact between the author and the reader concerning the work's applicability. Schofield (1993) argues that the author can increase transferability even more by assessing three questions: what is, what may be and what could be, as they write. 'What is' refers to the actual field of study, preferably the typical one that represents the particular context. 'What may be' is a question that necessitates the researcher to think about how present conditions affect the situation, and how might the passing of time would affect it differently, later. 'What could be' is a question that needs the researcher to actively look for more typical situations, more answers to the 'what is' question, with the aim of uncovering atypical situations. In a similar fashion, Aurini et al. (2016) define a potential strategy for increasing transferability as studying atypical and extreme ends of a spectrum, assuming the field has one and the researcher can define it.

4.2.4 Addressing Bias

Addressing bias is a necessary step in all qualitative research, but especially in action research where the researcher is expected to be actively involved with the inquiry. As with other methods of qualitative research, bias is an expected part of the process; it should be properly acknowledged rather than be treated as a problem. Herr (2007)

defines two levels of potential bias: on the first level, there is an initial level of bias at the beginning of the research. As mentioned before, the researcher, who is also a practitioner, has an extensive amount of tacit knowledge about the practice he is about to act on, which often translates to a certain perspective and certain expectations. This bias should be defined and acknowledged within the research design and various tools to help with that have been discussed up until now in this section.

The second level of bias however is expected to arise during the study, as the action unfolds. This bias is unprepared for, and can be remedied by peer support, in the form of validation meetings and critical friendships (Bone, 1996; Wright & Adam, 2015). Validation meetings can be periodically organized with peers to criticize and reflect on the process. It is important to note though, that this is not as involved a process as triangulation: peers are not expected to be a part of data collection and/or analysis. Instead, it is a more elongated form of constant debriefing and cohesiveness between chosen peers (Robertson, 2008) or a form of critical culture within the entire organization (Wright & Adam, 2015). Either way, preparing and planning for a form of continuous critical feedback from peers is a necessary step to acknowledge bias, in addition to considering various validity criteria in the initial phases of research design.

4.3 Qualitative Content Analysis Approach

In the previous section, I presented a brief history and the properties of action research as my main research strategy. Within action research, I will be conducting workshops in which participants will generate data through world building exercises. In this section, I present my overall approach to analyze this data. My main goal of analyzing the data from these workshops are to define the elements and the processes used by the participants for world building, the relationships between each other, and their implications on the WBD toolset.

Qualitative content analysis is one of the several research methodologies for understanding textual data. Krippendorff (2004) defines content analysis as "a research technique for making replicable and valid inferences from texts (or other meaningful

Table 4.3: Three approaches to qualitative content analysis and their coding strategies (Adapted from Hsieh and Shannon (2005, p.1285)).

Type of Content Analysis	**Study Starts With**	**Timing of Defining Codes or Keywords**	**Source of Codes or Keywords**
Conventional content analysis	Observation	Codes are defined during data analysis	Codes are derived from data
Directed content analysis	Theory	Codes are defined before and during data analysis	Codes are derived from theory or relevant research findings
Summative content analysis	Keywords	Keywords are identified before and during data analysis	Keywords are derived from interest of researchers or review of literature

matter) to the contexts of their use" (p. 18). He opposes the idea of separating qualitative and quantitative content analysis methods because "ultimately, all reading of texts is qualitative, even when certain characteristics of a text are later converted into numbers" (p. 16). However, there is a body of literature which defines qualitative approaches separately based on how it brings interpretation to facilitate deeper understanding of text, in order to extract inferences, categories and meanings (Barbara Downe-Wamboldt RN, 1992; Weber, 1990).

4.3.1 Role of Prior Theory

Qualitative content analysis focuses on the content of the extracted data, with focus on the features of the language used to convey the content and the context of the content. Therefore, qualitative data analysis typically involves a mixture of reducing the gathered data into groups, themes or categories and expanding a selection of it by deep examination and interpretation; while considering how the data was generated (Gibbs, 2007). However there are multiple ways to approach the content, based on how much role prior theory has on the analysis. Hsieh and Shannon (2005) identifies three such approaches (see Table 4.3).

As seen in Table 4.3, there are key differences in how the initial coding scheme is devised. There are various definitions for codes in different qualitative and quantita-

tive research methods, but in general, they describe the gathered data in relation to the categories the researcher employs in his analysis (Flick, 2014). Saldaña (2013) expands on that definition by stating that a code "symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data." (p. 3). Therefore, codes can be expansive and interpretive, in addition to being summative and deductive.

In a conventional content analysis, codes are derived during the data analysis, enabling a richer and more grounded understanding of the researched phenomenon (Hsieh & Shannon, 2005). In comparison, directed content analysis, the researcher establishes a coding scheme from prior theory, before looking at their own data. The coding scheme is expected to be updated throughout the analysis as needed.

My approach in analysis can be defined as a directed approach, because I extensively use prior theory on world building to make sense of my data. This is also expected since I use a toolset I developed through my theoretical framework, and therefore analyzing the results from a grounded point of view would be disingenuous. There are two specific methodologies defined in the literature for qualitative content analysis with a directed approach: from (1) Mayring (2000) and Schreier (2012), and from (2) Gläser and Laudel (2013). I will briefly describe the three approaches.

4.3.2 Directed Qualitative Content Analysis Approaches

Mayring's (2000) approach is a mixture of conventional and directed content analyses. His approach requires an open coding frame to be built through the analysis of an initial sample of the gathered data, modifying the scheme until it seems fit for the entire sample. Once the sample is adequately covered, the coding scheme is frozen and the rest of the data is analyzed without further changes to the scheme. While it is possible to identify this approach as conventional, Mayring (2000) suggests multiple techniques to derive initial codes, most of which start from previously designed systems of categories derived from the theory. Schreier (2012) has a similar approach to building initial categories. She suggests that these categories can either be developed though prior knowledge (e.g. theory, common sense, everyday knowledge), data driven, or a combination of both. She also suggests the coding scheme to be frozen

after developing it over a sample of data.

Gläser and Laudel's (2013) approach contrasts with Mayring's (2000) and Schreier's (2012), in the sense that it does not suggest a freeze on the coding scheme after a sample analysis. Instead, Gläser and Laudel (2013) suggest devising the initial coding scheme from theory and keep modifying it throughout the entire study. The trade off is that there is less openness in the beginning: the coding scheme is based on theory alone rather than the first sample of data. However, it introduces more openness in the latter stages where the coding scheme can be updated based on the empirical material.

My approach stands closer to what Mayring (2000) and Schreier (2012) suggest. I start my analysis with a strong theoretical framework, which I use to analyze participant data through the constructs of world building literature. However the first workshop's data strongly guided me to see how I can use these constructs. After analyzing this data, I identified the constructs I would use from the literature to categorize the data and create relationships. These relationships in turn helped me form a theoretical model by exposing mechanisms.

On the other hand, I subscribe to Gläser and Laudel's (2013) for not defining this exploration of mechanisms as *coding*. They discuss that coding is better for indexing the data, while qualitative content analysis often requires *translating* it. While coding generates a large index of the data which helps the researcher return to it during the analysis such as exploring co-occurrences; translation helps with extracting new knowledge from the data through a theoretical lens.

In my initial analysis of workshop data, I used a coding scheme to analyze the results generated by the participants. I coded the answers participants gave to the world building exercises in order to identify and categorize the approaches used to create them. However I concluded that it was not helpful to index the raw data, since it was not possible for me to categorize each answer to the exercises without relating it to the overall worlds participants generated. Understanding the overall worlds meant that I would go through the answers as a whole to extract relevant information and translate them in my own words to what those answers implied.

An excerpt from this translation process can be seen in Figure 4.4. The top of the

figure shows a sample of my work, to reveal technologies, functionalities and conventions regarding the fictional worlds from the participants' answers. The bottom of the figure shows a sample of my effort in writing about the fictional worlds in text, as I understood from the answers, with questions to reflect on how these worlds could have operated. Only after such work of translating the raw data to form narrative arcs within the fictional worlds, I could go back to the raw data and analyze their relationships within those words.



Tea	Exerc	Information from exercises	Type of information	Technology	Usage	World	Conventions
1	DFS1	There is a material called Tissui	Name of the material	Tissuet is a material that is made out of organic cells	Tissuet is used to make hand tools. These hand tools change their shape by themselves to accomodate its user's hand.	Tissuet if produced in Turkey Tissuet material and products can be copied by third parties illegally.	"Tissuet makers" is a new profession (no name)
1	DFS1	Tissui is used for making hand tools.	What is the use of this material?	Tissuet cells are grown in the lab to form the material.	The shape change happens as the user's hand approaches the tool.	Tissuet company have secretive practices with its workers and there have been violations.	Remote disabling call is called "untissuet"
1	DFS1	Tissui involves tissues that transform into each other.	A property of this material.	Tissuet cells transform between different types of tissues as they grow.	The shape change continues during the product's use as necessary, in longer uses of a tool.	Tissuet company controls its IP by issuing remote disabling calls to unlicensed copies of its products.	Tissuet products are called "helping hands"
1	DFS1	You "grow" a Tissui object.	The name and method of making this material	Tissuet makers collaborate with industrial designers and researchers.	Tissuet is also used to make complete artificial hands. Some people use these hands permanently attached to themselves, as third hands.	Tissuet products come in vacuum sealed packs that resist heat, radiation and temperature There is a religious backslash against the use of permanent third hands.	There are "artificial hands"
1	DFS1	Tissui is made of growing cells.	A method of making this material	Tissuet makers use anthropometric data to work on product ergonomics.			There are "emotionally sensitive" products.
1	DFS2	Tissui makers work with anthropometric data to create highly ergonomic products out of it.	What is the use of this material?	Tissuet is created in high-tech and sterile lab facilities.			

```
# Team 1
# Tissuet

Tissuet is a material made out of organic cells. These cells are grown in a
lab environment and as they grow, they transform between different types of
tissues.
> Do the material transform between various tissues as a manufacturing
  process? Does it start as one tissue and than transforms into another until
  it becomes its final form? Or is this a manufacturer controlled process?
  What are these cells exactly? Are they created for this material or do they
  taxonomically belong to some organism?

Tissuet is being used to make various hand tools which actively conform to its
user's hand. There are two important features: first, the tools not only take
the best fitting shape to your hand but they also actively change shape during
the entire use, to stay ergonomically sound.

> Is the fitting customizable? Can someone change how the material is shaped
  for their best comfort? Or is it a more "organic" process, in which you
  squeeze some part more and it changes shape? What kind of hand tools are we
  talking about? Are we just talking about the handles? Do we cover the
  handles with this material? Do they cover your hand?

And second, they can have protective properties: tissuet can resist electric
shocks or very high temperatures. For example there are Tissuet gloves that
metal casters and electric workers use, which don't just protect their hands
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Figure 4.4: Workflow for the qualitative content analysis. Inspired by Gläser and Laudel (2013).

Therefore, I define my analysis as extraction and translation rather than coding. A

comparison made by Gläser and Laudel (2013) can be seen in Table 4.4, and my qualitative content analysis workflow is represented schematically in Figure 4.5.

Table 4.4: Comparison of coding and qualitative content analysis (Gläser & Laudel, 2013).

	Coding	**Qualitative content analysis**
Main way of separating relevant from irrelevant information	indexing themes	extracting content
Reduction of information	none in initial steps	by selection and translation of information
Theoretical input in data analysis	possible but not enforced	enforced
Support of pattern recognition	co-occurrence of codes, use of full text, or further processing of coded text	cross-tabulating and comparing extracted information

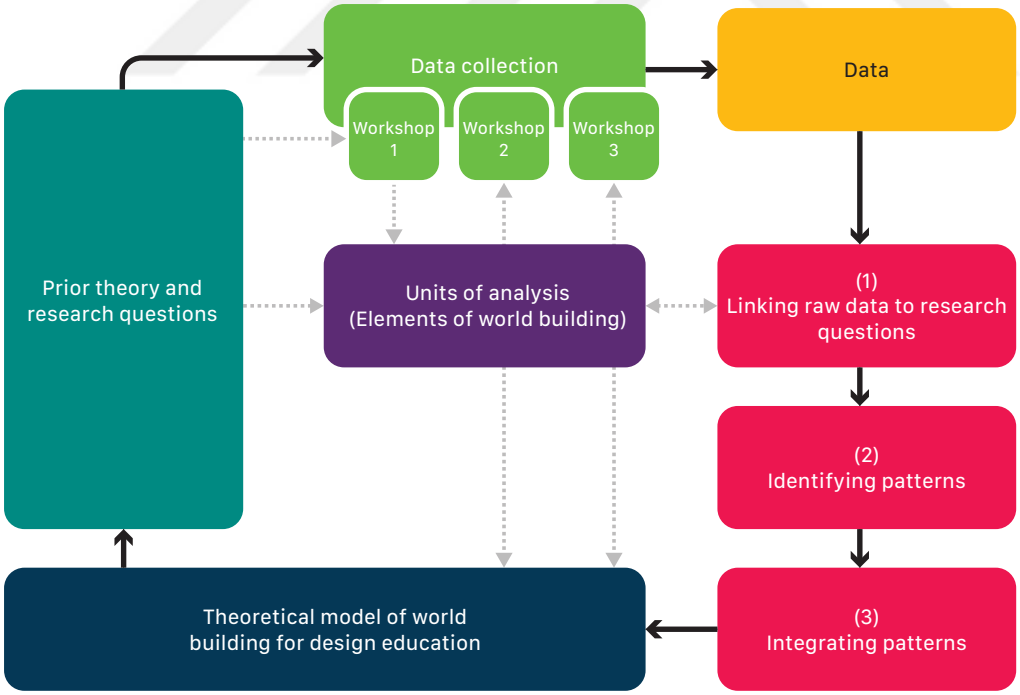


Figure 4.5: Translation of data through extraction, as part of the qualitative content analysis.

As represented in the figure, I start from prior theory and collect data from three workshops. This data is then qualitatively analyzed through three steps (1) linking raw data to research questions, (2) identifying patterns, and (3) integrating patterns. The results of these steps are used to create a theoretical model which extends the prior theory. In step 1, I use prior theory to come up with my analytical constructs through a translation of the data. I then use this analytical construction to conduct steps 2 and 3, identifying themes and relationships to uncover mechanisms.

In this chapter, I explained my research approach in general, followed by more detailed accounts of two methodologies I used: action research and qualitative content analysis. For each of these, I also explained any differences in application and how this affects my study. In the next three chapters, I present the three workshops I conducted as the empirical part of my study.

CHAPTER 5

DEFINING SPECULATIONS: WORKSHOP 1

The first workshop of my study aims to explore how design students conduct world building to create fictional knowledge for a future context. This exploration was done in three main steps: (1) participants used the world building for designers (WBD) toolset to generate fictional information. (2) I analyzed this information to identify their elements and properties. Finally, (3) I discussed the implications of these properties to define a process for how this elements are generated. Therefore, this chapter aims to answer the following sub questions regarding world building:

> Question 1.A: What are the elements of world building in design education based on relevant literature described in the previous chapters?
> Question 1.B: How are these elements generated?

This study is also important for designing the WBD toolset and using it for the first time. I will present how the initial version of the toolset was designed and share my observations as the workshop conductor, as a contribution of this workshop to my study. Furthermore, answers to questions 1.A and 1.B will be used to guide iterations to the toolset. The third sub question this chapter answers is:

> Question 2.A: How do these world building elements affect the world building processes in design education?

The workshop and its implications for my study is further elaborated in the following sections. The preparations and application of the workshop components are discussed under Section 5.1, output generated by the participants is discussed under Section 5.2, analysis of these results is discussed under Section 5.3, insights and key knowledge generated from the workshop are discussed under Section 5.4 and finally, a brief

summary of conclusions from the chapter is provided under Section 5.5.

5.1 Design

In this section, I explain how the workshop was designed, prepared and applied, as well as how the participants were chosen. The workshop was conducted in Middle East Technical University, Ankara on February 16th, 2019. It was titled "Nesnelerin Gizli Yaşamı" (Secret Life of Objects). The workshop was designed together and ran with my colleague Nagihan Tuna, who also works with design fiction on her dissertation for a different research goal. The preparation, logistics and data recording were done as a team, but the two halves of the workshop day were designed individually, for our respective research goals. The entire workshop had design fiction as a common approach, and the two halves were designed in a way so that the results of the first half were taken as input for the second half by the participants. The team effort also enabled us to observe and improve each other's strategies during the design of the workshop.

We decided to plan the workshop around a hypothetical world where common place devices would have sentience and can talk to people. We further narrowed down the theme to coffee machines, thinking that a specific device type would ease the imagination process within the relatively short workshop time. This was chosen due to the speculation that coffee making and consumption would be part of the daily lives of the participants and that coffee machines were familiar objects to them. For the morning session, Nagihan Tuna planned a persona generation phase during which participants would imagine how a coffee machine with a character would spend its day. These personas would then be an input for my afternoon session, during which I asked participants to build a fictional world where these anthropomorphic machines were common place.

In this workshop, participants used the initial version of the WBD toolset to build worlds. A topic is given to the participants to simulate an FFED process of an unfamiliar context. In the next section, I will present how the initial version of the WBD toolset was designed.

5.1.1 WBD Toolset

The aim of a toolset is to initiate a world building process in a limited time for the workshop. My proposed setup for the WBD toolset for this workshop was to have two phases: (1) world building exercises, and (2) diegetic prototyping. The purpose of the first phase, world building exercises, is to encourage participants to generate speculations about a fictional world. These speculations will collectively form a textual reference world for the participants to reflect upon. The second phase then enables participants to take a step back, view their textual reference world as a whole, and create an artifact for this world. In this workshop this artifact was a diegetic prototype (see Section 2.3.1.3 on p. 25). The way this proposed toolset fits to the theoretical framework I presented in the prior chapters (see Figure 3.2 on p. 58) can be seen in Figure 5.1.

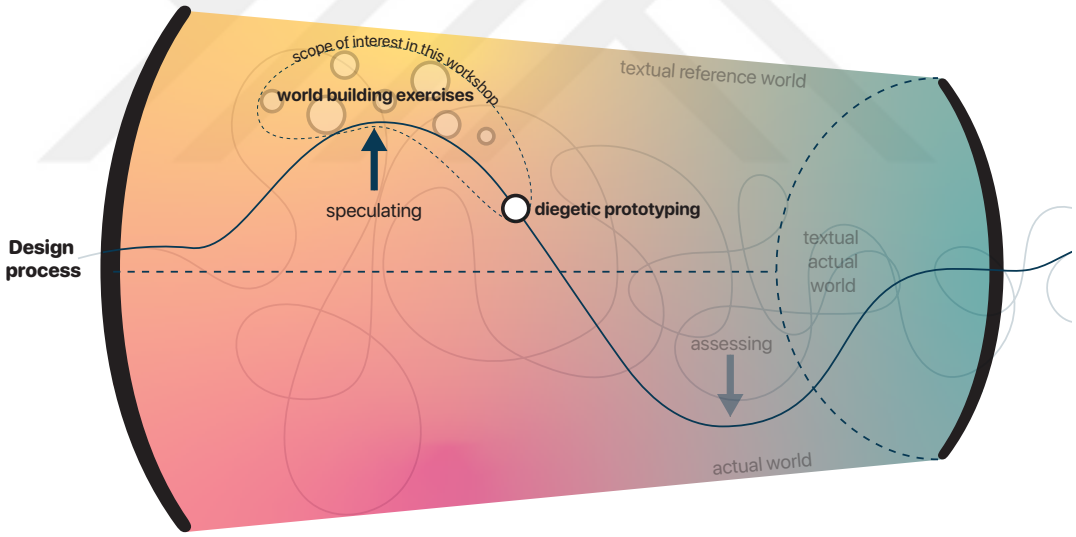


Figure 5.1: Workshop 1's scope of interest in the theoretical model.

I created the world building exercises based on my insights from the theoretical discussions I presented before, and a small-scale study I conducted over contemporary science fiction television shows. I will discuss these two attitudes in their respective section below.

5.1.1.1 Insights from the Theoretical Discussions

I had three insights from my literature review which guided me during the creation of world building exercises. First, I discussed in Section 2.2 that the design scenarios help bridge factual and fictional knowledge in the FFED, not through clear or systematic approaches but designer intuition. I planned to tap into this intuition by preparing two types of exercises. The first type of exercises ask for designerly tasks such as creating a brand, designing an icon or proposing product ideas. The second type of exercises are more about the world around the central designs, such as creating laws or regulations, writing parts of a Wikipedia article, and user reviews in e-commerce sites. I argue that these two types of world building exercises provide a entrance point for designers to conduct plausible and designerly contributions, while also enabling them be more inventive.

Second, I opted to rely on text as the output format for the exercises, as text was the most commonly used medium in the design fiction applications scanned (see Section 2.3.2.5 on p. 41). I concluded that text is both accessible to all participants regardless of their skill sets and is also applicable in the limited times I had with self-hosted workshops. I am also aware that long sessions of writing can be taxing; so while the exercises mostly favor text as answers, there was the occasional exercise which asked for visuals (such as designing an icon), and the participants were not specifically instructed to use text.

Third, I planned to use sequential and timed exercises. This means that each exercise was given after the previous one was done, and they were each timed. My reasoning behind this was to enable participants to build inferences over their speculations. My assumption was that each world building exercise would produce a prop (see Section 3.1.3 on p. 51), an item that represents a larger speculation in the textual reference world. Building multiple props in sequence would encourage participants to build larger narratives, creating inferences as described in Section 3.1.4. This is in contrast with a world building approach where participants build a wholistic world in their own pace. Although this alternative can provide more consistency, I argue that my approach is more suitable for revealing assumptions and tacit knowledge: timed and sequential world building exercises would start with intuitive speculations and each

following exercise will build on top, creating an immersion into these initial speculations.

5.1.1.2 Devices of World Building from Contemporary Science Fiction Shows

While the considerations presented above form a guideline on how the exercises will be built and applied, I conducted a small-scale study on contemporary science fiction television shows for determining their content. Since the workshop topic is sentient coffee machines, I identified three science fiction shows on television that revolves around sentient humanoid robots, or cyborgs. The analyzed shows were Humans (Donovan, 2015) from the UK, Westworld (Nolan, 2016) from the US, and Better Than Us (Dzhunkovskiy, 2019) from Russia. The question was to understand the kind of world building elements used in these shows to introduce a technology. Therefore, the analysis was limited to the first episodes to isolate the introductory elements used for world building, as opposed to the actual story.

I extracted each diegetic element taking role in world building from the first episodes of each of the three shows, through multiple viewings. The results from the show Humans can be seen in Figure 5.2. The results of the other two shows are presented in the Appendix B. I reduced the results into thematic groups and twelve themes emerged from the world building elements. These groups are listed below.

1. **The brand:** manufacturer of the product, with distinct characteristics.
2. **Packaging, labeling:** How the product is presented to the consumer.
3. **Storage, storage facility:** How the product looks after manufacturing and how it is stored.
4. **Model segmentation:** Variations of the product in the market.
5. **TV discussion:** A controversy or scare about the product.
6. **Language:** New phrases created or popularized around the product.
7. **Rules and laws:** Rules or strict conventions within the usage of the product or laws.
8. **Usage:** Scenarios regarding the usage of the product.
9. **Reason of existence, functionality:** One main and advertised purpose for the product.

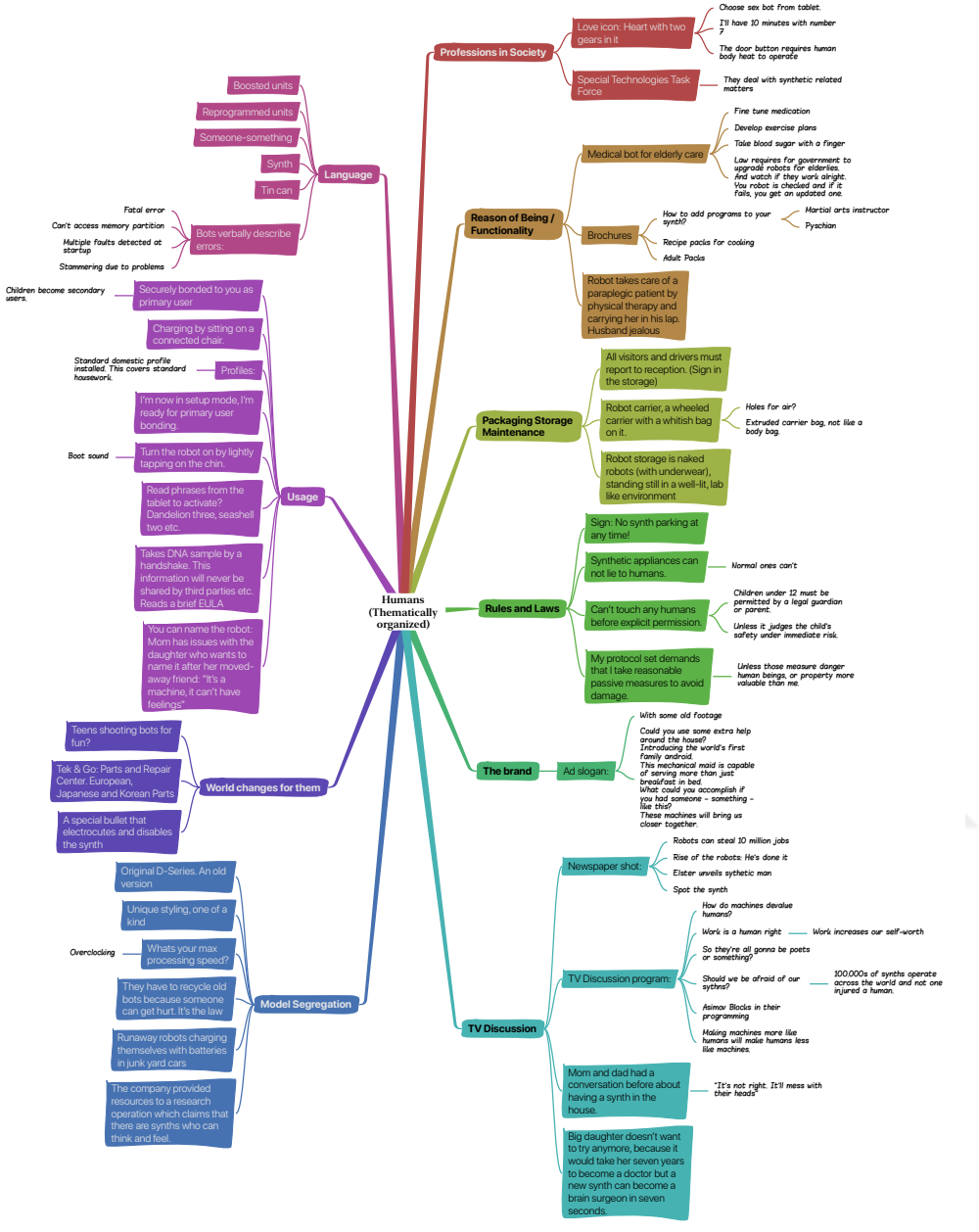


Figure 5.2: Organized world building elements extracted and from the TV show: Humans.

10. **Professions in society:** New or modified professions based on the implications of the product.
11. **What it's made out of:** Description of the technologies and materials used in the product.
12. **World changes for them:** Changes in spaces and infrastructure due to the use of the product.

Combining the results from theoretical insights and the extracted themes, I generated a final set of 12 world building exercises. While I kept some of the themes from the study presented above, I removed some for being incompatible with the topic of the workshop, and added new ones for the same reason. Therefore, the study described above acted as a guide, rather than a definitive result. The final set of exercises are presented in the next section (Section 5.1.2.3), in which I present the application of the workshop.

5.1.2 Application

The workshop was publicized 15 days in advance with posters seen in Figure 5.3 within the university building, as well the department's social media accounts. It was free for the participants, however we asked for at least third grade industrial design students, including graduate students, to maintain a certain level of experience in design projects and team work. Participants were provided snacks and hot beverages throughout the day.

5.1.2.1 Participants

We initially decided on a 20-person limit for participation as that would be the upper limit for our capabilities of logistics and management. The workshop was promoted through the institution's means via posters in the faculty and the official social media accounts, as well as our own personal social media accounts. The event was advertised as a design fiction workshop, the main contribution to the participants was a brief introduction to the domain and a hands-on experience with design fiction. There was no monetary compensation for the participants. Applications were made online



Figure 5.3: Workshop poster.

by answering a list of questions: age, university, year as well as open-ended questions about their experiences with user research, design scenarios, graphic design software and design fiction. Within two weeks of open registration, we received 34 applications. Applications came from seven universities, with the majority being from Middle East Technical University. The median age was 23, and while 18 participants were 3rd and 4th year undergraduate students, 7 were graduate students and 9 were bachelor's degree graduates.

Together with Nagihan Tuna, 22 participants were selected for the workshop, by diversifying their institutions first, and their educational level second. 16 of these applicants confirmed coming to the workshop, and 14 showed up on the day. The final group of participants were coming from 4 institutions, 4 being graduate students, 5 being graduate practitioners and 5 being undergraduate students. 6 groups were formed by distributing the participants by their educational status, trying to diversify

the groups.

5.1.2.2 Introduction

To introduce the theme and the concept of creating fictional story worlds for design, I prepared a short lecture for the start of the afternoon session. This presentation introduced design fiction and textual worlds, to familiarize the participants to world building exercises. Later in the presentation, the future theme of the workshop was given. The theme was "personality core (PC)" a hypothetical hardware component that enables appliances it is put to gain a personality (See Figure 5.4). These devices would be called Personality Core Enabled Devices (PCEDs). Neither the term personality, nor its implications in this future world were not precisely defined to allow exploration by the participants, however a brief discussion was had about artificial intelligence, devices that talk to each other and devices that observe and learn from their environment during the lecture.

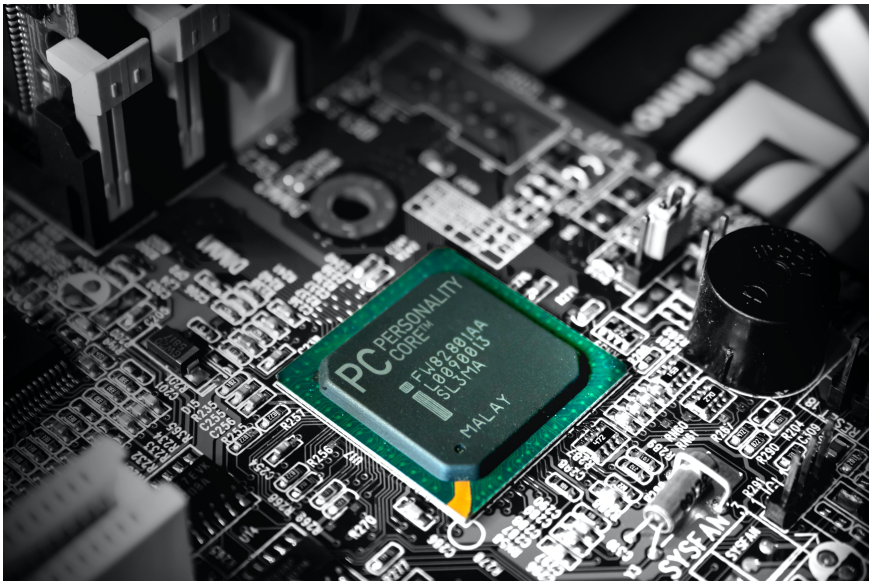


Figure 5.4: Composited image of the personality core, shown in the workshop.

5.1.2.3 World Building Exercises

After the presentation, a session was conducted with the WBD tool set. To start the session, the participants were told that they would be asked to imagine a fictional world where devices with personality core systems were common. Then, a large empty sheet of plotter paper and a set of empty stick notes were handed out to each team. They were told that a series of world building exercises will be presented to them in sequence. 12 world building exercises were prepared as described before (see 5.1.1). The list of exercises can be found below with their shorthand names. The micro elements refer to minor items of the fictional world while the macro elements refer to broader and worldwide implications.

1. Micro elements of the story world:
   (a) Generate two different greeting/good morning phrases for the PC-Coffee Maker and its fictional character owner. Describe your reasoning with a few keywords.
   (b) Create a brand for the PC-Coffee maker by combining one tech, one kitchen appliances and one fashion / furniture / home brand. Justify with a few keywords.
   (c) Company decided to have a button, that can temporarily disable the machine's PC. Design its icon. It has to be universal. Describe your reasoning with a few keywords.
   (d) What is the first paragraph of the PC-Coffee Maker in its Wikipedia article?
   (e) Imagine the product's user manual. What is one warning that is specific to PC technology? Write it down in a realistic language.
   (f) Imagine the product's Amazon page. Write down two short user reviews: the most up-voted positive one, and the most up-voted negative one.
2. Macro elements of the story world:
   (a) What is the cheaper/more limited version of the PC-Coffee Maker? What is the more expensive one? Describe the added or removed features.
   (b) Design a doorbell for a block of flats (apartment building) with a PC. What are the prominent features?

(c) Imagine PC enabled devices getting more prominent in the world. What is the 'occupation of the future'? What domain would you want your child to study in?

(d) As a marketer or designer, you are hired by a small, underdog company that is trying to compete with PC enabled devices. Describe the coffee maker you are proposing with a few keywords. How do you market it?

(e) What is the first legal bill regarding PC enabled devices aim to solve? Which country does it stem from? Why?

(f) In a world with more PC-enabled devices, re-imagine the industrial design education: what are the names and codes of the new courses? Write a 3rd year studio project.

The exercises were given in an order to alternate between creating micro and macro elements of the story world. Micro elements focus on the elements around a single idea, in this case, the PC-enabled coffee machine. Macro elements focus on the wider implications of them in the story world.

The exercises were beamed with a projector. On each slide, there was the text of the exercise as seen in the list above, together with a countdown timer. Exercises were briefly elaborated by the researcher as they appeared but not exemplified to keep participants open. Participants created as many number of answers they wanted for each exercise on sticky notes. At the end of each exercise, the notes were placed on the plotter paper, with the micro elements on the top and the macro elements on the bottom. An example work from one of the teams can be seen in Figure 5.5. There was no expected format for the answers: participants were free to write text or draw sketches and use the language of their choice.

5.1.2.4 Diegetic Prototyping

The next phase was diegetic prototyping. Each group was asked to create a mock-up for a landing webpage for a PC enabled coffee machine. Although specific requirements of this mock-up were not mentioned, Google Assistant's landing website as an example, seen in Figure 5.6. Participants were also encouraged to modify existing visuals, including entire layouts as necessary instead of creating elements from scratch,

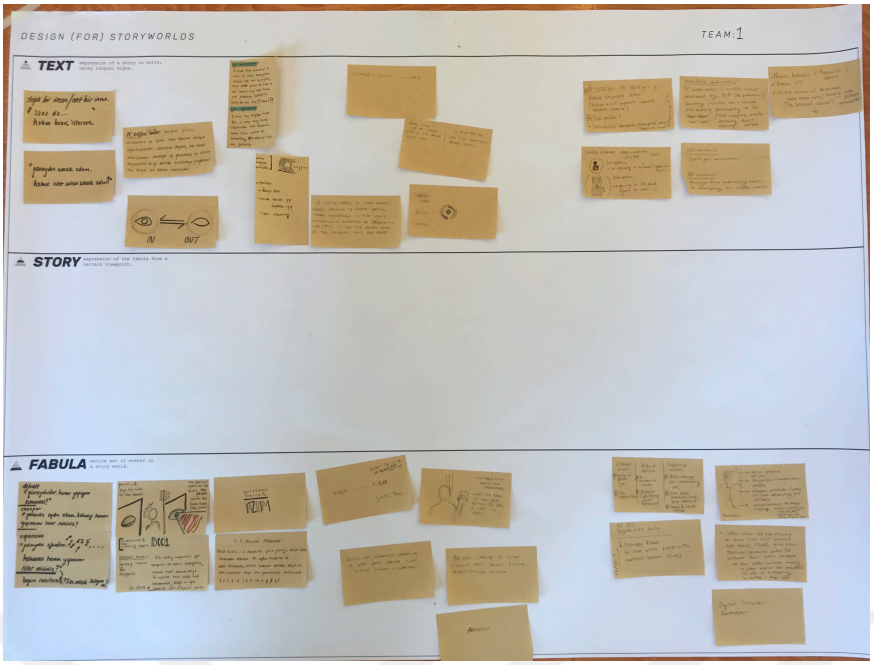


Figure 5.5: Example board.

to accomplish higher realism in the limited time. Landing pages typically includes branding and a summary of information regarding the product and how it is positioned in its context, all of which make it a good format for presenting the generated story worlds. Participants used graphic design software such as Adobe Illustrator on their own computers to create these mock-ups. As a final step, participants presented their diegetic prototypes in groups. In the next section, I will present the results generated by the participants from the workshop.

5.2 Results

In this section, I will present the participant output from the workshop. First, I will explain the results from the world building exercises and how I made sense of them using the literature from I presented in Chapter 3 about the concept of make-believe (see Section 3.1.3 on p. 51). Later, I will describe the diegetic prototypes made by the participants.

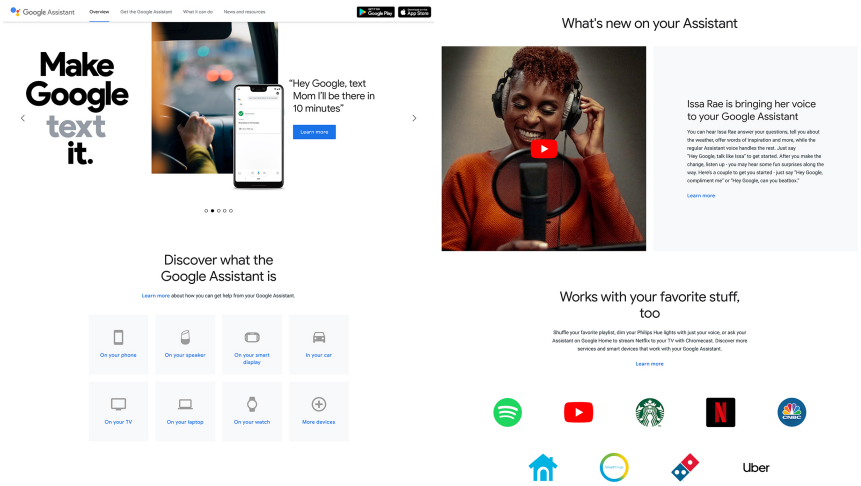


Figure 5.6: Google Assistant landing page, stitched. (https://assistant.google.com).

5.2.1 World Building Exercises

As mentioned before, teams wrote or sketched the output for each of the world building exercises on sticky notes and I later digitized the contents. To make sense of the story worlds generated through the world building exercises, I define each of these outputs as a prop.

Props are words and sketches created for every world building exercise on individual sticky notes. They are left as they are written by the participants, and are only grouped by the researcher in terms of the exercise they were responded to. As the literature suggests, they are prescriptions for imagination: meaning that they can imply further fictional knowledge. Consider the following prop, given as an answer to the world building exercise in which asked for a paragraph of a Wikipedia article on the PCEDs.

> "PC-Coffee-Maker is a cooking appliance to brew coffee, which includes a personality card. [...] there are 5 types of personality cards. These are happy maid, loyal friend, grumpy old man and ... "[1]

This prop introduces "character cards". In this textual world, character cards represent physical components that add different character traits to PC enabled devices. For another exercise in which they created a design education course, they imagine a course for creating characters.

> "ID 382: Building characters: [...] Prototyping & manufacturing characters."

This prop further materializes the character card concept, defining a card as something that is designed and manufactured. In another prop, the team presents a new occupation for their textual world, about designing PC enabled device characters for individual people, based on their personality analysis.

> "Custom designed characters for individuals. Character analysis of individuals." [2]

All three props from these exercises imply the following three speculations: (1) there are preset character cards for PC enabled devices, (2) these are designed and prototyped by specialists that includes designers and (3) there are ways to create personalized character traits for individuals.

To understand the textual worlds created by the participants, props and what they speculate are thematically grouped and these groups are defined as *arcs*. While the arc does not encompass all the information presented in the speculations, it presents a singular synopsis within the textual world participants created. The three speculations given above are grouped into one arc within their textual world: PC enabled devices have pre-designed character traits.

45 props were generated from the exercise sheets. These props and their speculations were then grouped into 8 arcs. Most arcs were shared amongst the worlds created by multiple teams. These arcs, together with their authoring teams can be seen in Table 5.1.

This list reveals that most arcs are shared, but there are differences between the arcs in this regard. The first two arcs are common amongst all teams. I argue that either the topic of the workshop or the types of the world building exercises encouraged these arcs to emerge. These insights will be further discussed in Section 5.4. There are however two unique arcs at the end of the list that were only generated by one team each. From another point of view, most teams explored a wide range of arcs (four to six, out of the eight I identified), exception being Team 3 who generated only two arcs.

Table 5.1: Arcs generated in the textual worlds.

Arc	Content	Teams
1	Humans and PCEDs have complex social relationships.	1,2,3,4,5
2	PCEDs have complex social relationships amongst themselves.	1,2,3,4,5
3	PCEDs have pre-configured character traits.	1,2,4
4	PCEDs have or develop traits that is continuously explored by people.	1,4,5
5	PCEDs have societal roles and rights.	2,5
6	People work and care for the well being of PCEDs.	1,2
7	PCEDs may deviate from their pre-configured character traits.	4
8	There are groups who are opposed to the complex social relationships between PCEDs and people.	1

To summarize, each answer to a world building exercise in the WBD toolset, participants generated a prop. These props prescribed imaginations towards a textual world. Based on the principle of minimal departure, any difference between the textual and the actual worlds, specified by these props imply speculations. These speculations are thematically grouped and reduced to arcs.

World building exercises represent the first part of the workshop. After the world building exercises, participants created diegetic prototypes, presenting arcs of the textual worlds they created. These prototypes are presented in the next subsection.

5.2.2 Diegetic Prototypes

Each team generated a diegetic prototype after the world building exercises. The prototypes were static web page mock-ups for a PC enabled coffee maker in their story world. A crop from a diegetic prototype can be seen in Figure 5.7 as an example. All prototypes can be seen in Appendix C.



Figure 5.7: Example diegetic prototype.

Teams have three different approaches in creating their prototype web pages, in terms of content. Teams 1 and 4 generated a world in which PC enabled devices come in models that can represent a multitude of characters, either by adapting and learning or programming. Within these two teams, Team 1 used more generic language to communicate how the device can adapt and learn. Team 4 on the other hand employed more elements of diegesis from their story world, such as names for the different device characters or employing a company hot line for "character abnormalities". Team 4 also stood out in the workshop by generating a new arc that did not appear in their world building results. This arc included certain PC enabled coffee machines becoming popular with their conversational abilities so that they started having their own video streams and audiences.

Teams 2 and 5 generated web pages for devices that have one specific character and focused on detailing the character traits. These individual characters have names and their traits have various implications on their usage. Both teams relied heavily on

customer reviews to articulate on the implications.

Finally, Team 3 generated a web page for a device that customizes the coffee based on the user's mood. Although parts of the mock-up mentions the device able to become friends with its user, their main idea was the machine's abilities in making different kinds of coffees.

In this section I identified two elements used in the world building process. These are props and arcs. Props are elements of the textual worlds which prescribe further speculations. The world building exercises of WBD encouraged the participants to create them as either text or sketches. Arcs are identified as groups of thematically related props. An arc gives a inferred synopsis within the textual reference world. In the next section, I present the analysis to further explore props created in this workshop.

5.3 Analysis

The analysis of this workshop is conducted by defining the properties of props. I conducted a content analysis on the props generated in the workshop. Through the analysis, I identified two properties for props: descriptive and prototyped. The analysis also revealed two approaches in creating the props: metaphorical and causal. These properties and approaches in cration will be further explored in the following subsections.

5.3.1 Prop Properties: Descriptive and Prototyped Props

The analysis revealed that there are two distinct *forms* of props. Because text was a preferred way of prop creation in this workshop, form refers to the usage of language in the results. These are descriptive and prototyped props. The following prop is an example of a prototyped prop.

> "Constitutional Court of the Republic of Turkey: According to Bill 54352...3, it is illegal to abuse and offend PC-Coffee-Makers, including offending their social and religious beliefs. This bill is in effect from 03.05.2025."
> 

This prop is written for the world building exercise that asks for the content of a legal bill concerning PC enabled devices. While some of the phrasing in the prop can be considered out of place for a legal bill, it generally follows the tone of a court's message, specifically ones seen on banned websites in Turkey at the time of the workshop.

I will compare it to the following prop, which is generated for the same exercise by another team. This prop does not present a legal bill, but it rather describes multiple ideas for legal concepts in short bursts. In this way, it is more akin brainstorming: the ideas cover more ground but lack detail.

> "Machines must have pension funds during employment. No bribery is allowed. Machines are taxed." [4]

Props that attempt to adhere to their respective media are considered *prototyped*, while props that speculate through brainstorming or descriptions are considered *descriptive*. Both approaches have utility for world building: descriptive props provide a wide exploration of different ideas while prototyped props provide a focus on implications of singular ideas. Examples above both present multiple speculations. The first and prototyped output has the overarching idea that PC enabled devices are protected from abuse by law. However, the form of the medium asks for examples for this overarching idea, as legal bills often do. And in this example the participants generated two implicit inferences for their textual world: PC enabled devices may have social and religious beliefs.

The latter and descriptive example presents the overarching idea that PC enabled devices have public responsibilities. However, the brainstorming approach generated three large examples: that the devices have pensions, bribery and taxation. Without exploring the diegetic medium of a bill, none of these large examples were explored in more detail to uncover their implications.

5.3.2 Links Between Props: Metaphorical and Causal

While form usage helps distinguish how props can be categorized by how they present an idea, the analysis also revealed how these ideas were created. During the analysis,

two approaches for creating props were identified: metaphorical links and causal links. Participants used *metaphorical links* to create props representing textual world entities, based on similarities to actual world entities. The following quote is a result of an exercise for writing a negative review of the PCE-Coffee Machine for an online retailer:

> "Very incompatible. It slacks off all the time and it's cranky. It fired all my kitchen robots by complaining and complaining. Don't buy, it's not worth your money." [5]

This prop creates the speculation that PCEDs can have unexpected social interactions with other PCEDs and can even fire them from a house. Another prop below is from an exercise where participants created a project for undergraduate design education.

> "Gossip room for objects. It's really important for objects to know everything about their surroundings. To improve this skills and environment, design an open website to share for object's data."

In this prop, a "gossip room" is defined for PCEDs to interact with each other about their users and surroundings. Both props create the second arc mentioned in Section 5.2, that PCEDs have complex social relationships amongst themselves. I consider the link establishing the prop here metaphorical: people can fire other people or gossip with one another in the actual world. PCEDs are like people. Therefore, PCEDs can fire others or gossip with one another in the textual world. The common link here is firing or gossiping, hence they create the complex social relationships for PCEDs. Subjects of this arc are changed from humans to PCEDs in the textual world by the participants.

There are similar props constructed in the workshop with metaphorical links. The fourth arcs mentioned in Section 5.2 is about PCEDs having and developing character traits that are continuously explored by people. This arc is created by speculations like product psychologists that help PCEDs or fictional courses that deal with the behavioral psychology of products. In this case, certain diegetic components exists both in the actual world and the textual world: psychologists and behavioral scientists. However in the textual world, their roles are different: they deal with products instead of people. Likewise, the arc theme is about the PCEDs having societal roles. This

theme was constructed using metaphorical POGs about how PCEDs can get married, or sue one another, just like human beings in a society.

The second type of link for creating props are defined as *causal links*. Causal links create a textual world, based on a cause and effect relationship with a another speculation from the same textual world. The following prop is given by the participants as a legal bill.

> "If an individual spends too much time with a PCED based on a certain quota, they will be taken to rehabilitation." [6]

Another prop describes a fictional design project that focuses on enabling more human to human interaction, in a textual world that is possibly devoid of it.

> "Design an interaction creating a step-back feeling that increases human interaction."

Both props are grouped under the eight arc mentioned in Section 5.2, that there are certain groups opposing the state of complex social relationships between people and PCEDs. This gives a causal link for the arc: (1) the team speculated that people will spend too much time with PCEDs, (2) some people will be bothered by this, and (3) there will be legal requirements to rehabilitate people who over-socialize with PCEDs. This exemplifies a causal link that connects two props to each other. Another example of a causal link is used by the following prop.

> "Coffee makers are not allowed to share their user's personal life details, rituals with other machines / products with PC without their user's consent. This bill was posted after coffee machine makes a joke about the president's sex life in a meeting in the USA."

This speculation is grouped under arcs four (PCEDs have or develop traits that is continuously explored by people) and seven (PCEDs may deviate from their preconfigured character traits). The speculation involves a cause and effect within itself. It first recites the legal text in the first sentence, about how PCEDs can not share owner data with other PCEDs. In the second sentence, it gives the in-world reason for this: it was considered after a PCED revealed an intimate knowledge about a popular figure.

Props created with metaphorical and causal links are not mutually exclusive. There are props which include both approaches. The prop below is a negative customer review for a PCED.

"Negative: “It started to say I’m worthless. Refund wanted."

This prop is generated by both metaphorical and causal links. On the one hand, it builds a metaphorical link between the relationship between friends and the relationship between PCEDs and their owners. On the other hand, it implies a causal development: the PCED was not hostile before and then it started to become one.

To summarize, links establish how a prop defines the textual world and how it is different from the actual world. Participants justified their speculations by framing the rules of these make-believes. Metaphorical links create likelihood between actual world and textual world speculations. Causal links create cause and effect relationship between textual world speculations.

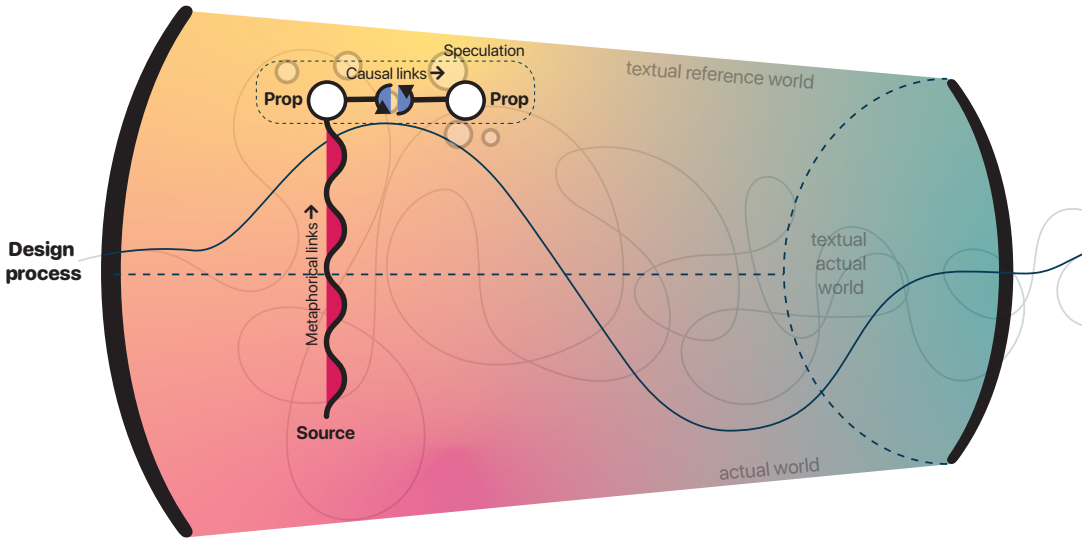


Figure 5.8: Schematic view of the world building activity, as defined after the workshop.

5.4 Discussion

Analysis of the props generated in the workshop revealed two categories of properties. Props have metaphorical and causal links; and their content can be described or prototyped. In this section, I will discuss the implications of these properties over the results of world building activities. There are two insights to be discussed. First, I will discuss how causally created props are more reflective than metaphorically created props. Second, I will discuss the limitations of prototyped props and how to support them further in world building.

5.4.1 Causal Links and Reflection

During the world building exercises, participants created props with metaphorical links to establish the truths of their textual worlds. As an example, props created by Team 1 and separated by being metaphorical and causal can be seen in Figure 5.9.

In this case, metaphorically created props establish what the PCED devices are, their properties, and their limitation by defining them directly. In Team 1's textual world, PCEDs have preprogrammed characters to be good-natured, but they also learn from the environment and adapt. These adaptations also mean that PCEDs evolve and can have unexpected character traits that people explore.

Causally created props on the other hand, build on top of these speculations and explore their implications. PCEDs can start being mean or annoying to people as they evolve. Some people are concerned about the excessive time spent with PCEDs and support rehabilitation in such cases. PCEDs have religious beliefs and are protected against hateful interactions.

While metaphorically created props establish the textual worlds, causally created props enable reflecting on these textual worlds. Causal props explore the further implications of the metaphorical props. In Team 1's world building activity metaphorical props which establish that the PCED characters are designed to be well-behaved but can evolve, are extrapolated by causal props which establish that PCEDs can become annoying. This extrapolation also resulted in more unique themes: people getting

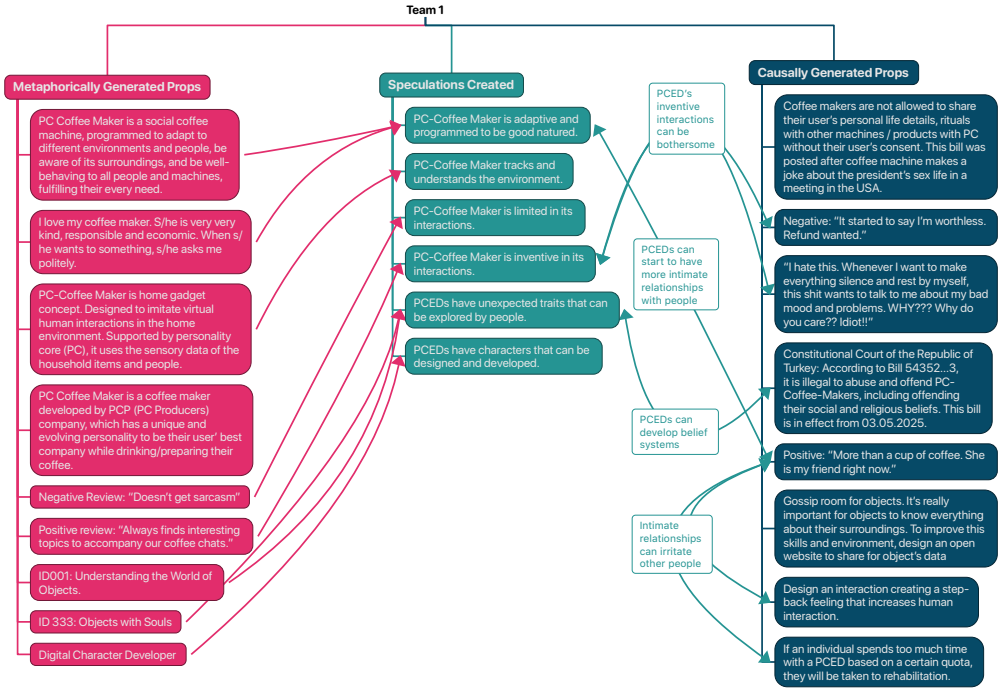


Figure 5.9: Establishing and inferring using metaphorically and causally created props.

concerned about the excessive time spent with PCEDs was a unique theme for this team and was generated by a causal prop.

It is also observed that causal props were generated mostly on the world building exercises for creating customer reviews, legal bills, and design projects. All of these exercises demand an artifact to be established: customer reviews require a product or service to be reviewed, legal bills require an issue to be solved, and design projects require a problem space to be improved. Therefore, these exercises ask for a before and an after state. Workshop results indicate that world building exercises will generate more unique insights with causal props, and causal props can be generated by exercises with a before/after state. This is taken into consideration for improving the toolset for the next workshop, by adding sub-questions to exercises for backstories.

5.4.2 Inventiveness and Limitations of Prototyped Props

In this workshop, the result indicate that prototyped props reveal assumptions and generate implicit knowledge about the textual world; through the use of language. The following props are created for the world building exercise which asks for a new undergraduate design course for the textual world, presented in Table 5.2.

Table 5.2: Props representing new undergraduate design course titles for the textual worlds.

Team	Prop
1	"ID001: Understanding the World of Objects."
1	"ID 333: Objects with Souls"
2	"Behaviors of objects / Materials"
2	"Object-centered design"
3	"Course: PC Culture: Side effects of PC culture. PC Culture Evolution"
4	"ID 382: Building characters: Social relations of objects. Prototyping& manufacturing characters. Legal concerns in designing comrades."
5	"ID 105: Introduction to Basic Characters"
5	"ID 305 Designing behavioral psychology of products"

Prototyped props borrows prosal constructs from their template mediums. For the example exercise presented above, participants adapted phrases used in typical course names, such as "Understanding [...]", "Introduction to [...]", or "Designing [...]". By adhering to these constructs, participants were able to generate textual world knowledge economically. Team 1's props in Table 5.2 speculate that objects have characters that can evolve further than an original design and can be explored. Team 2's object-centered design implies the existence of needs in PCEDs. Team 3 introduces the concept of an evolving PCED culture. Team 4 frames PCED characters as products that are designed, prototyped and manufactured. Team 5 introduces basic characters, adhering to a typical curriculum which first year classes work on simpler versions of topics. All these are examples of prototyped props, generating knowledge through the prosal constructs of the target medium.

Familiarity of the participants to the target medium increased the specific knowledge generated through the props. Props generated for the world building exercise which asks for a legal bill in the textual world is presented in Table 5.3.

Table 5.3: Props representing new legal bills for the textual worlds.

Team	**Prop**
1	"Constitutional Court of the Republic of Turkey: According to Bill 54352...3, it is illegal to abuse and offend PC-Coffee-Makers, including offending their social and religious beliefs. This bill is in effect from 03.05.2025." [7]
1	"If an individual spends too much time with a PCED based on a certain quota, they will be taken to rehabilitation." [8]
1	"Coffee makers are not allowed to share their user's personal life details, rituals with other machines / products with PC without their user's consent. This bill was posted after coffee machine makes a joke about the president's sex life in a meeting in the USA."
2	"Machines must have pension funds during employment. No bribery is allowed. Machines are taxed." [9]
2	"Finland: Lawfulness, justice. Switzerland: They have nothing else to worry about." [10]
3	"Bill: The coffee machine can listen to the resident via its sensors. In case it is hacked, someone else can also listen in. A law can regulate this. The law came out in the UK because it is the most hacked country." [11]
5	"Bill: Iceland (A pioneer, once again!) legalized marriage between PC-Enabled devices and people. According to the law, in case of a conflict, both people and the machines can apply to the courts, and demand a divorce." [12]

As seen in the table, only Team 1 generated prototyped props for this world building exercise, while the other teams generated descriptive props. The prototyped prop implied that there are religious and societal convictions in PCEDs. Compared to the results of the world building exercise about a new design course in Table 5.2, prototyping is considerable lower, arguably because of unfamiliarity to the prose of a legal text. To keep a balance between prototyped and described props, familiarity to the medium must be a consideration in exercise design.

5.5 Concluding Remarks

In this chapter, I presented the design, application, results, analysis and reflections on the first workshop of the study. Conclusions of this chapter is presented by answering the questions asked in the beginning of the chapter:

> Question 1.A: What are the elements of world building in design education based on relevant literature described in the previous chapters?
> Question 1.B: How are these elements generated?
> Question 2.A: How do these world building elements affect the world building processes in design education?

For Question 1.A, I identified props, and arcs as the components of speculation in the world building process.

For Question 1.B, I define two types of properties for the props generated by the participants. The first type refers to the links: props can be created from metaphorical or causal links. The second type refers to form usage: props can be described or prototyped.

For Question 2.A, I discuss two implications. (1) Metaphorical props establish the fictional truths of a textual world, while causal props initiate a reflective and critical thinking process over them. (2) Prototyped props use prosal constructs in their target mediums to generate implicit knowledge or reveal assumptions of the participants about their textual world.

I also conclude that the toolset should encourage participants to include causality (exploring before/after scenarios) and consider the familiarity of participants to the target mediums of the exercises. Both insights are used to iterate the toolset for the second workshop presented in Chapter 6.

To summarize, this workshop revealed the dimensions of creating props in world building, as the first step of world building in early design activities. In the next chapter, I present the second workshop which explores world building further, by focusing on how these props form arcs and how arcs are processed during world building.

CHAPTER 6

ASSESSING SPECULATIONS: WORKSHOP 2

The second workshop of my study aims to further explore the world building process in a broader context. In the first workshop, participants used the WBD toolset to generate worlds for a well-defined theme: around sentient coffee machines. Such a well-defined theme was suitable for kickstarting the world building process and the resulting textual worlds were similar to one another. This enabled me to see the patterns used in creating the textual worlds, from which I established the types and the properties of props, arcs and links.

However, because the textual worlds were similar and they were not used in a subsequent step, differences of these textual worlds were not explored in detail. Therefore, the workshop was not adequate in showing a process of world building. To better understand it, this workshop focuses on the process of world building, more specifically, which arcs of the world building remain resilient through an assessment phase. My sub-questions for this study are:

> Question 1.C: What are the different approaches in the world building process for sustaining certain narratives?
> Question 1.D: How do the properties of speculations affect the resiliency of narratives design students generate during world building??
> Question 2.B: How do different approaches used by design students to progress their generated worlds, affect the perception of these worlds?

Question 1.C refers to how the world building activity runs as a process. While I explored props in the previous chapter, I did not focus on arcs as they were created and evolved during the world building process. I made changes to the WBD toolset

to enable participants build their props cumulatively and used printed sheets for the exercises to aid my data collection. The resulting data was formed as a linear process and helped me observe which arcs as a whole: letting me see which of them remained resilient and which did not. The answer to this question revealed different types of arcs and approaches by teams which use these different types of arcs.

Question 1.D refers to a comparison between the prop properties defined in the previous study, and the answers to questions 2.A. Results of this comparison are used to identify the implications of prop properties to the arc resiliency.

Question 2.B refers to how participants evaluated the results of their world building process. A peer-evaluation phase was added to the end of the workshop to understand how participants viewed the results of world building done by their workshop peers. Results of this peer-evaluation was compared the particular approaches of world building employed by teams to see how these approaches affected believability. Answer to this question will be used to iterate the WBD toolset. The improvements on the toolset prior to the workshop is presented in this chapter, as well as suggestions for further improvements based on the results of this workshop. The way this workshop fits to the theoretical model of world building in design education can be seen in Figure 6.1.

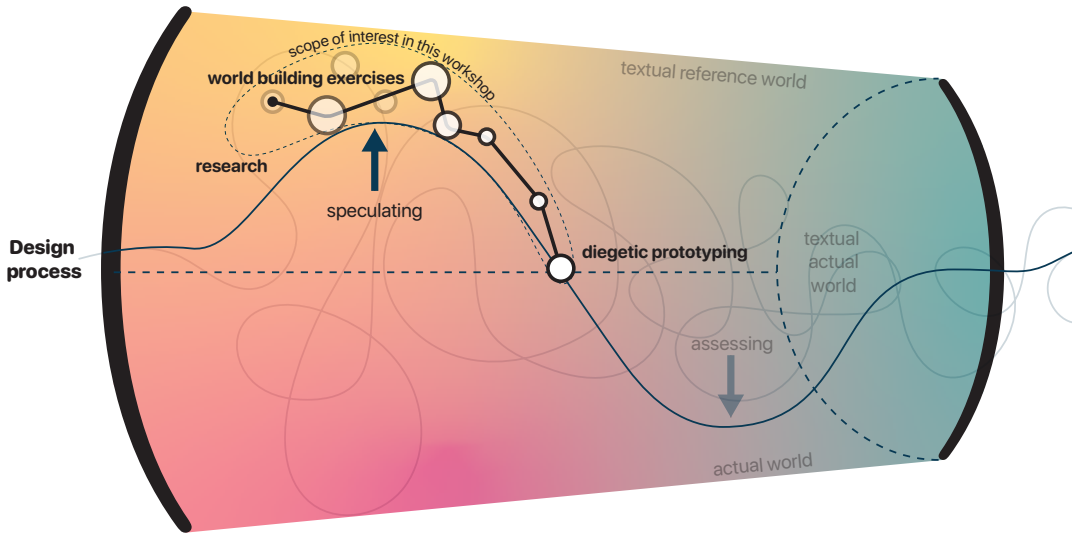


Figure 6.1: Workshop 2's scope of interest in the theoretical model.

The workshop and its implications for my study is further elaborated in the following

sections. The preparations and application of the workshop components are discussed in Section 6.1, output generated by the participants is discussed in Section 6.2, analysis of these results is discussed in Section 6.3, insights and key knowledge generated from the workshop are discussed in Section 6.4 and finally, a brief summary of conclusions from the chapter is provided in Section 6.5.

6.1 Design

In this section, I explain how the workshop was designed, prepared and applied, as well as how the participants were chosen. The workshop, titled “Organic Design” was held in Middle East Technical University, Ankara on October 5th, 2019. Like the previous one, it was conducted as a stand-alone workshop, in the sense that it was not part of another design project or course. It was planned for a whole day, running between 10am to 5pm, on a weekend.

The workshop was advertised to be on "research prototyping" using design fiction. It was defined as generating diegetic prototypes for research conducted on disruptive technologies. The main contribution to the participants was an introduction to diegetic prototyping and hands-on experience. There was no monetary compensation for the participants.

The workshop was publicized 15 days in advance with posters seen in Figure 6.2 within the university building, as well the department’s social media accounts. It was free for the participants, however we asked for at least third grade industrial design students, including graduate students, to maintain a certain level of experience in design projects and team work. Participants were provided snacks and hot beverages throughout the day.

6.1.1 Participants

The workshop required an application and selection process for the participants. During the application process, participants were asked to self-evaluate their skills in five categories. These were graphic design, video editing, authoring (creative writing),



Figure 6.2: "Organic Design Workshop" poster.

physical mockups and 3D visualization. Applicants with higher self-evaluation were preferred for a better variety in creating research prototypes. They were also asked whether or not they were familiar with design fiction as an approach.

A total of 24 applications were received from 5 different institutions in 3 cities. They included 13 fourth year students, 8 third year students, 2 master's students and 1 doctoral student. After a round of communication, a final group of 9 participants ended up attending the workshop. One candidate left the workshop after the morning session, due to a misunderstanding of its scope and therefore is not included as a participant in the study. Table 6.1 shows teams and their members with their respective self-evaluation.

Table 6.1: Participant profile and distribution for Workshop 2.

Team	Participant	Level[1]	Familiarity to design fiction[2]	Self-evaluation of skills[3]				
				Graphic Design	Video Editing	Authoring	Physical Mockups	3D Visualization
1	1	4	1	4	4	3	5	3
	2	4	1	3	2	3	3	4
2	3	4	1	3	2	4	4	4
	4	4	1	4	2	3	4	4
3	5	M	2	4	4	3	5	5
	6	3	1	5	4	3	4	5
4	7	4	1	4	4	3	4	4
	8	4	1	4	4	3	4	3
5	9	3	1	4	2	4	4	4
	10	3	1	3	3	3	3	2

1 3= 3rd year student, 4= 4th year student, M= Master's degree student.

2 0= Never heard of it, 1= Heard about it but never worked with it, 2= Worked with it, 3= Experienced with it.

3 1= Very poor, 2= Poor, 3= Average, 4= Good, 5= Very good.

6.1.2 Theme and Application

The theme of the workshop is left broader than the previous workshop. Participants were asked to foresee a world, where organic tissues were mass produced. They were then asked to focus on implications, as imagined by product designers.

The workshop is conducted in three steps: (1) research phase, (2) world building phase, and (3) peer-evaluation phase. Steps 1 and 3 are new additions to the workshop process and the reasons are explained below.

6.1.2.1 Research Phase

In the research phase, the general theme was announced to the participants with a slide from the introductory presentation, shown in Figure 6.3. After the introductory presentation, participants were given 30 minutes to conduct an online research within their own teams.



Figure 6.3: Slide from the workshop presentation, introducing the theme.

Before the research phase, each team was given research finding sheets, in which they were asked to summarize each finding from their online research in their own words. Also in every research finding sheet, they were asked to cite the source (using an URL shortener when necessary) and describe the source with their own words. This was to encourage them to reflect on the type of source they were using, whether they perceived it as more informational or more inspirational. Finally, they were asked to pick whether it was informational or inspirational with a short survey accompanying each choice. Filled samples can be seen in Figure 6.4.

This newly proposed research phase has two purposes. First, it serves as an actual research phase for the participants, so that they are more knowledgeable and warmed up to the topic at hand. Second, it records the findings as data, using the research findings sheets. These will be used to see how initial research findings are transformed through the rest of the workshop using world building processes.

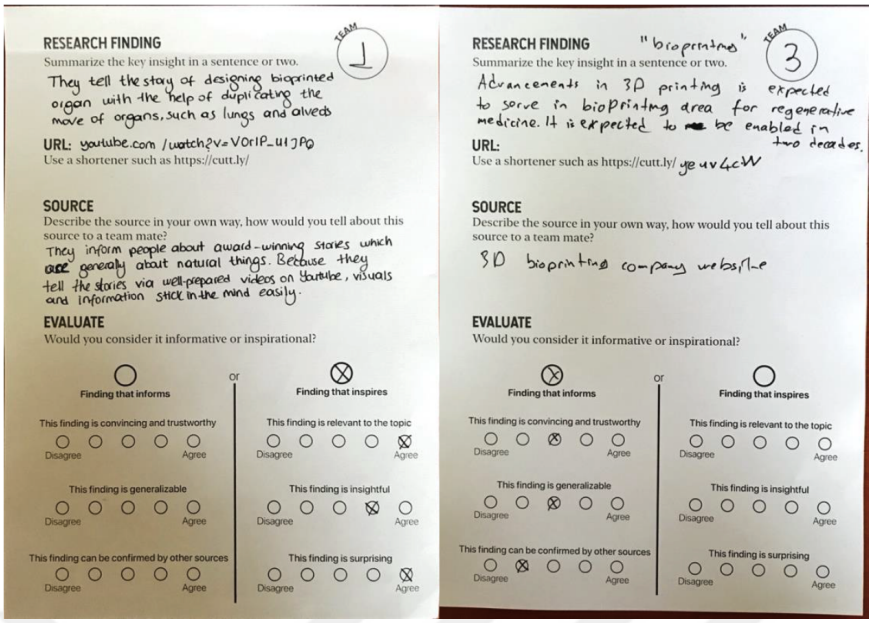


Figure 6.4: Filled research findings sheets from the workshop.

6.1.2.2 World Building Exercises

Both the design and the content of the world building exercises are iterated for this workshop. For design, exercises were printed on individual sheets of A4 paper, instead of projecting them in the presentation slides and letting participants write their answers on sticky notes. A sample exercise sheet can be seen in Figure 6.5, while the complete set of exercises can be seen in Appendix D.

This was done for two reasons: (1) filled exercise sheets stayed on the working spaces of teams, so the knowledge generated throughout the world building phase remained accessible to participants, and (2), most exercises had multiple follow-up questions about the same exercise. Both these design improvements are done to increase causal and prototyped props. Participants were expected to build more causal props if they kept knowledge on their textual world more accessible and answered follow up questions. Follow up questions enabled participants to work on both descriptive and prototyped props for the same exercise.

To compare a world building exercise between the first workshop and this one, consider the design changes shown in Figure 6.6.

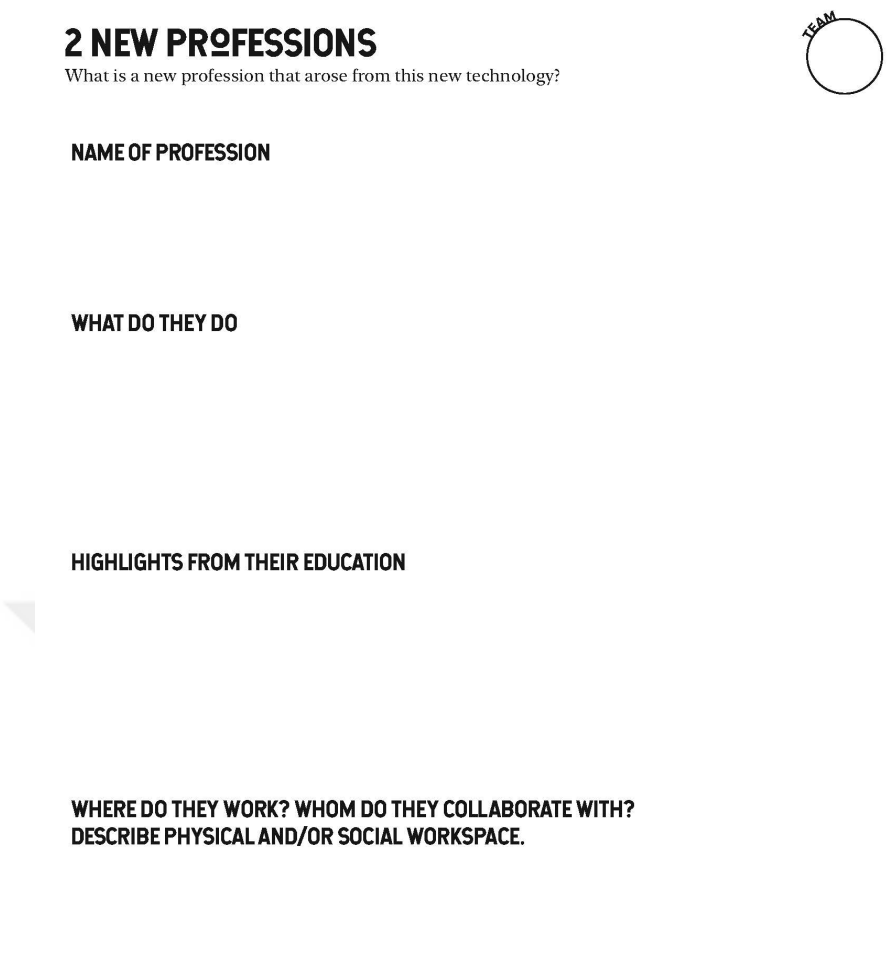


Figure 6.5: Sample exercise sheet from Workshop 2.

The exercise design in the previous workshop resulted in participants using free form answers in the sticky notes. Most teams ended up choosing between descriptive and prototyped answers: in the example above, the answer on the left is a descriptive prop which brainstorms ideas of a fictional law. The iterated exercise design used in the second workshop, asks for three questions: law text, country of origin, and the historical background. These sub questions encourage participants to both prototype the prop (law text) and brainstorm descriptions (historical background).

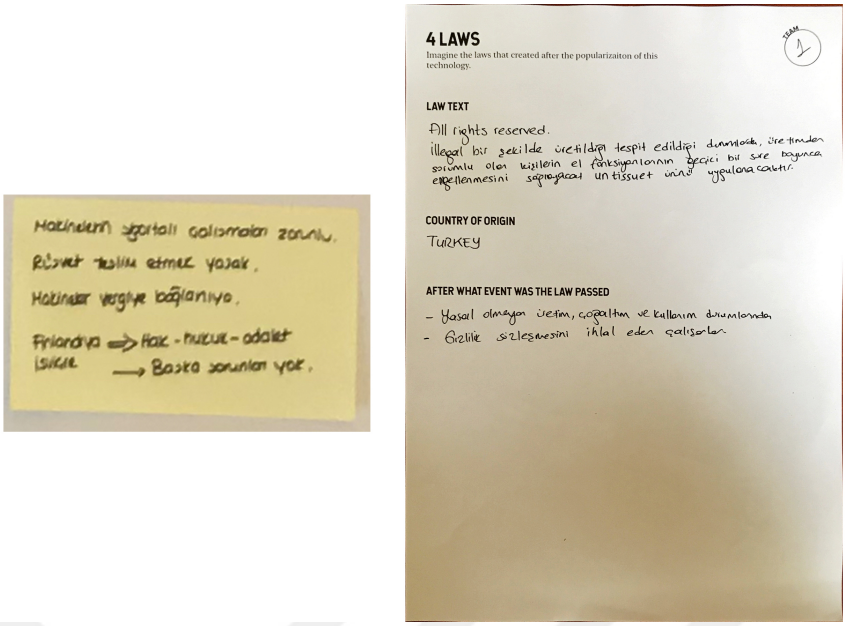


Figure 6.6: Comparison of law making exercise between workshop 1 (left) and 2 (right).

The content of the world building exercises refer to the questions asked. While the total number of exercises remain unchanged from the previous workshop, the contents were updated by changing the questions that: (1) did not generate props in the previous workshop and (2) were not adequately prototyped due to the unfamiliarity of the participants to the target medium (see the discussion in Section 5.4.2). The new set of questions used in this workshop can be seen in Table 6.2.

Following the world building exercise, participants were given time to plan what they would build for diegetic prototypes. Each team was given a *research prototype sheet* in which they recorded their plan (see Figure D.14). Unlike the previous workshop in which participants were given a specific template for diegetic prototypes (landing website), they were free to choose their own medium and content.

Peer Evaluation Phase

During the final phase of the workshop, teams presented their diegetic prototypes to the entire group and the group evaluated each team's prototype using *peer review sheets* (see Figure D.15). A similar evaluation was designed for the research findings to be used before the world building exercises.

Table 6.2: Content of world building exercises used in Workshop 2.

No	Title	Description on sheet	Questions on sheet
1	How it's made	Imagine how this new material will be commercialized. What could be the production techniques? Name the material and components and feel free to describe production techniques with text or diagrams.	Name of the material What are some of the components or products made from this material? Production technique
2	New professions	What is a new profession that arose from this new technology?	Name of the profession What do they do? Highlights from their education Where do they work? Whom do they collaborate with? Describe physical and/or social workspace
3	Brand Identity	Imagine the company or institution that is a major player in this field.	Name and logo Slogan Brief History
4	Laws	Imagine the laws that were created after the popularization of this technology.	Law text Country of origin After what event was the law passed
5	UX	Describe a user experience within this new technology. Use any form you wish (text, story board, diagrams etc.)	
6	TV Discussion	Imagine a panel discussion on a news channel. Fill the screen caption below with a (1) headline, (2) discussion summary and (3) panel guests.	A schematic screen cap with a chyron setup was provided for participants write a title and subtitle for the discussion.
7	Storage	How will materials, components or products made by this technology be stored?	Where and how is the raw material stored
8	Infrastructure	Imagine some of the new infrastructure made necessary by the new technology.	New domestic environment New _____ New _____
9	Packaging & Labeling	Imagine the products of products made with organic design.	Labels for the new materials Universal icon for the new material Packaging design for a sample product
10	Model segmentation	How will less expensive and more expensive products will differ from each other?	Sample product and feature Lower end product and how it differs Higher end product and how it differs
11	Functionality	Describe one scenario in which organic design will solve a problem by a novel functionality.	
12	Language	Go over the previous boards to create new bits of language for any new actions, verbs, adjectives and nouns.	2-column table structure with Words on the left and Meaning on the right.

6.2 Results

In this section, I present and discuss the resulting textual worlds from the workshop. Each team's work is presented under its own title and includes their research findings, textual worlds and diegetic prototypes.

6.2.1 Team 1

Team 1 imagined a material they called Tissuet. This material was based on organic cells and was grown in lab conditions. They started by applying this material to hand tools, as handles, so that the handles would transform their shape in real time during use for better ergonomics and comfort. Ergonomics was a focal point at this point of world building, as they imagined people working with this material to be educated on anthropometric research. The company was imagined to be strict with their intellectual property rights and applied a remote call to unlicensed products to stop them functioning.

The team imagined sample products like computer mice and thermoses, which changed their shape as soon as a user was reaching for them. In the 6th world building exercise for which they imagined a controversy, a new usage was imagined, which was a third hand from this material that one could attach permanently to oneself. However, this usage did not come up again, later on. In the 7th exercise, in which they imagined the storage facilities in the factories, the team elaborated on how this material reacted to human touch, to justify usage of "automatic creatures" for factory logistics. This reaction was further evolved into the material being personal, as in, becoming bound to an individual after the first contact. In the infrastructure exercise, the second major functionality was developed, which is that the material is protective against extreme conditions, such as heat and electricity. Examples were given for this were gloves worn by metal casters and electricity technicians. In the model segmentation exercise, they developed another side functionality which remained isolated in this exercise, which was that the material was able to sense hormone levels and alter them.

As research prototypes, the team created two ad posters for the material, one depicting

the shape shifting properties and the other one depicting the protective properties. These can be seen in Figure 6.7.



Figure 6.7: Team 1's diegetic prototypes from workshop 2.

6.2.2 Team 2

Team 2 developed a material called Growtect, which is more an enhancement fluid than a material. The team started by imagining enhancements such as feet you could mount to babies that grew with them and that could be detached for medical inquiries when needed and ears that could translate languages in real time. They quickly started developing a rich world around this idea, stating that Growtect was developed to end the pain and suffering that was dominant in the society before. They also created a conflict in which people had to be poor with no material desires in order to be eligible for Growtect, which they imagined as a government-controlled substance. "Ministry of Misery" would conduct evaluations of people requesting Growtect and would let them get it only if they are poor enough.

The team imagined that this created a city in which the society would throw out their riches constantly to get these enhancements, to the point where rich from other cities

flocked here. Later they imagined that every eligible individual would have their own tanks of Growtect in a government building, which would be personalized constantly by mixing bodily fluids, such as saliva and urine. Anyone who uses someone else's Growtect product would be punished by more material means.

The research prototype was a video shot by the team, depicting the evaluation of an individual by the Ministry of Misery for Growtect. In the video, the individual throws out her branded clothes and accessories and the evaluator praises the perfection of an enhanced but poor body, symbolized by a naked mannequin. Stills from the video can be seen in Figure 6.8.



Figure 6.8: Stills from Team 2's diegetic prototype from workshop 2.

6.2.3 Team 3

Team 3 started from the production methods of their imaginary material and called it TissueLawn. They imagined an agricultural process, in which makers of the material would start the production and it would continue by itself, yielding organic textiles. These makers would be called tissue farmers and the process was accidentally discovered in an actual farm in Konya. In the early exercises, the makers were described

as God-like, and the company carried the tone in their slogan, “God died when we were born”.

The team articulated on counterfeit production of these tissues, with background information like how some illegal producers could not stop the on-going production when needed. They also mentioned the maintenance of these organic textiles: they had an optimal life span of 50 years during which they had to receive a certain amount of sunlight and to be moisturized. Otherwise the textiles would wrinkle and die. Finally, they mentioned how this material would help reduce waste in the world.

Their research prototype was a montage of videos, edited from sources found online. The montage resembled a commercial slot of a TV channel, showing an advertorial for the clothes made from this material and a news segment about the counterfeit production. Both videos had a synthetic voice dub written by the team and superimposed text. The advertorial section was about clothes, carrying the properties of different animals, which was not explicitly mentioned in the world building exercises. Stills from the video can be seen in Figure 6.9.

6.2.4 Team 4

Team 4 created a material called Fabricelamun, a textile product that was used to build dresses, accessories and even space suits. It was built from 3D printed cells. They imagined that the cells used in the printing belonged to organisms with specific properties that were reflected in the final product. For example, cells from an organism that could withstand heat would be printed to create suits that could withstand heat.

Later in the world building process, they focused more on the color changing aspect of the material, designing a color disc that could be used by the wearer to change the color of their garments. On late stages, they touched the wider use cases once again, by mentioning that there were professional versions of this material that allowed suits which would help wearer breath in otherwise unbreathable environments. In the end, their research prototype focused on the color changing aspect, as a short looping animation showing a billboard in a city about the color changing dresses. It can be

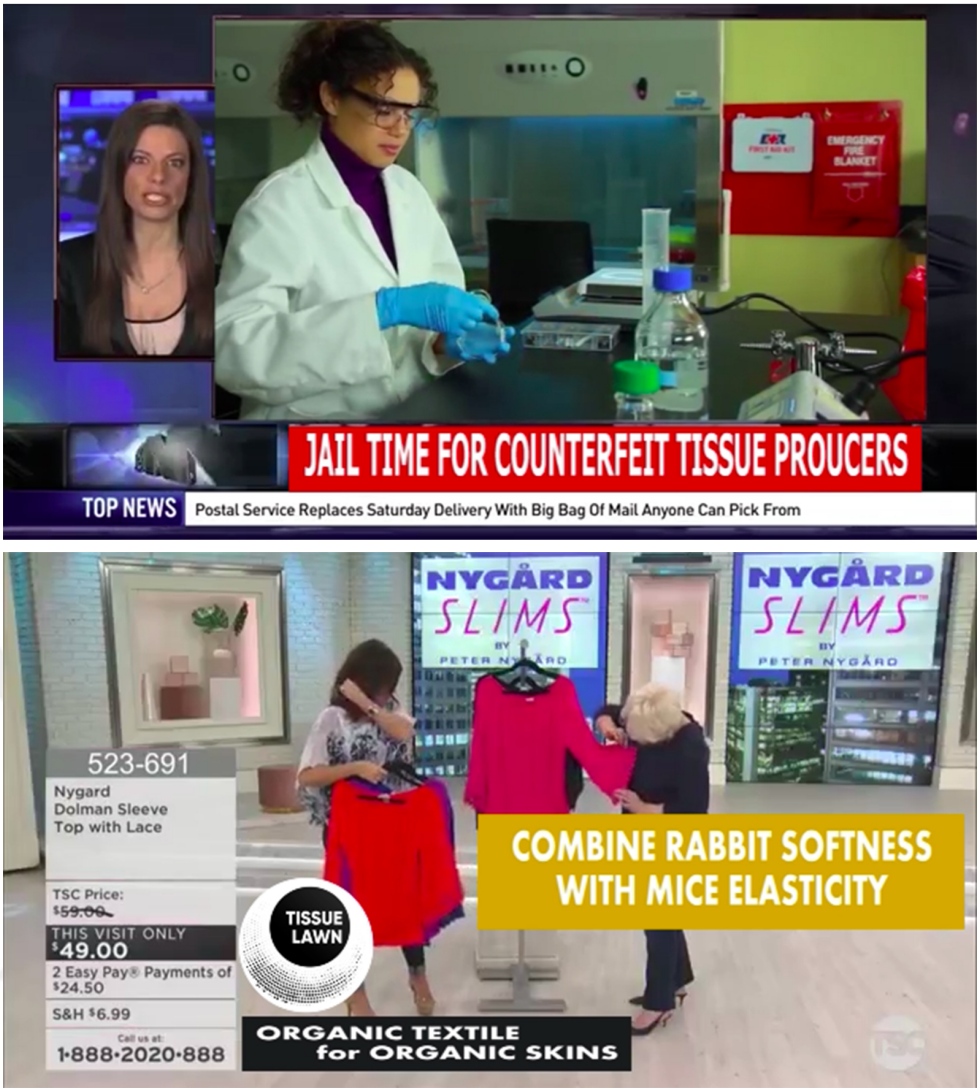


Figure 6.9: Stills from Team 3's diegetic prototype from workshop 2

seen in Figure 6.10.

6.2.5 Team 5

Team 5 started by imagining two distinct directions for this material, one called Bio-proto for synthetic organs and one called Orgaclothes for organic textiles. Later they dropped the organ arc and focused on the textiles. Their imaginary textile products relied on two scenarios. One, these clothes would be bought for babies and children, and would be able to grow in size with them. And two, they would normally decay and decompose into the nature when left by themselves. However, there would be



Figure 6.10: Still from Team 4's diegetic prototype from workshop 2.

solutions and refrigerated closets in homes that would slow or delay the decay.

The team therefore focused heavily on the sustainability angle, by imagining that the waste produced by garments and their production would heavily decrease. Their research prototype was a webpage mockup for this company, advertising some of the properties of these garments. It can be seen in Figure 6.11.

6.3 Analysis

In this section, I present the analysis conducted to answer my sub-question 1.C: How does world building transforms knowledge? The version of the WBD toolset that I used in this workshop defines a process in which the participants start from a research finding. From this research finding, they generate props using sequential exercises. Sequential exercises mean that at least some props will be thematically connected, forming arcs. At the end, they build a diegetic prototype that showcases one or more arcs from this textual reference world.

The focus of analysis of this workshop is on this progression of arcs. While the first workshop focused on individual props and how they are created; this workshop focuses on how arcs evolve during the process. This is why the toolset was iterated

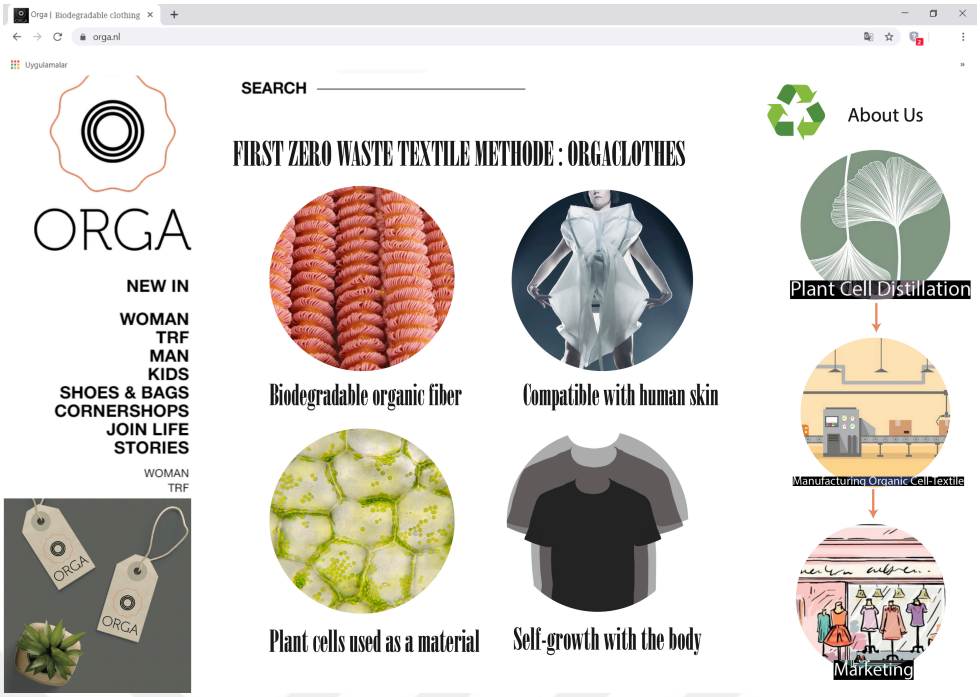


Figure 6.11: Team 5's diegetic prototype from workshop 2.

after the first workshop, to emphasize the sequential nature of the exercises by having each exercises in its own sheet of paper. This was done to make sure participants had their previous exercise questions and answers in sight, as they fill in the next one.

As mentioned before, the main aim of this analysis is to identify a process. To better see this process, I generated arc progression maps for each team. Props generated by each team was digitized into boxes of text or images, and placed under the world building exercise for which they were generated to. The layout was designed to have the sequential world building exercises from left to right: including the research phase in the leftmost spot, and the diegetic prototype in the rightmost. The resulting map represents a team's journey form left to right, as they generate props for each exercise.

Next, I started from the end of the process (diegetic prototypes) to identify the arcs, gradually moving leftwards, to the beginning (research findings); connecting the props that belong to the same arc. Each arc has a distinctive color given to the props that belong to it, and props that belong to multiple arcs are presented in dark gray. Team 1's progression map which has a single arc progression completed can be seen in Figure 6.12 as an example. This shows how a single arc's progression looks in

these maps. A scaled down thumbnail of all five arc progression maps with all arc progressions completed, can be seen in Figure 6.13 as reference. Full versions of all maps can be found in Appendix E.

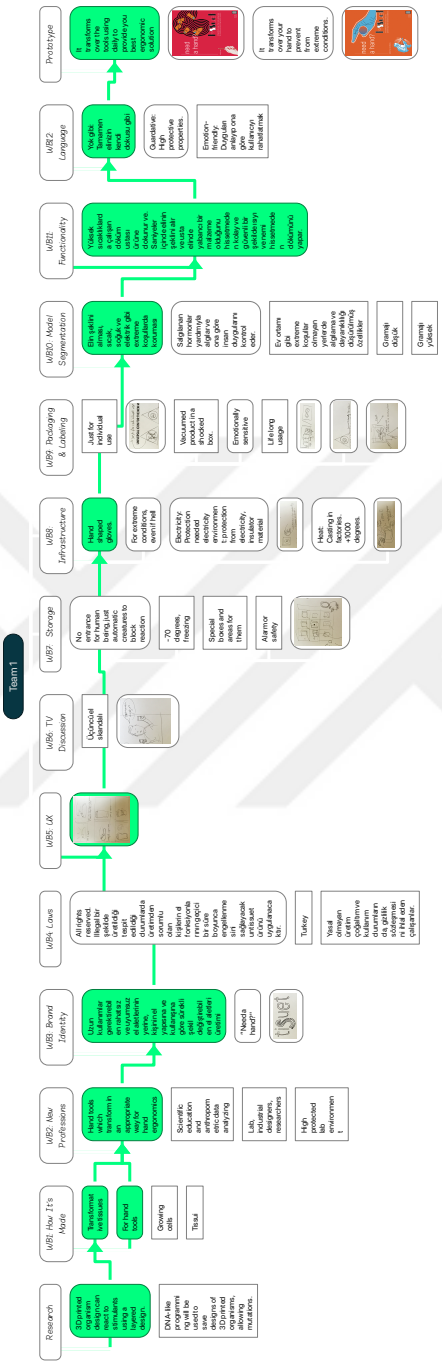


Figure 6.12: Team 1's early arc progression map showing one progression.

The arc progression maps reveal different approaches in maintaining or creating new arcs throughout the world building process. In the following paragraphs, I present my

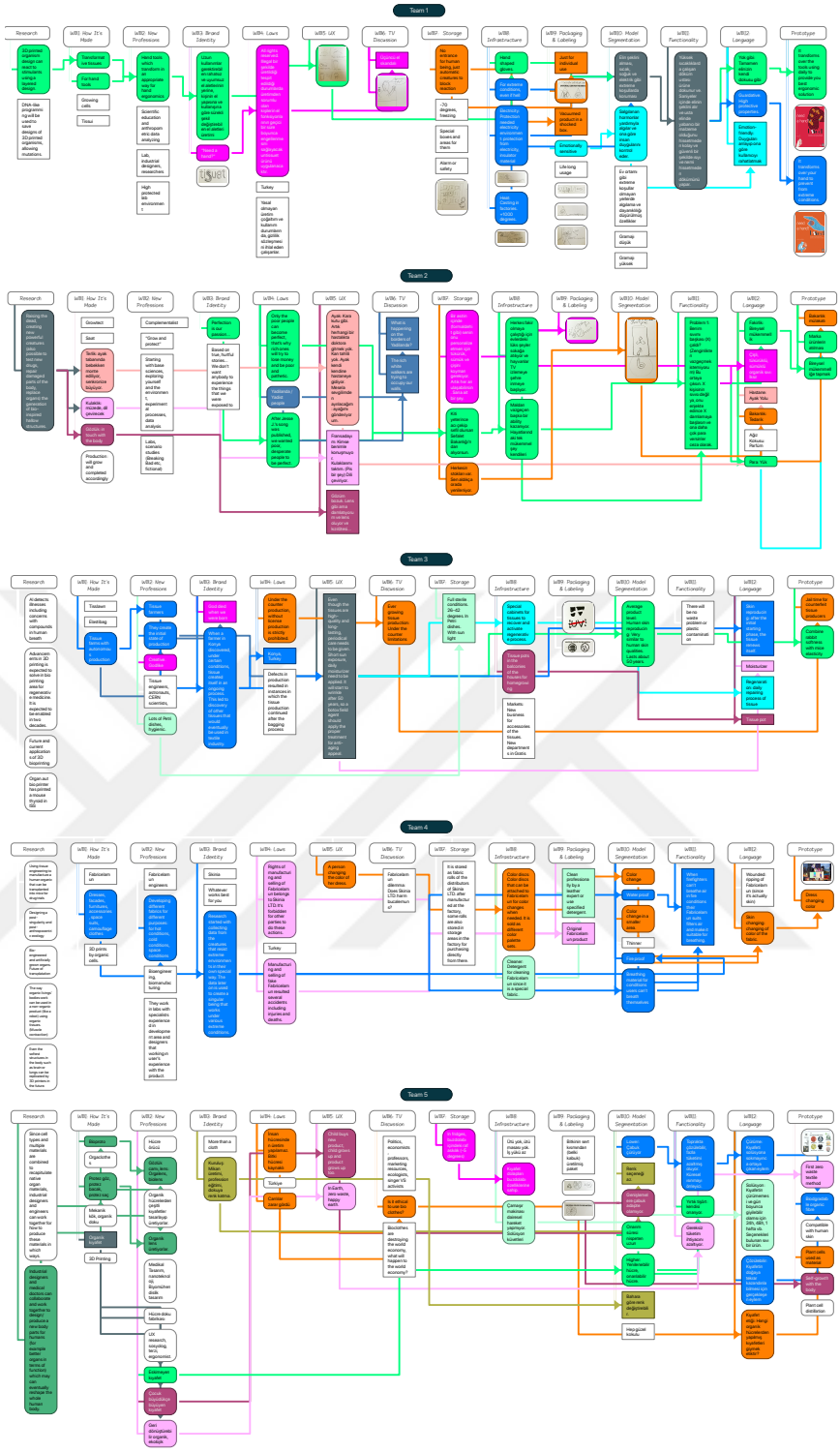


Figure 6.13: Thumbnail of all arc progression maps from workshop 2, full version can be seen in Appendix E.

observations on these approaches with examples from each team's work.

6.3.1 Team 1's Arc Progression

Team 1 focused on one resilient arc, that started from their research findings and was carried out through the entire process to the diegetic prototyping step. This arc was that organic tissue can transform its shape when touched so that it fits the particular grip of the touching hand. On the research finding sheet that this arc was based on, the participants found 3D printed organism designs that can react to stimulant using a layered design. On the first world building exercise that follows the research phase, they define the organic material as "transformative tissue" and state that it's used for "hand tools". This arc was carried out throughout the process unchanged (See Figure 6.14).

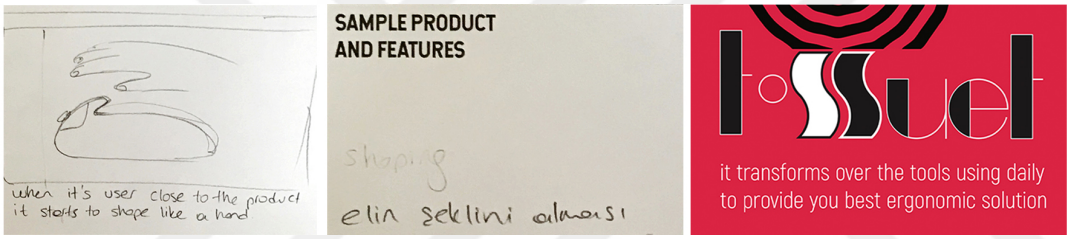


Figure 6.14: Excerpts from world building exercises on Team 1's most resilient arc.

In addition to this one resilient arc, Team 1 generated multiple arcs which were less resilient: they emerged in certain world building exercises, but disappeared in the world building process before they reached the end. In exercise 3, the team generated the brand motto of the company which produced their organic material as "Need a hand?". In the very next exercise, they created a law text as follows:

> "All rights reserved. In situations where illegal production is detected, *untissuet* will be applied to people responsible for said production, temporarily stopping their hand functions." [13]

This prop implies that Tissuet is not just a hand tool but can act as a hand and hence, disabling its functionality would disable the hand functions of its wearer. In exercise 6, the team presents a TV discussion on the religious viability of third hands (See

Figure 6.15, the man on the left: "Not appropriate", the man on the right: "Totally appropriate", the title says: "3. Hand Scandal").

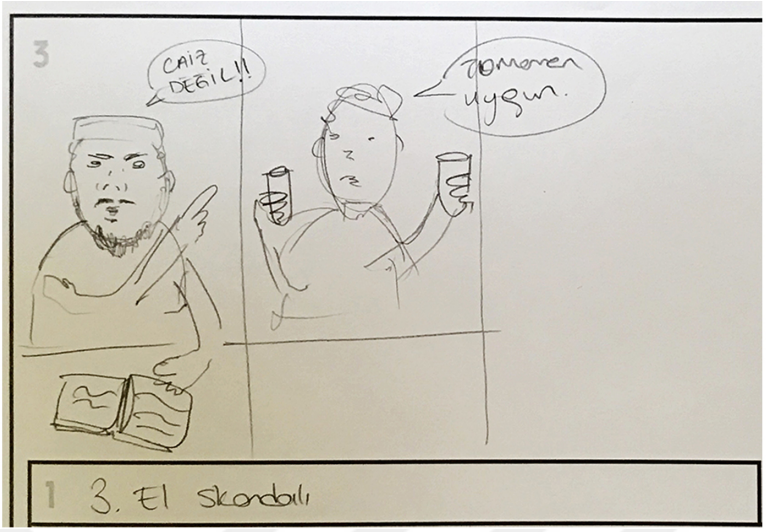


Figure 6.15: Excerpt from exercise 6 by Team 1.

This exercise solidifies the material's use as a complete additional hand, by giving it a name and visualizing it attached to a person. However, this arc about the third hand does not come up again in the process, including the diegetic prototype. There are two other arcs that has a similar type of low resilience. In exercise 7, the team refers to an unwanted reaction between people and the material, stating that no humans enter the area of production to avoid it. Later in exercise 9, they enhance this arc by creating a warning label about the material being "for individual use only", referring to a personal binding of the material upon touching it. This arc however does not come up again later. Likewise, in exercise 9, the team creates a label for the material about being "emotionally sensitive". In the next exercise, they state:

> "Detects [emotions] via the hormones released and controls the person's emotions."[14]

This arc is revisited once more on exercise 12 but was not used as part of the diegetic prototypes. I argue that there is an internal assessment which makes some arcs more resilient than others. In the above examples, the material's ability to take the shape of a hand grip was a resilient arc and was carried out throughout the process. However, its ability to be used as a complete third hand attached to a person, or that it can

sense and manipulate the emotional state of its user remained temporary and less resilient. Since these are arguably more impactful properties of this fictional material, I conclude that their existence were later ignored because they were not deemed part of the fictional truth after assessment.

Team 1's arc progression map can be simplified as a schematic view as seen in Figure 6.16.

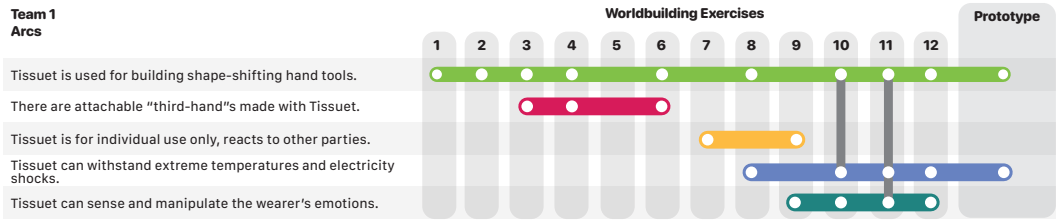


Figure 6.16: Arc progression scheme of Team 1.

6.3.2 Team 2's Arc Progression

Team 2 took a distinctive approach in the workshop, by focusing heavily on the aspect of implications of the technology, compared to a specific product made with that technology. Their research findings were In exercise 2, the team stated that their brand's motto is "perfection is our passion". Starting from this prop, they created their most resilient arc: society in this textual world want to be perfect, perfection can be attained through using Growtect, the fictional organic material, and the only way to receive Growtect is to be devoid of material riches. This arc emerged in exercise 3 and was heavily focused on throughout the world building process, ending with being used in the diegetic prototypes. In exercise 4, the arc is elaborated via a law text:

> "Only the poor people can become perfect, that's why rich ones will try to lose money and be poor and pathetic."

In exercise 7, they further enhance the arc by adding that the material is only distributed by the government, after proving to them that you are poor enough. Their diegetic prototype was a video, showing an interview between a Growtect applicant and a government official, in which the applicant threw away her shoes proving her desire to become poor.

Like Team 1, Team 2 had one major resilient arc that ran through most of their world building process. And also in a similar fashion, Team 2 had multiple less resilient arcs that they generated and later did not carry on. In the first exercise, they generated three different arcs on organs built with their new organic tissue: ears you can attach to translate languages in real-time, eye glasses that grow on your eyes after being applied as eye-drops, and health-tracking slippers that are "mounted" to babies after birth which grow with them. All these arcs are in response to their research finding: which they summarize as such:

> "Raising the dead, creating new powerful creatures (also possible to test new drugs, repair damaged parts of the body, replace organs) the generation of bio-inspired hallow structures."

As seen, Team 2's research finding focuses on enhancing humans as a whole, including giving them immortality. Therefore in the exercise 1, they imagined the aforementioned organs that become one with their users, enhancing their abilities. Their resilient arc emerged in the third exercise and took the world building focus over, while the team continued creating less resilient arcs in other exercises. Like Team 1, these less resilient arcs did not reach towards the diegetic prototypes. For example in exercise 7, they created a prop about a personalized "elixir", created from the individual's bodily fluids, as the source of each individual's own Growtect. This arc was revisited in two other exercises but was not referred to in the final diegetic prototype. Team 2's arc progression map can be simplified as a schematic view as seen in Figure 6.17.

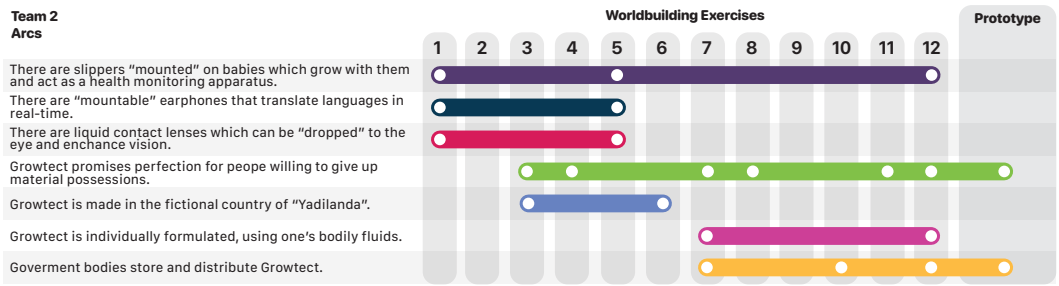


Figure 6.17: Arc progression scheme of Team 2.

Both Team 1 and Team 2 had singular resilient arcs which were maintained throughout the world building session, and less resilient arc which were temporary. Less

resilient arcs increased the width of the worlds around the more resilient arcs, but they did not remain in focus.

6.3.3 Team 3's Arc Progression

Team 3 started their world building process by generating a prop about tissue farms: their organic material was a harvested using a tissue growing process. While this arc remained resilient for most of the world building process, a number of other arcs emerged. Unlike the previous teams, these arcs were not temporary: they remained resilient throughout the process.

For example, the team generated a arc about unlicensed production of tissues in exercise 4. This particular exercise about future law text produced similar props in the work of other teams: unlicensed production. However Team 3 kept using their prop, forming a arc: they widened their textual world by introducing "tissue pots" in exercise 8, a home-growing solution for personal tissue production. The new arc therefore stayed resilient throughout the process, including being used in the final diegetic prototype.

Similarly, another arc was generated in exercise 5 about how the material has properties similar to human skin, such as "starting to wrinkle in about 50 years". This arc was generated in the middle of the world building process but continued to be resilient: it was revisited in exercise 10, and was used in the final diegetic prototype as a much more enhanced version. In the prototype: the team presented an advertorial in which we witness versions of the material, which "combine[s] rabbit softness with mice elasticity". This was built on top of the props about the material showing properties of human skin.

Team 3's approach is different from the first two teams in terms of resilience. Team 1 and 2 had singular resilient arcs throughout the process with other less resilient arcs temporarily widening up their worlds. Team 3 on the other hand, had their strong initial arc lose focus over time, while the new arcs emerging from later exercises staying resilient over the process. Hence, they ended up with a different arc represented in their diegetic prototype than the initial arc they started up with. Team 3's

arc progression map can be simplified as a schematic view as seen in Figure 6.18.

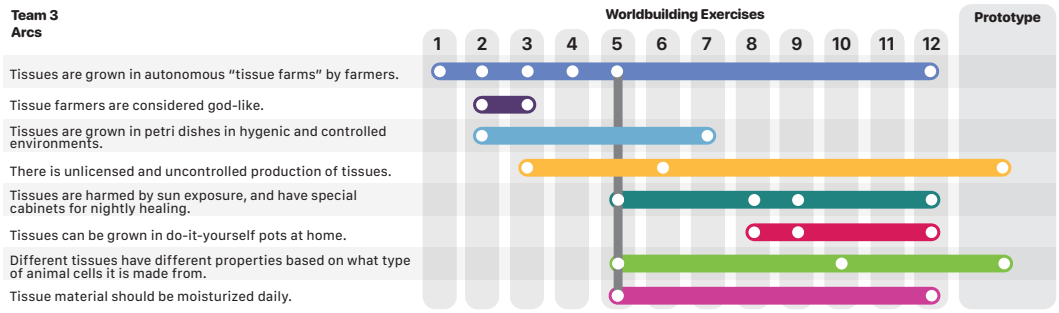


Figure 6.18: Arc progression scheme of Team 3.

6.3.4 Team 4’s Arc Progression

Team 4 generated the smallest number of arcs compared to the other teams in the workshop. Their initial arc was about a functional fabric made out of organic tissues. In the first exercise, they stated that the fabric was used in "dresses, furniture, accessories, space suits, and camouflage clothes". In the next exercise, they enhanced the arc by emphasizing the fabric’s functionality as helping users in extreme environments. Gradually developing this arc, they generated another prop in the next exercise that explains how this material was developed by research on animals that withstand different conditions and how a new "creature" was bred which could withstand all of these conditions, as a source for the new material.

In exercise 5, the team generated their second and last significant arc: the fabric can change color by its wearer’s choice. While the team did not abandon their first arc (on how the fabric can withstand extreme conditions), they gradually focused more on the color changing aspect. In their final diegetic prototype, the team presented a short animated billboard, showing a dress made of their material, changing color.

Team 4’s approach is similar to Team 3, in the sense that they start with one resilient arc, and gradually lose focus on it to focus on another resilient arc. Team 4 started with the arc about an organic textile that allows people to breathe in space. Then, over the course of their world building activity, they shifted their focus to the color changing aspect of this material. While they produced other arcs during the process, they

were not resilient enough to be carried on through the end. Team 4's arc progression map can be simplified as a schematic view as seen in Figure 6.19.

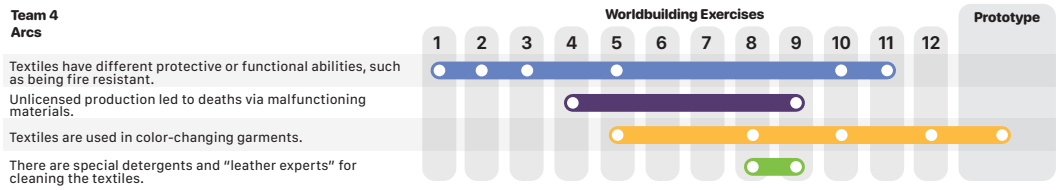


Figure 6.19: Arc progression scheme of Team 4.

6.3.5 Team 5's Arc Progression

Team 5 started the world building process with two arcs: organic clothes that grows with the child and prosthetic organs for enhancing people. After the second exercise, the prosthetics arc was abandoned and the team continued on with the organic clothes arc.

Team 5 kept their organic clothes arc resilient throughout the process and added several other arcs in the exercises. They established that their organic textile is made form cells and that there are ethical issues regarding what kind of cells being used:

> "Clothing ethics: Which clothes are more ethical to wear, based on the kind of organic cells they are built with?" [15]

They generated a arc regarding a liquid solution that keeps these organic clothes from decaying and that this solution has different strengths:

> "The solution is a liquid product that keeps the garment from decaying and be wearable for the day. It has different kinds: 24 hours, 48 hours, 1 week etc."[16]

The team also generated a arc on the impact of these clothes on decreasing waste and pollution, including a separate discussion on how this affects the global economy since people are buying much less clothes.

What sets Team 5 apart from the other teams is that most of these arcs which they generated in addition to their initial arc, remained resilient. Their final diegetic pro-

totype showcased the most number of arcs compared to other teams. Therefore, the arcs which they generated during the world building process were not temporary and they accompanied the initial arc. Team 4's arc progression map can be simplified as a schematic view as seen in Figure 6.20.

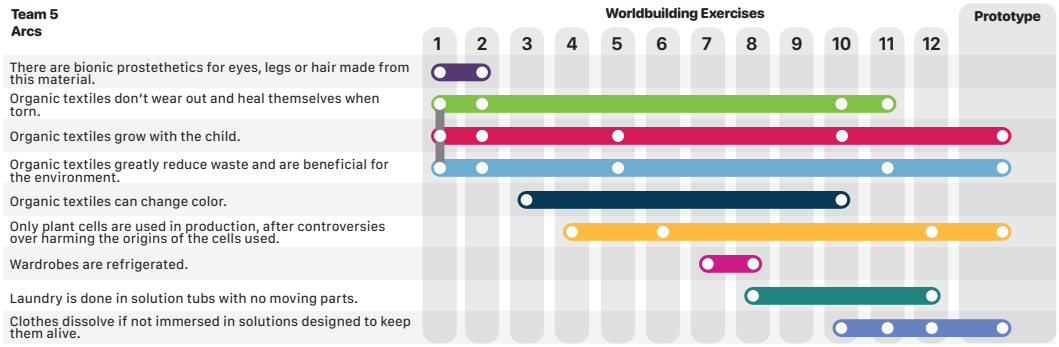


Figure 6.20: Arc progression scheme of Team 5.

6.3.6 Approaches in Transformation

As seen in this section, teams had different approaches in world building, regarding how they generated and kept their arcs throughout the process. I identify two patterns to explain how world building in my study worked.

First, all teams had a primary arc, with the exception of Team 5 which had two. These arcs are established in the first or the second exercise, meaning that it was at least partially imagined by the participants before the world building exercises started. Team 1 and 5 sustained their primary arcs from start to end. Team 2 and 3 also sustained their primary arc until the last world building exercise but did not use them in their diegetic prototypes. Team 4's primary arc disappeared more prematurely compared to the other teams. Therefore I deduce that participants relied on resilient primary arcs to establish their world building activities.

Second, teams generated emergent arcs. These arcs emerge later in various world building exercises throughout the process and add wider implications or details to the textual world. There are two types of emergent arcs observed in in the workshop. First are the *temporary emergent arcs* which stay active for a brief number of exercises and than disappear. Second are the *permanent emergent arcs*, which stay resilient through

the whole world building process and end up in the diegetic prototypes. All teams used temporary and permanent emergent arcs.

To better present these different types of arcs, I visualized the arc progressions together, showing the different approaches described. The visualization can be seen in Figure 6.21. Blue lines in the center every team's map represents primary arcs, turquoise lines represent permanent emergent arcs, and pink waves represent the temporary emergent arcs. In the next section, I will discuss the implications of this analysis for my research questions, by comparing them to peer evaluation results and the concepts I defined in the previous workshop.

6.4 Discussion

In this section, I discuss my analysis and present insights about my research questions, as well as an update on my world building model using these insights. The section is organized in two subsections: (1) the insights regarding the world building model and (2), insights regarding reflections and updates on the WBD toolset.

6.4.1 Insights on the World Building Model

To generate insights and update my world building model, I present a discussion of prop properties (metaphorical and causal; described or prototyped) derived in the previous study (see Section 5.3 on p. 99) and their implications on the different types of arc progressions. These insights will contribute to the world building model, by defining how world building occurs depending on the types of props used.

6.4.1.1 Prototyped and Described Props

During the analysis, I observed that prototyped props often generated new emergent arcs. As a reminder, prototyped props refer to props which are true to the medium of the source world building exercise used.

One example is the world building exercise, which asks about the brand identity of

the new material's maker. One of the questions asked for the slogan of the brand and participants generated prototyped props. Team 1's slogan reads: "Need a hand?", referring to the highly ergonomic hand-tools build by their fictional company. This prop however quickly generated a temporary emergent arc about the material being used as complete hands. In the next world building exercise, the team created a descriptive prop about "disabling" the hands of people who built unlicensed products, hence elaborating the new arc about the material being used to build new hands. The arc is finalized in the sixth world building exercise in which they describe the idea downright as a "third hand". A drawing then depicts a person in the TV studio, with a third hand attached. The arc is not used again in the world building process. The relevant excerpt from the team's arc progression map is shown in Figure 6.22.

Other examples include Team 1's prototyped prop about the packaging of the product, for which they drew a warning symbol titled "Emotionally sensitive" (See Figure 6.23). This generated a new arc on the material being able to sense and manipulate the emotional state of its users.

Team 2 also branched of an emergent arc out of the brand identity world building exercise. The slogan they used, "Perfection is our passion" is the earliest prop on their arc about the material being used to enhance people. Team 3's graphic explanation of their material's user experience is the source of multiple emergent arcs:

> "Even though the tissues are high-quality and long-lasting, periodical care needs to be given. Short sun exposure, daily moisturizer need to be applied. It will start to wrinkle after 50 years, so a botox field agent should apply the proper treatment for anti-aging appeal."

For the same world building exercise, Team 4 sketched a person wearing a color changing dress, which became their permanent emergent arc. Team 5 generates "solution tubs" in a world building exercise on the new infrastructure. This created an emergent arc on how the garments made from the team's organic textiles would be kept from dissolving, using solutions of different strengths.

While prototyped props generate the emergent arcs, descriptive props sustain them. In the above examples, each emergent arc generated by a prototyped prop is sustained in further world building exercises by a descriptive prop.

Unlike a conventional design process during which the designers create descriptions (requirements, briefs, etc.) first and then prototype them through sketches, mock ups and models; rapid world building activity creates new arcs through a opposite process. Participants create holistic, finished props first, and then proceed to elaborate them through descriptions and annotations. These elaborations position the arcs in their textual worlds, explaining how they work or how they interact with other arcs.

For example Team 5's solution tubs establish a mechanic on how biodegradable fabrics from organic tissue are part of the team's textual world. This is an emergent arc. In further exercises, they describe how the solutions work. This establishes the arc in the textual world, making it more resilient. As long as these explanations are made, the arcs remain resilient. A schematic view of this discussion is presented in Figure .

6.4.1.2 Metaphorically and Causally Generated Props

Up until now I discussed how descriptive and prototyped props affected world building approaches. Now I will discuss the remaining two prop properties and their effects on world building from the previous study: metaphorical and causal props. To remind, metaphorical props carry properties from the actual world of the participants to the textual worlds they create, through metaphors. Causal props are created by generating cause and effect relationships within the textual world.

I observe that metaphorical props are heavily used in the beginning (speculation) and at the end (assessment) of the world building activity. Between these points however, world building is carried out by generating causal props.

The increase in causal props during the middle phases can also be attributed to the way the toolset is designed. For example Team 4, generated a metaphorical prop in the second world building exercise about how their organic textile can be used in different products, with different properties:

> "Developing different fabrics for different purposes: for hot conditions, cold conditions, space conditions"

In the next exercise when they were asked about the history of the company, they

imagined that these properties are derived from different "creatures'" skin. Furthermore, they imagine that the company, at one point in their history, developed a new creature with combined properties, so that its skin would be better suited to multiple environments.

> "Research started with collecting data from the creatures that resist extreme environments in their own special way. The data later on is used to create a singular being that works under various extreme conditions."

Later in the process, the team stated that one such property would enable firefighters to breathe in fires, when wearing these textiles. The final prop in this arc describes this textile in a practical setting.

> "When firefighters can't breathe air in fire conditions their Fabricelamun suits filters air and make it suitable for breathing."

I describe this transformation as follows: a speculation begins with a metaphorical prop. Team 4 imagined a new type of textile from organic material, and much like how a type of textile in the actual world would have different use cases, they established that their material has multiple use cases. Once this metaphorical prop was established, they continued world building by imagining what implications this metaphorical prop has in their textual world. If an organic material has different use cases, then it should carry different properties. If it carries different properties, then it should be made from different source organisms. If it is made from a source organism, then there could be a custom-bred source organism in this textual world which carries multiple desired properties for this textile. These speculations therefore are made via causal props. When the team attempted to assess this arc (i.e. justify its point in the textual world by defining a practical outcome), they imagined a suit that helps firefighters breathe. I define this as a metaphorical prop: firefighters use technical suits, and the imaginary textile can have different properties. Therefore it can also be used as a firefighter suit.

This transformation defines a process in which participants start their arcs with metaphorical props: they define likenesses between the actual world and their textual world. Then they develop props for their textual world using causal relationships. Finally,

they end their arcs using metaphorical props once again, to establish the implications of their world building activity in the actual world.

To summarize this subsection, I present an updated model for world building in the FFED (See Figure). The discussion points represented in the model are as follows:

1. New arcs emerge by prototyped props, but they remain resilient through descriptive props. Some of these arcs remained throughout the world building process while some ended up disappearing.
2. New arcs use metaphorical props in the beginning to establish a connection with the actual world, and at the end for justifying their existence. Causal props are used in the middle of the progression to elaborate the arcs.

This section concludes my deductions from this workshop about the world building model. In the next section, I present my deductions about the WBD toolset and how it would be iterated for the next study.

6.4.2 Insights on the WBD Toolset

In this section, I present my discussion on the shortcomings and future improvements on the WBD toolset. I will first discuss the results of the peer evaluation phase, followed by the workshop evaluation questionnaires.

6.4.2.1 Peer Evaluation

After each team's presentation in the workshop, the remaining teams were given a peer evaluation sheet to fill out. This sheet included questions with a Likert scale to measure the believability of the textual world created by the presenting team. The results of this peer evaluation questionnaire are presented in Table 6.3.

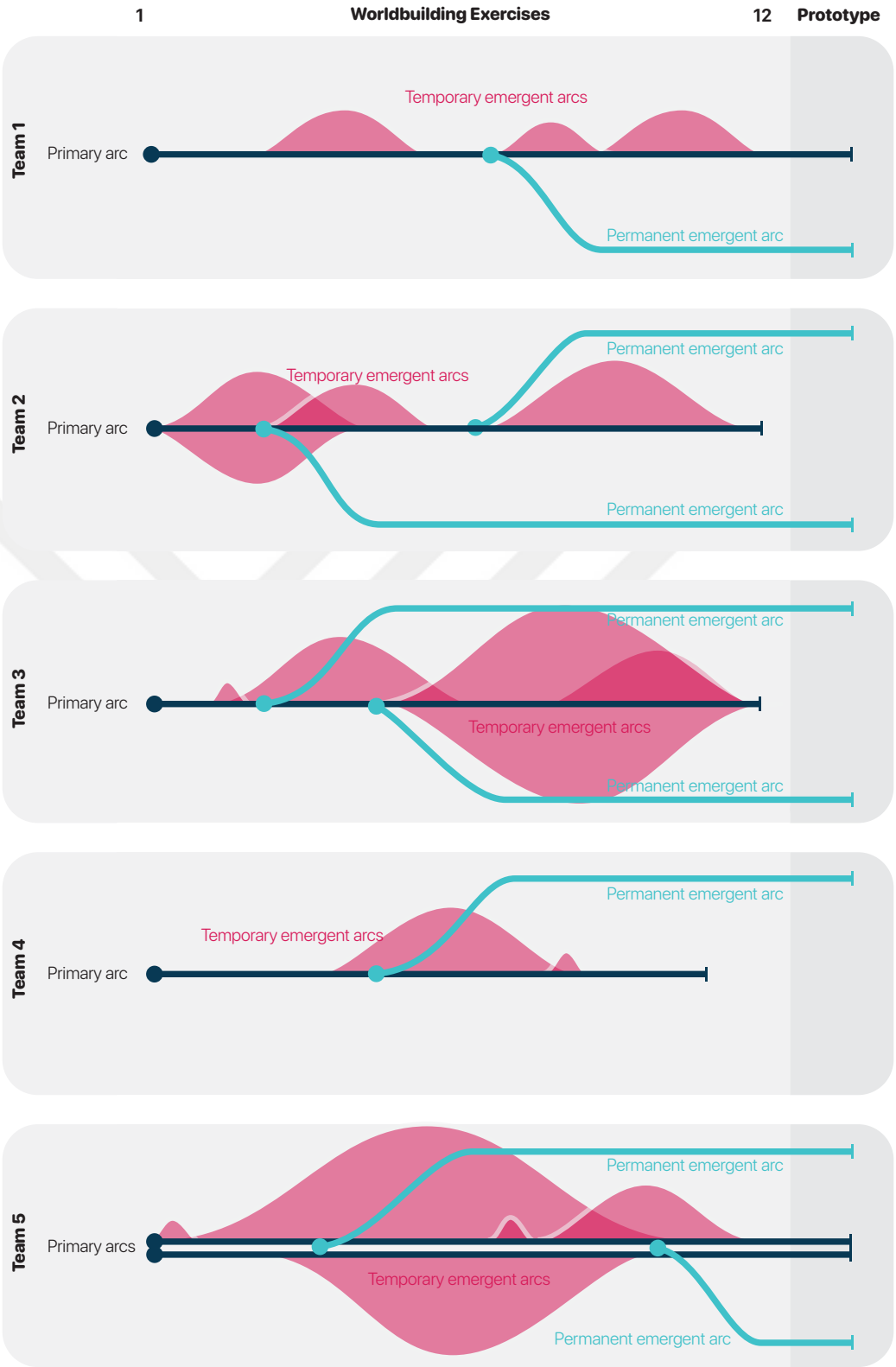


Figure 6.21: Comparison of world building approaches by types of arc progression.

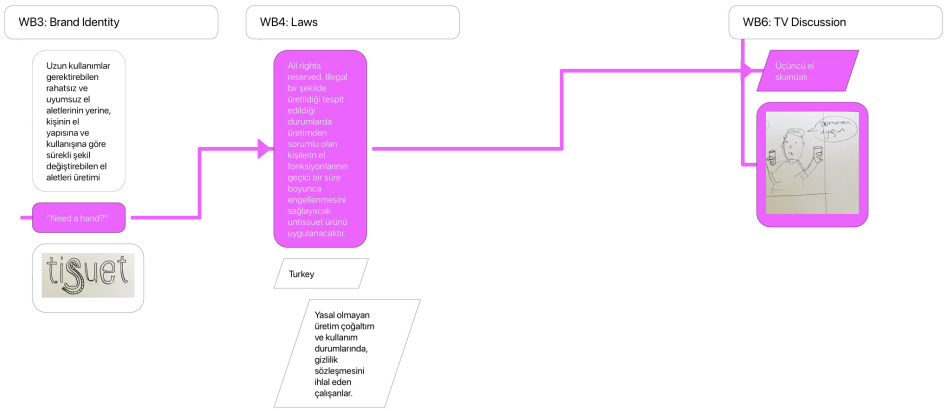


Figure 6.22: Prototyped props and their emergent arc.



Figure 6.23: Prototyped prop of Team 1 on emotional sensitivity.

Table 6.3: Peer evaluation results.

Evaluating Team	**Team 1**				**Team 2**				**Team 3**				**Team 4**				**Team 5**			
Evaluated Teams	**2**	**3**	**4**	**5**	**1**	**3**	**4**	**5**	**1**	**2**	**4**	**5**	**1**	**2**	**3**	**5**	**1**	**2**	**3**	**4**
This finding is convincing and trustworthy	5	5	3	4	2	2	2	5	5	3	2	4	4	3	4	5	4	3	5	4
This finding is generalizable	5	5	3	5	2	2	2	4	4	4	2	4	3	3	3	3	3	5	5	4
This finding could have been confirmed by other sources	5	4	4	5	1	1	1	4	4	4	2	4	4	2	4	5	5	4	4	4
This finding is relevant to the topic	5	3	4	5	5	5	5	5	5	4	3	5	4	2	4	5	5	5	5	5
This finding is insightful	5	5	2	5	4	3	3	5	5	3	3	4	5	3	2	4	5	4	4	4
Average	**5**	**4.4**	**3.2**	**4.8**	**2.8**	**2.6**	**2.6**	**4.6**	**4.6**	**3.6**	**2.4**	**4.2**	**4**	**2.6**	**3.4**	**4.4**	**4.4**	**4.2**	**4.6**	**4.2**

Table 6.4: Comparison of peer evaluation averages and number of arcs in diegetic prototypes.

	Team 1	**Team 2**	**Team 3**	**Team 4**	**Team 5**
Peer Evaluation Average	3.9	3.9	3.8	3.4	4.6
Number of Arcs Used in Diegetic Prototype	2	2	2	1	4

The results of the peer evaluation process reveals that there is a positive correlation (r = 0.989) between how believable the teams were found and the number of arcs they sustained throughout the world building process (see Table 6.4). Team 5 which used the most number of arcs in their world building process got the highest marks from their peers in terms of believability, while Team 4 which used the least number of arcs got the lowest marks. Therefore, I argue that sustaining more arcs during the world building process increases how believable the resulting textual world is.

6.4.2.2 Feedback Survey

I conducted a separate survey with the participants for evaluating the workshop itself. The questions were categorized based on the three phases of the workshop (research, world building exercises and diegetic prototyping) and aimed to identify gaps in how the toolset performed in terms of usability. The questions, as well as the average points they received can be seen in Table 6.5.

From the results, I deduct that:

1. Timed exercises were disrupting to the participants. Most participants tended to agree that the timing of world building exercises were stressful and that they would have done a better job with the diegetic prototype if they had more time. This resulted in a different application methodology for the next study, in which I did not time every world building exercise separately.

2. Team work was regarded as a positive aspect. Participants mostly disagreed that they would perform better alone in the world building phase. This assured me to continue with team-based application of the toolset, without creating modules for individuals.

3. Participants were generally content with the workshop, in terms of how novel it was and how much it inspired their creativity and insight generation.

4. Evaluations regarding the diegetic prototyping phase had cautionary results. Participants somewhat agreed to the statement that diegetic prototyping did not add anything useful on top of the world building exercises. They also mostly

Table 6.5: Workshop Evaluation.

Statement	Team 1	Team 2	Team 3	Team 4	Team 5	**Average:**	**Variance:**
Research							
Finding sheets were useful to me	5	4.5	4	4.5	4.5	4.42	0.202
I had a hard time separating informational and inspirational findings	1.5	2	3	3.5	4	3.00	1.125
I had a hard time summarizing findings	1.5	2	2	3	3	2.42	0.660
Describing the source in my own worlds helped me think about its credibility	4.5	3.5	4.5	3	4.5	3.92	0.577
Evaluating each finding was insightful	4.5	5	4.5	4	3.5	4.27	0.401
I use similar methods when I do research on my own	3.5	2.5	2.5	3	3	2.81	0.356
I can incorporate some of these methods in my future design work	4.5	4.5	4.5	4	4.5	4.38	0.340
world building Exercises							
Exercises were insightful	5	4	5	4.5	4.5	4.54	0.228
Exercises increased my creativity	4.5	5	5	4.5	5	4.85	0.099
Exercises became easier to do towards the end	3.5	5	5	4	5	4.65	0.474
Timing of the exercises made me stressed out	3	2	3.5	4	3.5	3.23	0.817
I would have done a better job if I was alone	1.5	1	2	2	2	1.73	0.359
Exercises felt relevant to the design topic	5	4.5	5	4	3.5	4.25	0.432
I had a hard time writing coherent and high quality text	3.5	3	4	4.5	3.5	3.73	0.401
Exercises helped me imagine a coherent future world	4.5	5	5	3.5	4.5	4.50	0.458
I would do similar exercises in my future ideation work	4.5	3.5	5	4	4	4.15	0.349
Diegetic Prototyping							
I can see the purpose of diegetic prototyping	5	4.5	4.5	4	4	4.31	0.189
I felt overwhelmed by diegetic prototyping	2	2	2	2	3.5	2.35	0.474
I would have done a better job with more time	4	3.5	5	4.5	4	4.23	0.901
I had a hard time with group work in diegetic prototyping	2	1.5	1.5	2	2	1.77	0.151
I would have done a better job with better production skills	3	5	3.5	3	3	3.58	1.077
I used information from the previous phase in diegetic prototyping	4	4.5	3.5	2.5	4	3.65	0.683
Prototyping did not add anything useful on top of the previous phase	1.5	2.5	1.5	2.5	2.5	2.19	0.731
We generated new insights about the topic as we worked on the prototype	4.5	4.5	4.5	3.5	3.5	4.04	0.769
I felt creative and insightful during the prototyping phase	5	4.5	5	3.5	4.5	4.42	0.452

agreed that production skills were an important factor in diegetic prototyping. Combined with the timing issue mentioned in the first item of this list, this resulted in me rethinking the last stage of the workshop, and removing the prototyping aspect.

Apart from the points, four participants utilized the optional feedback section with free text. Two participants entered positive comments about how they could use the toolset in their own design processes. One of those participants singled out the world building phase as the most useful. Two other participants entered negative feedback about the process. One participant wished there would be presentations and/or discussions between the world building phase and the diegetic prototyping phase, stating that they could not reflect on their world building results. The other participant complained that the insights developed at the very end could be more about product design, stating that they would be more content if the end results were more concrete.

I use these feedback from the participants to identify gaps in the usability of the tool, and my own world building model to see how the toolset can provide more believable textual worlds. In the next section, I present these gaps and my solutions.

6.4.2.3 Iterating the WBD Toolset

In this section, I present the issues I identified with the WBD toolset and how I iterated the toolset's design to mitigate them.

First, I want to increase the resiliency, and therefore the number of arcs used throughout the process. The peer evaluation revealed that the more arcs used throughout world building, the more believable it was perceived to be.

Up until now, the design of the toolset focused on observing a linear process so that (1) it was rapid in application, and (2) world building exercises built on top of each other. In this particular study, I utilized this style of application to see which arcs were developed and which arcs disappeared in the linear process.

However, the results indicate that unlike my assumptions, the number of arcs carried out throughout the world building process was limited. Based on the overall analysis,

I consider the following reasons: (1) the particular sequence and timing of the world building exercises hindered the resiliency of arcs, and (2) diegetic prototyping phase was disconnected to the rest of the process.

Sequence of World Building Exercises

The sequential application of the world building exercises and the strict timing of each exercise reduced collaboration within the team. During the application, I observed that in the beginning of each exercise, a very short discussion between the team members commenced. Shortly after the discussion, one member took the exercise sheet and filled it in, with rare interventions form the other peer. This behavior only got worse as the exercises proceed, as the participants had issues with timing and wanted to cut the discussions shorter to have more time filling out the exercises.

Furthermore, the sequential application which mandated every exercise to be filled before moving on to the next one had created issues for the resiliency of the arcs. The world building exercise about writing a law for the new technology is a clear example. Using my insights from the previous workshop, this exercise was supposed to generate prototyped props for the teams to build on. However, most teams wrote similar arcs in this exercise, about unlicensed production of their organic material. I consider that this exercise was provided too early in the process, and combined with the time limit, most it steered the teams into the same direction, instead of inspiring more divergent arcs. Another world building exercise on packaging and labeling, which is created with the same goal in mind but was given later in the sequence generated more diverse arcs. On the one hand, I observed that prototyped props generate emergent arcs and should be encouraged early in the world building (see Section 6.4.1.1). On the other hand, prototyping too early has shown that the emerging arcs were too similar, which I argue that they were not specific enough for the particular textual worlds they were created for.

Based on these observations, I conclude that the sequential application has critical limitations. The next iteration of the toolset should encourage prototyping, but in the participant's own pace. Giving more choices in which order they would complete the world building exercises and how much time they would allocate to each one would be beneficial for the resiliency of arcs, and therefore the believability of the textual

worlds they create.

Diegetic Prototyping Phase

Diegetic prototyping phase was used in both this and the previous study, as a means of concluding the world building phase. In this study, it was also useful to show which arcs were used in this final phase, and therefore were primary arcs. However both my personal observations as the workshop conductor and the participant feedback shows that time and production skill limits played a role on the scope of these prototypes. There was also participant feedback about how the lack of presentations or discussions before this phase decreased the amount of reflection they did over their textual worlds.

Based on these observations, I conclude that the diegetic prototyping phase should be replaced by a concluding phase that does not require similar production skills or time, and provides a discursive space for the teams to reflect on their world building activity.

These two topics cover the gaps I identified with the WBD toolset in this workshop. These gaps are worked on in the next workshop and the process is described in Section 7.1.

In the next section, I provide a summary of this workshop as well as the answers to the research sub-questions identified in Section 6.1.

6.5 Concluding Remarks

In this chapter, I presented the design, application, results, analysis and reflections on the second workshop of the study. Conclusions of this chapter is presented by answering the questions asked in the beginning of the chapter:

> Question 1.C: What are the different approaches in the world building process for sustaining certain narratives?
> Question 1.D: How do the properties of speculations affect the resiliency of narratives design students generate during world building??

Question 2.B: How do different approaches used by design students to progress their generated worlds, affect the perception of these worlds?

For question 1.C, I generated arc progression maps that lay out how teams created and sustained arcs during world building. Through these maps, I identified primary arcs, which establish a backbone of the textual world, and emergent arcs which broaden the textual world. I further identified permanent and temporary emergent arcs.

For question 1.D, I identified that participants find textual worlds with a higher number of sustained arcs more believable.

For question 2.B, I identified two relationships. First, prototyped props more often generate emergent arcs while described props sustain them through the world building process. Second, metaphorical props are used to connect fictional arcs to the actual world in the beginning and at the end of the arc generation process while causal props help develop the arc within the textual world. In the beginning, metaphorical props establish a resemblance to the actual world, causal props develop the arc by creating a narrative that runs within the textual world, and at the end, metaphorical props provide a justification of the arc by connecting it back to the actual world. An iterated version of my theoretical model on world building in design education in light of these discussions can be seen in Figure 6.24.

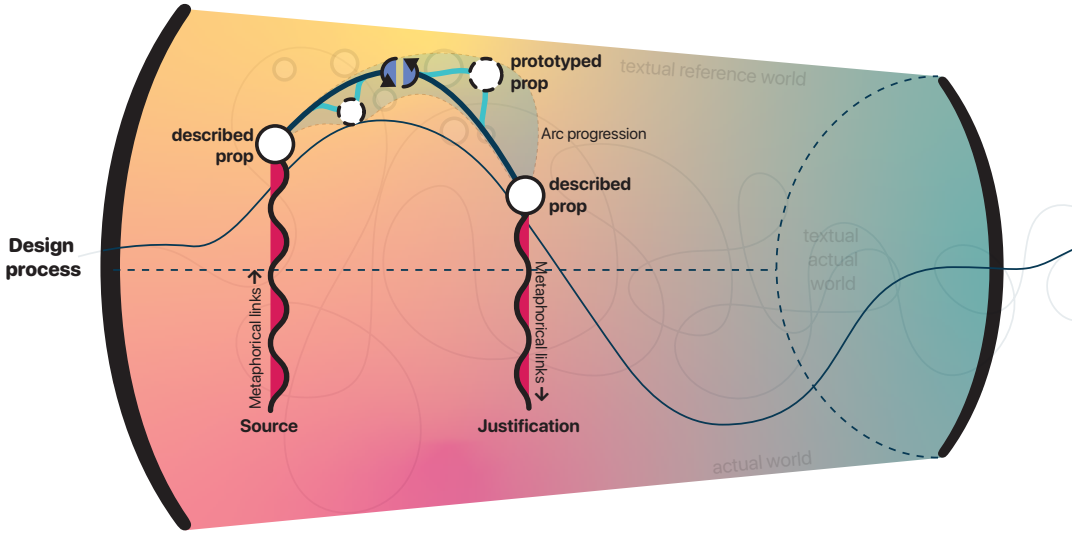


Figure 6.24: Iterated theoretical model after workshop 2.

I also present two gaps for improving the WBD toolset's usability. First, the sequential and timed run of the world building exercises should be changed in favor of a lesser structured process. This will improve collaboration within the team and avoid prototyping props too early in the process, resulting in more diverse arcs. Second, the diegetic prototyping phase should be replaced with another reflection process, to enable more discussion and sharing. The new process should also remove the perceived necessity for production skills to produce a prototype.

To summarize, this workshop enabled an understanding of world building as a process. I further examined the types and properties of this process, as well as the implications of the previous workshops on it. In the next workshop, I will utilize and observe world building in a real-world design education project to better understand and identify assessment and centering phases.

CHAPTER 7

UTILIZING WORLD BUILDING: WORKSHOP 3

The first two workshops of my study were conducted as self-hosted workshops. This allowed me to create a world building experience for my participants and control the process. While these workshops were useful in establishing my toolset and an initial model on understanding world building, they were limited in understanding how the toolset and the model would operate in a real-world design education project.

The third workshop of my study was conducted as part of a studio course, which allowed me to test my tool in a real-world educational context and investigate what kind of constraints should be included in my world building model. My scope of interest in this project was relatively wider and I inquired about the entire design project to understand how world building is utilized within. The scope can be seen over the theoretical model in Figure 7.1. Overall, this workshop focused on answering the following questions:

> Question 1.E: What are the pragmatic concerns of design students for world building, and how do they affect the speculations and assessment made by the design students?
>
> Question 2.C: How can pragmatic concerns of design students affect the world building processes,and how can the WBD toolset be finalized in light of these concerns?

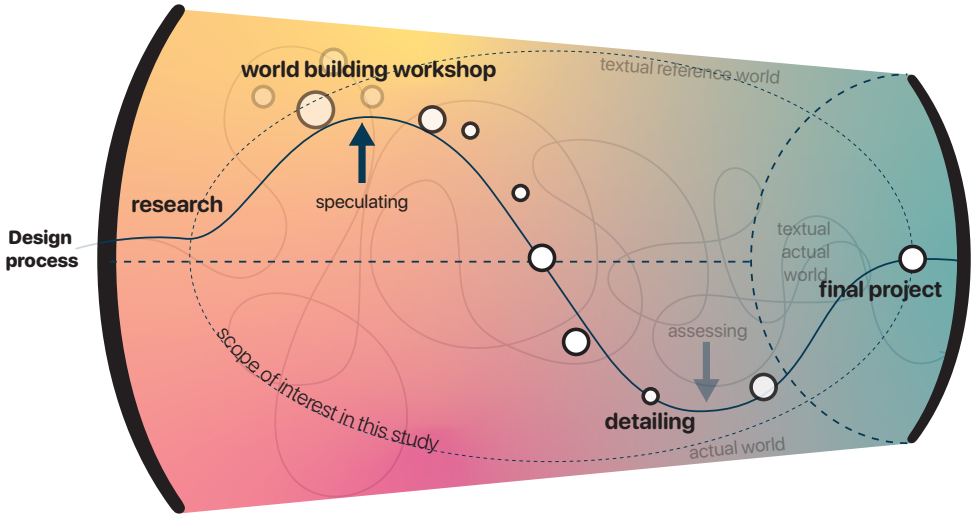


Figure 7.1: Workshop 3's scope of interest in the theoretical model.

The workshop and its implications for my study is further elaborated in the following sections. The preparations and application of the workshop components are discussed in Section 7.1, analysis of the project outcomes is discussed in Section 7.2, 7.3, and 7.4; insights and key knowledge generated from the workshop are discussed in Section 7.5 and finally, a brief summary of conclusions from the chapter is provided in Section 7.6.

7.1 Design

In this section, I will explain the context in which the workshop was utilized as well as the design of the workshop itself. The workshop was conducted as part of a fourth year design studio course in Middle East Technical University, in which students complete advanced industrial design projects, with emphasis on rigorous research, user centered design, feasibility, sustainability and collaboration.

During the fall semester of the 2019-20 academic year, the second project of ID 401 was decided to be a future envisioning one. Titled "Future of...", the project asked students to imagine the year 2040, and envision one of the six given activities: shopping, exercising, cooking, intercontinental traveling, music-listening, relaxing, designing,

and gaming. Students worked in teams of four to five, each team working on one of these activities.

The project description uses the term "future design vision" as one of the goals of the project and states that considering trends and future forecasting will be a vital part. The project brief, which is the first document distributed to the students before the project can be seen in Appendix F.

I was kindly invited by the studio tutors to conduct a workshop, as they were developing the project in the prior months, based on my research interest on futures and world building. I was given a rough estimation of the project's scope and I explained them the world building exercises done in my previous workshops.

In the following weeks, I prepared a blueprint plan for the workshop which is designed in light of what I learned from the previous workshop. After getting a green light from the studio tutors, I worked on the final version of the toolset to be used in the workshop. This workshop was also the first workshop not to be personally conducted by me. This allowed me to anticipate how a third party would conduct the workshop over a guide. I will present more details on the project, the workshop and its toolset, and the application of the workshop in the next subsections.

7.1.1 The "Future of..." Project

The "Future of.." project was intended to let students think about future trends and technologies, develop scenarios and present them in a convincing manner. The project was conducted in seven steps: trends research, activity projections, WBD workshop, initial ideas jury, individual design challenge, preliminary jury and the final jury.

In the first three steps, students were expected to conduct research and build worlds. The first step is titled "Trends research" and asked students to look into one of the seven given trends as a team. The given list of trends can be seen in Figure 7.2.

After the trends research, the second step was titled "activity projections". This was a shorter, in-class exercise during which the students were revealed that their 2040 activities will be focused to Istanbul. The following two tasks were to be done as

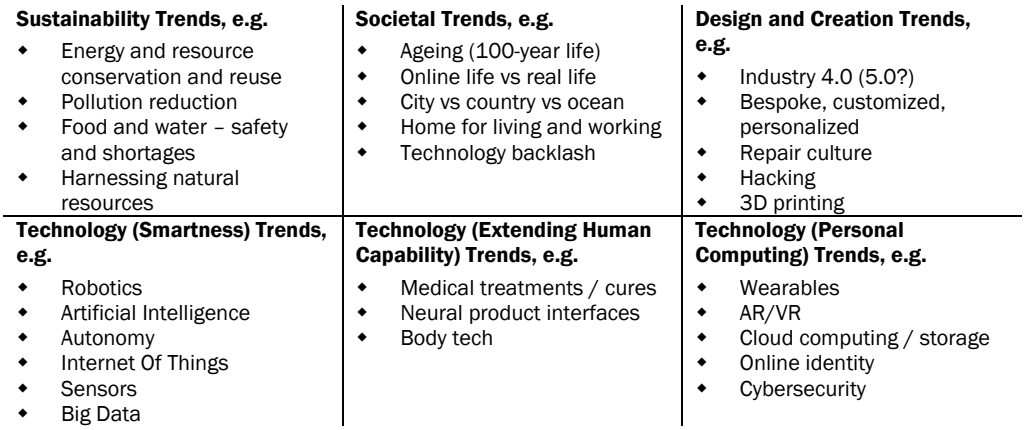


Figure 7.2: List of trends for the trends research.

a group: "(1) research the current state of your activity (e.g. what do people do about/for it, in 2019?), and (2) research forecasts and trends specific to your activity (how/why is it predicted to change?)". Later, students were asked to relate some of the trends identified in the trends research phase with the newly researched activities, answering the following questions: "(1) which of the sub-topics are relevant to your activity, and (2) how might they shape the activity in 2040".

The third step was my workshop. It was described in the class documents as the following: "you will rapidly create fictional artifacts of a potential future world based on your research, becoming comfortably engaged in them for developing your initial ideas". It was the final step of the FFED, after which the students were expected to start working on solutions and focus on the product design.

In the last four steps, students followed a conventional design studio process. Following the workshop, they conducted two juries and an individual design challenge, with scheduled critiques form the tutors in-between. The project was finished with an open final jury on December 26th, 2019. The whole project took about 2 months, kicking off on November 7th, 2019, the workshop being done in November 21st, 2019, and the final deliverable being asked on January 7th, 2020.

In the next subsection I will present how the workshop and the related toolset was iterated for this workshop, based on the insights generated from the previous workshop.

7.1.2 Workshop Design

In the last chapter, I concluded that the toolset should be iterated with the following considerations in mind (see Section 6.4.2.3, 146):

1. Timing of the exercises has utility for conducting rapid applications. However, participants were stressed and they stated that their performance was lower due to that. Moreover, timing constraints lowered the discussion among team members, as they rushed to finish the exercises in time, without discussing first (see p. 147).
2. The linear application of the world building exercises had limitations. The particular order did not consider the difference between descriptive and prototyped props. Asking for prototyped props too early in the process did not generate a wide range of results. (see p.147).
3. The reflection phase in which participants generated diegetic prototypes was not regarded as useful by the participants. Some especially mentioned a desire for more group discussion between teams about the worlds they created, and not just the prototypes (see p.148).

To manage these concerns, two main changes I did for this iteration were to change the world building phase, and to create a new reflection phase. In addition, the physical representation of world building was reconsidered, and a board layout was envisioned to put all the workshop output on. This allowed participants to view their and each other's world building processes as it happened, creating a more discursive space. A final consideration was to create a guide for the workshop conductor to follow, as I was not conducting this workshop myself. These four changes will be described in more detail in the following subsections.

7.1.2.1 Changing the World Building Phase

In the previous workshop, the world building phase included 12 exercises, each printed on a separate piece of paper. Each exercise had a main question and follow-up questions to combine descriptive and prototyped props (see Section 6.1.2.2). In this workshop, I grouped the world building exercises into two groups: descriptive exercises

and prototyping exercises.

Descriptive exercises ask relatively more open ended questions. They can be answered with brainstorming and annotations. There were four descriptive exercises in the workshop. The questions and sub-questions can be found in Table 7.1, and the exercise sheets themselves can be found in Appendix I (p. 297-300).

Table 7.1: Content of descriptive world building exercises used in Workshop 3.

No	Title	Description on sheet	Further inquiries on sheet
1	Imagine scenes from this world	After doing your research, how do you anticipate your designated activity in the future world? Now, imagine people who are involved with your activity: how is their day? Draw 3 scenes from their day using sketches and annotations.	
2	What is a product or service in this world?	Based on the scenes you just anticipated, what is a product or service in this future world that is a part of your designated activity? Use a simple sketch or a system map and annotate. Then, give it a name.	Draw the product or the system map. Name of the product or service.
3	What is a new profession in this world?	Some products and services enable new professions: for instance, an Uber driver. What new profession(s) does your new product or service enable in your future world?	Highlights from their education Who do they collaborate with? Where do they work? Name of the profession What do they do?
4	What is a typical misuse or alternative use of this product or service?	Products and services evolve during their lifetime, people use them in unpredictable ways. Imagine such a way that your product or service is used.	Description of the misuse or alternative use How has it started? Is it dangerous? How?

Descriptive exercises were applied like they were in the previous workshops: they were handed out one after the other, and participants were given 5 minutes to complete each. Prototyping exercises were given after these exercises were complete. Unlike the descriptive exercises, prototyping exercises were given altogether, and a total of 165 minutes were given for completing at least 7 of the 10 exercises. The questions and sub-questions of prototyping exercises can be found in Table 7.2, and the exercise sheets themselves can be found in Appendix I (p. 301-310).

In addition to these world building exercises, one empty exercise sheet was also given to the teams. This sheet was optional to fill, if the team had another idea for an exercise. This sheet can be seen in Appendix I (p. 311).

Table 7.2: Content of prototyped world building exercises used in Workshop 3.

No	Title	Description on sheet	Further inquiries on sheet
5	What is a screen cap of a TV discussion regarding this product or service?	What do the two opposing views about the product or service argue? Use speech bubbles to animate the scene. Write the subtitle and title of the discussion.	"A visual template for a discussion segment with an empty chyron"
6	How does the typical home change due to this product or service?	Draw a scene from a typical house of this world. What changed due to the new product or service?	
7	What is a new phrase people use, regarding this product or technology?	We create new words by transforming the meaning of existing phrases based on the usage of a product or service. For example, the word "cloud" is now used as a remote space that stores your data. Or "blocking" means banning someone from accessing your social presence. Think about a new one regarding your product or service.	"A visual template for an online dictionary page for the phrase" Word Current meaning New meaning(s)
8	What is the company behind this product or service?		Name and logo Slogan Brief history: Where was it founded? How did it grow? Competitors: Does it compete with a company we know?
9	What is the Wikipedia article of this product or service?	You may use the two articles given as examples.	"A visual template for an empty Wikipedia page shown on a smart phone, with two others showing the articles for Netflix (service) and Amazon Kindle (product)."
10	What are the most popular positive and negative reviews of this product or service?		"A visual template for an empty Amazon product page's customer reviews section, with the top positive and the top critical review titles."
11	What is the higher-end, and the lower-end versions of this product or service?	Start with the middle one, it is the default model. What is removed to make a cheaper model? What is added to make a more expensive one?	"A visual template for an empty offering comparisons page, adapted from Roku's comparison website."
12	How does design education change to adapt to this world?	Imagine a new course in our department.	"A visual template for an empty course page in the online course catalog of the institution" Code and name [of the course] Instructor Course content
13	What is a law or regulation about this product or service?		Law or regulation text After what event was it passed? Origin country
14	What are some of the global symbols regarding your product or service?	Some products or services generate their own symbols for warnings or general use. See examples below and generate your won symbols and their meanings.	Example symbols given: contactless payment, autonomous driving, no-drone zone, and vegan product.

The new world building exercises and their execution is designed after the conclusions of the previous workshops. In Chapter 5 I identified described and prototyped props as the two types of props in a world building process. In Chapter 6 I concluded that prototyped props are more suitable generating emergent themes in the world building process and should be encouraged for widening the textual reference world. In the same chapter, I also concluded that the sequential application of the exercises can hinder the development of prototyped props. This application attempts to solve it by applying exercises which support descriptive props first to establish the textual reference world, and then applying exercises which support prototyped props reflect on this world and generate more arcs.

7.1.2.2 Changing the Reflection Phase

In Chapter 6, I concluded that diegetic prototyping did not support a discursive space and it relied too much on the participant's skills. In this workshop, I prepared a new reflection phase, based on a variation of PEST analysis, a known method in strategic management literature for defining world overviews (Kim-Keung Ho, 2014). The variation I used had five dimensions (PEEST): (P)olitical, (E)nvironmental, (E)conomic, (S)ocietal, and (T)echnological. Political aspects include policy and legislation changes, environmental aspects include changes related to climate change and sustainability, economic aspects include how business and industries change, societal aspects include cultural and demographic changes, and finally, technological aspects include changes regarding major disruptions and their implications.

After the world building phase, participants were asked to use sticky notes to come up with key arguments on these five dimensions. A pentagon printout with each dimension on one corner was designed for the participants to put on the wall, so that their arguments can be organized around it. This encouraged participants to discuss together about their worlds and also enable other teams to observe them. The PEEST pentagon designed for the workshop can be seen in Figure 7.3.

In addition to the PEEST pentagon, a smaller step was added as a replacement for the diegetic prototyping from previous workshops. The participants were asked to come up with a design project brief which belonged to the world they created. In



Figure 7.3: PEEST pentagon for the reflection phase.

the middle of the PEEST pentagon, another printout was to be taped and participants were to write a short design brief (see Appendix I, (p. 315). This replaced the diegetic prototype, by asking participants to create an artifact from their world, but without requiring extensive video editing or graphic design skills. I applied what I learned from previous workshops on how participants create more prototyped props when they operated with mediums they were familiar with (see Section 5.4.2 on p. 106). Design briefs were media design students are familiar with, so my assumption was that they would be able to create them with relative ease.

7.1.2.3 World Building as a Board

In the previous workshop, participants mentioned a lack of discursive space, particularly between the teams. The only time during which the teams listened to each other's work was the diegetic prototyping phase. Timing constraints in a self-hosted workshop was the primary reason for not being able to design a more interactive setup. Without compensation, it was not feasible to conduct a workshop which spanned multiple days.

The same time-constraints remained in this workshop too. Due to how packed the project calendar was, there was a limited amount of time which could be allocated to the workshop. During the planning phase, I offered two options for the studio tutors, a full-day plan and a half-day plan with a home assignment and presentations done in the next-class.

To mitigate the challenge of time-constraints and the lack of inter-team discussions, I designed the workshop output to be put up on the walls of the studio. There were specific printouts to organize research finding sheets on the wall (see Appendix K.10, p. 332), as well as the PEEST pentagon being used with sticky notes around it. The proposed board plan can be seen in Figure K.10 of Appendix K. Through the workshop guide, I encouraged the tutors to keep the world building boards intact throughout the project, so that the participants can both see other team's worlds, and further reflect on their own. A photograph from a finished board can be seen in Figure 7.4.

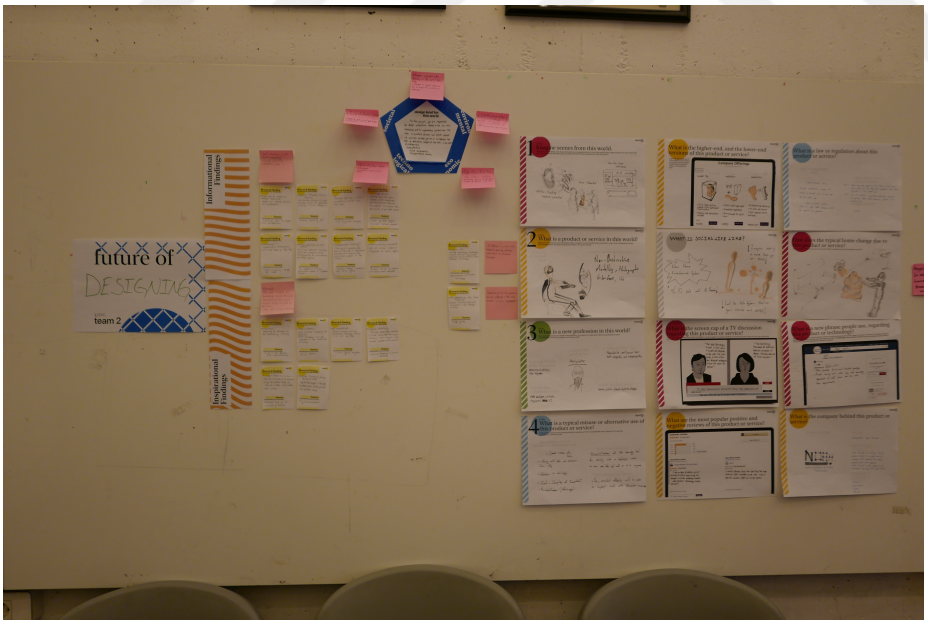


Figure 7.4: A world building board from the workshop.

7.1.2.4 Creating a Workshop Guide

Finally, this workshop was not conducted by me, but by a colleague with the help of the studio tutors. Therefore, I prepared workshop materials which enabled third parties to conduct the workshop in a consistent manner. These materials were as follows.

1. Workshop presentation: A slideshow which was designed to be presented all throughout the workshop. It included definitions of steps and processes, as well as interactive timers for world building exercises, to help workshop conductors throughout the entire process (see Appendix J).
2. Workshop guide: A printable workshop guide, which described the processes step by step, illustrating the board layouts and referencing the corresponding slides for each step, from the workshop presentation. It also included notes on specific attitudes or goals that should be expected from participants, so that the conductor can answer potential questions and further guide them (see Appendix K).
3. Printable materials: World building exercises, PEEST pentagons and other printouts to build the boards were given as a PDF, with a trimming guide so that the conductor could know how to cut them to size from common printer pages (see Appendix I).

After the project was completed, I used two analysis approaches to make sense of the results: content analysis from the project deliverables, participant interviews, and evaluation questionnaires. The content analysis helped me to understand the world building process within a real-world design education project. Participant interviews helped me to understand pragmatic concerns of students. Both analyses enabled me to iterate my theoretical model for world building. Finally my insights from these processes, as well as the evaluation questionnaires enabled me to iterate my toolset. In the next section, I will present my content analysis.

7.2 Content Analysis

After the project was completed, I started by immersing myself to the project worlds each team had built. For this task, I reviewed the project deliverables of each team, which shows their entire progress from early research to the final outcomes. I took notes and then digitized the highlights of project development for each team, grouping these highlights into four main phases of the project: research, world building, detailing and outcome (see Figure 7.5).

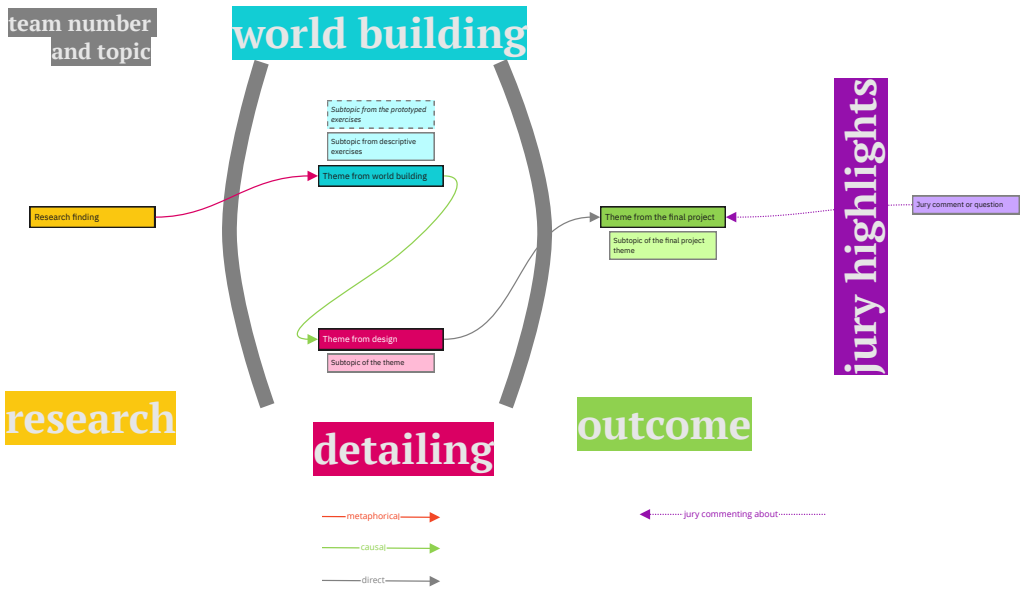


Figure 7.5: The layout used for content analysis.

In the "research" section, research findings were placed in individual boxes. In the "world building" section, arcs extracted from the world building exercises were placed. For each arc, I further extracted the speculations which make up the arc, separated by whether they come from descriptive exercises, or prototyped exercises. Speculations from descriptive exercises are marked by a solid frame while the speculations from prototyped exercises are marked by a dashed frame. The "detailing" section represents the process between world building and the final jury. In the "detailing" section, arcs extracted from both the initial ideas jury and the preliminary jury were placed. In the "outcome" section, arcs from the final jury were placed. Finally

in the "jury highlights" section, comments and questions asked by the jury members were summarized as individual highlights.

Using this data, I conducted a qualitative content analysis to understand how the arcs progressed throughout the project. For the research section, I used the text verbatim as written by the participants in the research finding sheets, using photographs taken after the workshop (see Figure 7.6 as an example). For the world building, detailing and outcome sections, I extracted speculations and arcs using project deliverables from each team. I further showed my extracted arcs and speculations to participants I interviewed with and asked them to corroborate. I added or edited speculations based on participant suggestions. For the jury highlights, I was personally present on the final jury event. I took notes and also recorded the sessions with permission from the students and the other jury members. I used the transcription of these sessions to deduct the highlights. Team 6 is not included in the results or the analysis of this workshop, because no members of the team were available for the interview and therefore it was excluded from the rest of the study too.

After placing the content on these progression maps, I interpreted the *links* between them as metaphorical or causal. Metaphorical links are shown as red arrows while causal links are shown as green ones. The jury commentary was linked to the related arc using dashed purple arrows. The progression maps for all teams can be seen in Appendix L.

Based on these progression maps, I concluded two findings. First, I compared the overall project processes of each team and observed how they evolved the world they built from research findings, to the environment they presented in their final juries. This comparison is presented as types of "centering", as the final stage of world building in design education. Second, I compare progression of singular arcs within projects: how they initially start from research findings and evolve through the rest of the project. This comparison is presented as types of arc progression, representing how design students can progress within future oriented projects.

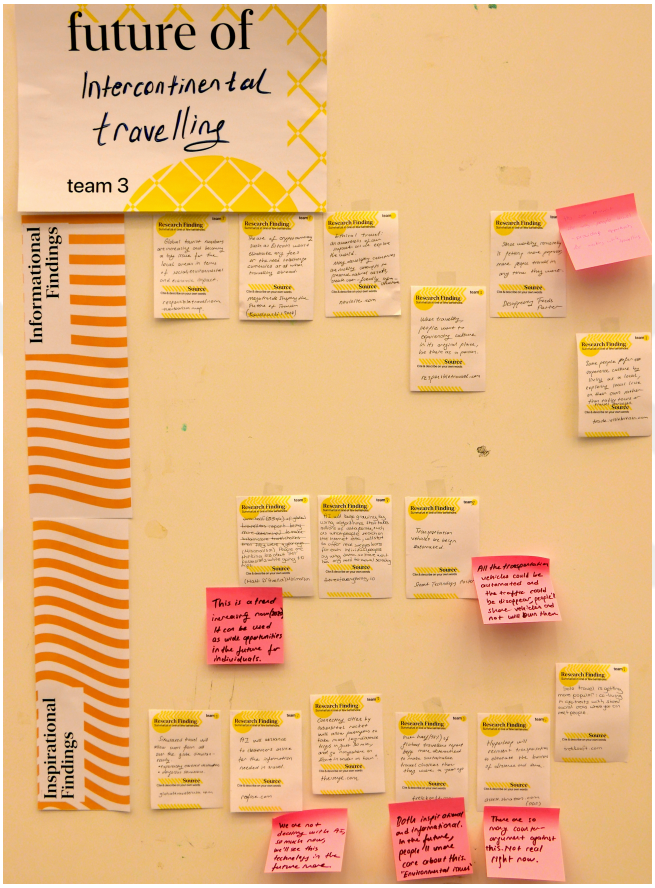


Figure 7.6: Photo of the research finding sheets.

7.2.1 Centering

Centering represents the finalization of world building by blending the textual reference world and the actual world. The result is a textual actual world. The theoretical background of this blend was presented in Section 3.2.1. I identified three approaches for centering in this project: (1) redesigning for worlds, (2) reframing in worlds, and (3) subverting worlds.

7.2.1.1 Redesigning for Worlds

Team 1 developed a number of speculations from their research findings: making musical taste a form of data that can be shared, a set of products which would increase the sensory impact of music and the advance of holograms as a way to communicate and watch entertainment. During the world building phase, they developed arcs that are compatible with this textual world. In the detailing phase, they causally developed most of these speculations: music that can be improvised for individuals by the musical taste data, sharing this music with other people, and watching holograms of street performances from other parts of the world. They also added more speculations from their research as well, such as running earphones with selective noise canceling. Their output had a large selection of these arcs, integrated into different products which come together and form a product family.

Looking at their project deliverable, Team 1's world did not seem to change much throughout the project. Major arcs that define Team 1's textual world remained. By the end of the project, musical taste was still a form of data which could be shared, and hologram concerts were still used. Team 1 kept their world intact, but they changed their product: they embedded their solutions and scenarios into a different set of products by the end of the project. This process was also corroborated by the interviews, in which team members mention how they wanted to include a large variety of scenarios they developed into the final outcome, as a way of increasing believability.

A similar approach is observed in Team 2's work on the future of design. Their world building was mostly built on a "shape shifting material", which could be manipulated in the three dimensional space using voice commands and gestures. After working

on the implications of this material in their future world, the team switched to using virtual modeling. Their solutions in the detailing phase were similar to what they had in the world building phase. Instead of using a shape shifting material, they used the voice and gesture controlled system to make virtual modeling. From then on, they developed the same arcs though the outcome phase.

Similar to Team 1, Team 2's world did not have major change. The major change was done in the product they were positioning in this world: their modeling device started working with a virtual model, instead of the physical shape shifting material. In the interviews, participants from Team 2 justify this change via a lack of technological grounding: they could not imagine how such a material could exist. Therefore, the shape shifting material was taken out but the world they built largely remained in place. These two teams followed a progression in which they did not have major changes in the worlds they had built. Rather, they changed what they were designing for these worlds.

7.2.1.2 Reframing in Worlds

Team 4 and Team 7 had similar approaches to each other, which can be contrasted from the rest. Team 4 built a world using their research findings, about how people would be exercising using virtual reality. They speculated that there would be custom-made exercises for individuals using their personal data to make it easier to progress, and a gamified system which would reward them for exercising. As they progressed from the world building phase to the detailing phase, virtual reality was disregarded as the main component of the system and the team started imagining their users in gyms, schools and on the streets. One of the arcs developed in the detailing phase, a resistance suit to help exercise, was developed as the final system. Team 4's world did not have a major change: both how people wanted to exercise but expected easier ways, and the aspects of gamification remained. Much like Teams 1 and 2, Team 4 changed what they designed for this world, from a VR system to a garment. However in addition to that, they also changed the context they are designing for. Instead of focusing on people at home, they started focusing on people exercising outside. They changed which part of their world they were designing for.

A similar change is also observable for Team 7 who worked for relaxing. During the world building phase they focused on commuting, specifically on taxis. They argued that working people would be in need of relaxing individually in their own private space and developed a taxi service which had various enhancements in the cabin to help passengers relax. The idea of a relaxation taxi was disregarded in the detailing phase, however it is very apparent that they used main arcs developed during world building, in their final outcome. Their design is a capsule-like room to be placed in offices, providing relaxation to individual employees. Both the problem definition and the solution is similar to their taxis from the world building phase. However, they changed the context from commuting to office space. Both Team 4 and Team 7 had kept their worlds unchanged throughout the project but changed the particular context they were designing for, within those worlds.

7.2.1.3 Subverting Worlds

A third approach can be observed in Team 3 and Team 5's progressions. During their world building phase, Team 3 used their research findings about the negative outcomes of global tourism and focused on what they define as over-tourism. They developed virtual tourism in which people don't physically travel, but use virtual reality to see other places. They developed several implications of this future world, such as the property rights of virtual versions of the real world places, and the creation of non-existing travel destinations. However in the detailing phase, the over-tourism angle was completely dismissed. The team rebuilt their fictional world, as a future in which people still traveled. Therefore, the products they designed for this world were also rethought: they started focusing on a pair of augmented reality glasses which would help travelers find points and people of interest in their destinations. One arc that found its spot in the final project from the world building phase was about virtual reconstructions of some historical sites in cities, so that the travelers can experience them with their AR glasses. This reminisced the arcs from their world building phase in which they created virtual worlds for virtual tourists.

Team 5 had a similar process, during which they changed a major part of their future world. In the world building phase, they focused on the disappearance of physical

shops, and that people would be able to purchase whatever they see around them by touching the objects. However in the detailing phase, they subverted this idea and started focusing on physical stores. From that point on, their project was about redesigning a clothing store experience for the future. In the interviews, they justify this change with an assessment on how dystopic it felt. They mention that the first world they built was too individualistic and physical stores were important for people to socialize. Unlike Team 3, I could not trace any arc from their world building phase in their final project.

Based on the analysis above, I identified three types of strategies for centering. Some teams kept the world built consistent throughout the project and changed the particular product they were designing or the particular context they design for. Others made major changes to the worlds they built, later revamping their speculations for their new world. These strategies are visually represented in the theoretical model in Figure 7.7. Next, I present the second findings, as the different types of arc progressions throughout the projects.

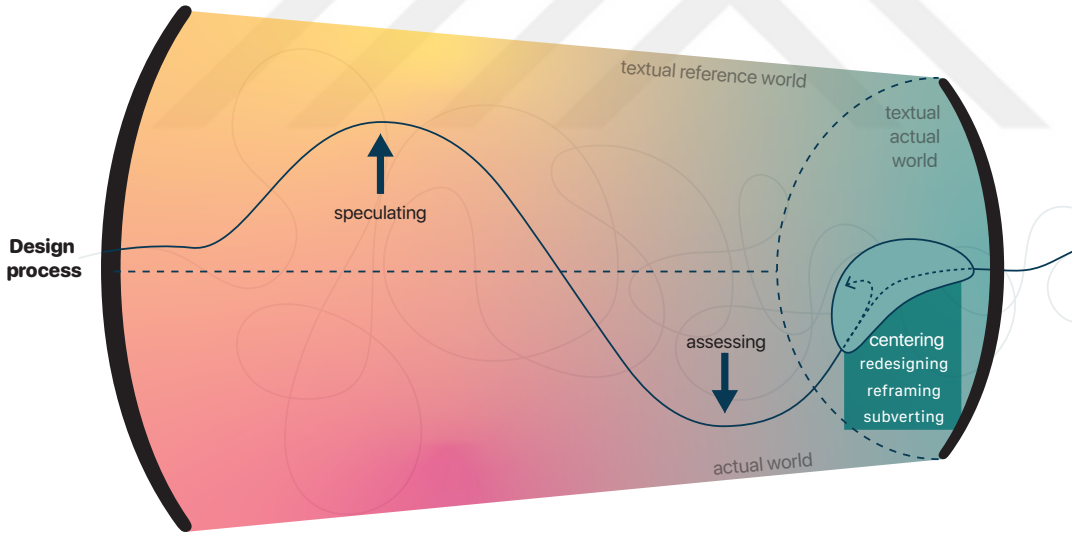


Figure 7.7: Centering as the third phase of the theoretical model.

7.2.2 Types of Arc Progression

In this content analysis, I tracked the arcs to understand how they were formed and how they progressed throughout the projects. I identified four types of progressions:

full progression, progression without detailing, progression without world building, direct progression from research to outcome. In the following subsections, I will describe and exemplify each type of progression.

7.2.2.1 Full Progression

The first type of arcs start from research and can be traced through world building, detailing and outcome phases. In the example below, team 1 had a research finding about how connectivity between products will increase personalization and this will enable individualized products (see Figure 7.8).

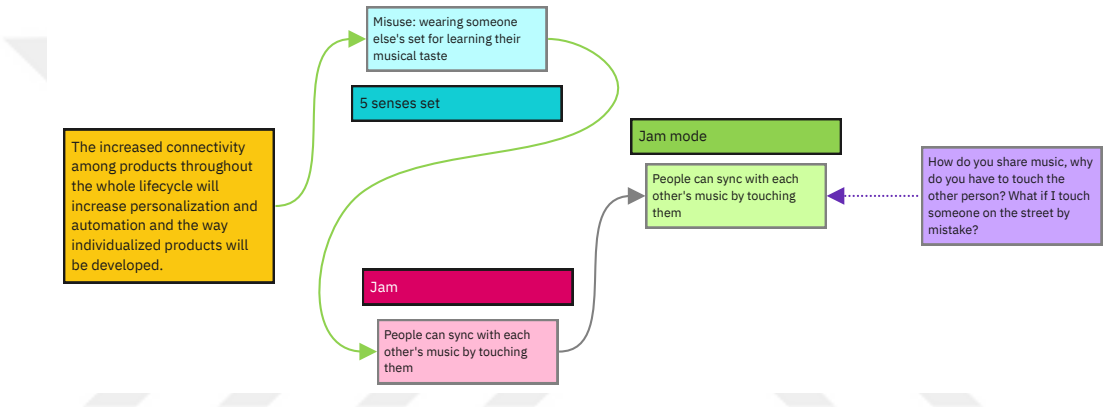


Figure 7.8: Full progression example from Team 1.

This research finding was causally developed into the "sound shirts" in the world building exercises being personal and individual use only. The team first mentioned this feature as a misuse of the product: if somebody else wears one's sound-shirt, they can discover their musical taste. This misuse can be traced causally into a purposeful functionality of the product in the detailing phase: people can sync their music by touching to each other. At this point, the product was not a garment but a smart bracelet. However in this textual world, "musical taste" is a data set embedded into people, and this data set can be shared via physical contact. During world building, this was a misuse and considered as stealing the data. During detailing, it was considered as a use case. The arc was directly carried onto the outcome phase and was further discussed by the jury. The jury questioned whether or not accidentally touching or bumping into another person would "sync" the musical taste. This question can

be traced back to world building: as the jury also considered the misuse potential of the feature, just like how the team first speculated it as.

The following example of full progression is from Team 2 (see Figure 7.9).

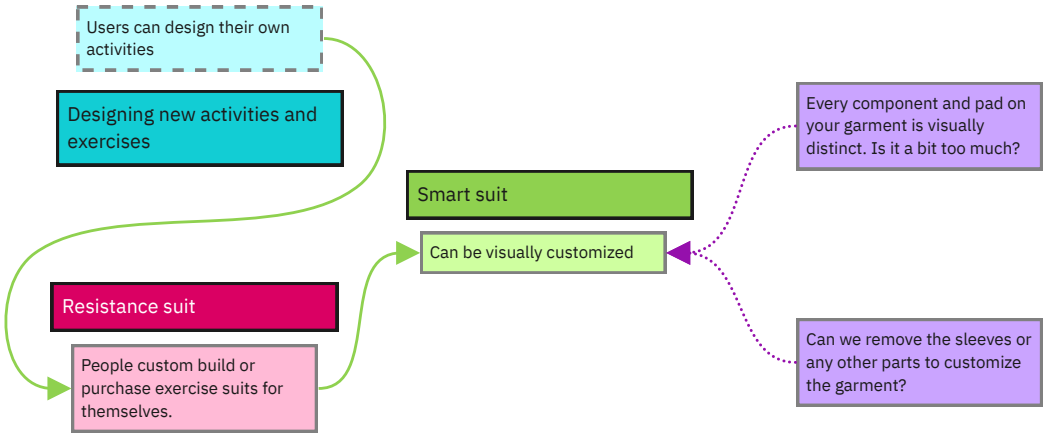


Figure 7.9: Full progression example from Team 2.

In this progression, there is no research finding which I could link to, but the arc can be traced from world building to detailing to outcome. During the world building, the team speculated that there would be custom designed physical exercises for individuals. Through a causal link, this arc can be traced in the detailing phase. Here, a speculation is made about how people build custom exercising suits for themselves, which help them do particular physical exercises. Finally in the outcome phase, a speculation about the exercise suits being visually customizable can be causally linked here. The arc in this example started as customizing exercises, then progressed into customizing the suit which helps with the exercises, to a more visual customization.

7.2.2.2 Progression Without Detailing

The second type of arcs start from research, and can be traced in the world building phase and the outcome phase, skipping the detailing phase. I can not claim that the arc was not considered by the students in the detailing phase at all, since I do not have access to their entire process. However, if the arc was not apparent as a major theme in the jury presentations, I considered that arc as not active during detailing.

The following example is from Team 3 (see Figure 7.10).

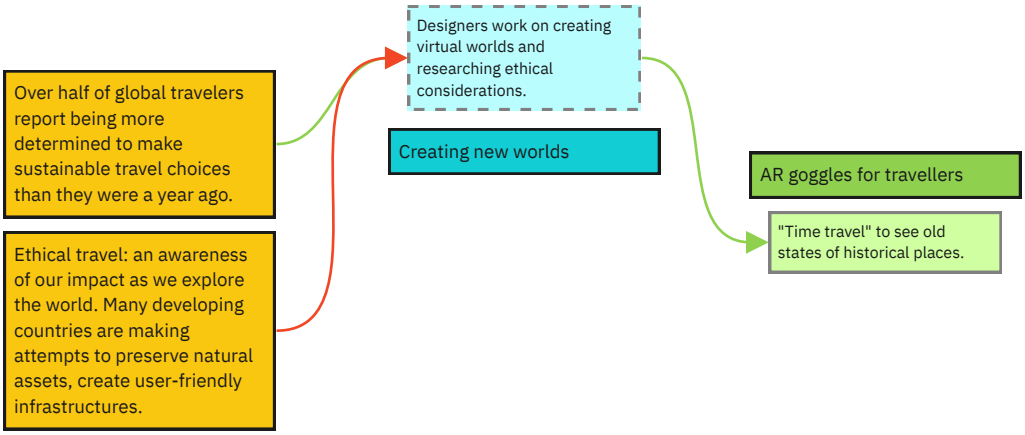


Figure 7.10: Example of progression without detailing, from Team 3.

In this progression, there are two research findings observed: (1) travelers are increasingly considering sustainability as a factor in their planning, and (2) tourism's impact on places, especially in developing countries, is a topic of discussion. I traced these findings into the speculation within the world building phase: designers research and create virtual worlds which aim to eliminate the negative impact of over-tourism. The team focused on virtual tourism, in which tourists would not physically travel to destinations but use virtual reality to experience them. During the detailing phase, the arcs about over-tourism and virtual traveling were not followed through and the team focused on enhancing physical traveling. The product presented in the outcome phase was an augmented reality system which would be used by the travelers in their destination. Despite the change in the overall approach, from virtual tourism to a physical one, one arc can be traced through: that there would be "historical versions" of hotspots in the destination cities which can be viewed with the augmented reality glasses. Since these hotspots would be designed from scratch, it is considered as a causal continuation of the previous speculation: both speculations involve designers building virtual worlds for travelers.

The following example is from Team 7 (see Figure 7.11).

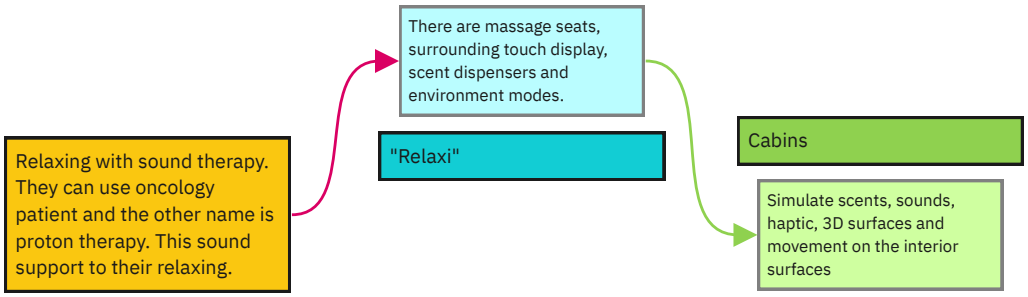


Figure 7.11: Example of progression without detailing, from Team 7.

The team developed an arc about a relaxation focused taxi service, which would help people relax during their commute in the future. One speculation within this arc is that there would be massage seats with soundscapes which would immerse the passenger in different "environment modes". A research finding which can be loosely connected to this speculation is that the team found a soundscape application for comforting cancer patients who are receiving a form of radiotherapy. This arc was not followed through actively through detailing but was once again observed in the outcome phase. The team built an office pod, which employees can spend time in and be immersed into a different reality using different stimulants, one of which is the soundscape. The whole arc of their office pod is quite similar to their relaxing taxi cabin from the world building phase.

7.2.2.3 Progression Without World Building

The third type of progression starts from research, and can be traced in the detailing phase and the outcome phase, skipping the world building phase. Some research findings were not utilized in the world building phase, and were directly utilized in the detailing phase.

The following example is from, Team 2 (see Figure 7.12).

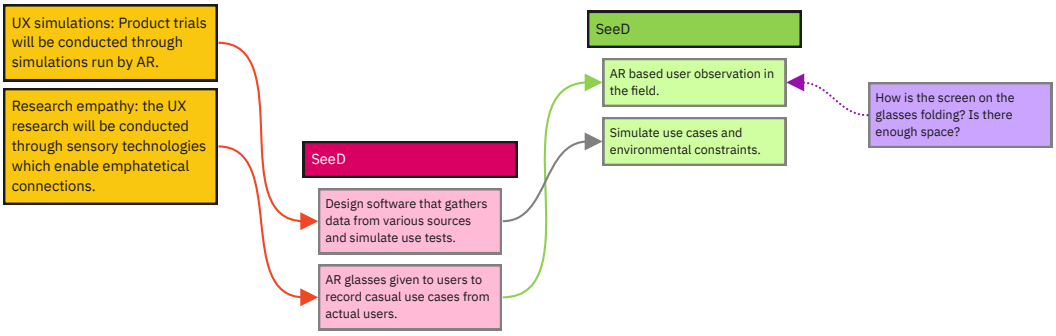


Figure 7.12: Example of progression without world building, from Team 2.

Team 2 recorded two research findings about conducting user experience research with augmented reality technologies. User experience research however was not used in their world building phase, which focused on doing design with a shape shifting material. A continuation of these research findings was observed in the detailing phase, during which the team speculated about a design software which automatically gathers user data and conducts tests. Augmented reality glasses were also mentioned as data collection tools from users. This arc was carried on through the outcome phase in which their proposed solution had a set of augmented reality glasses and a simulation of user testing.

Another example of progression without world building was done by Team 5 and it can be seen below (see Figure 7.13).

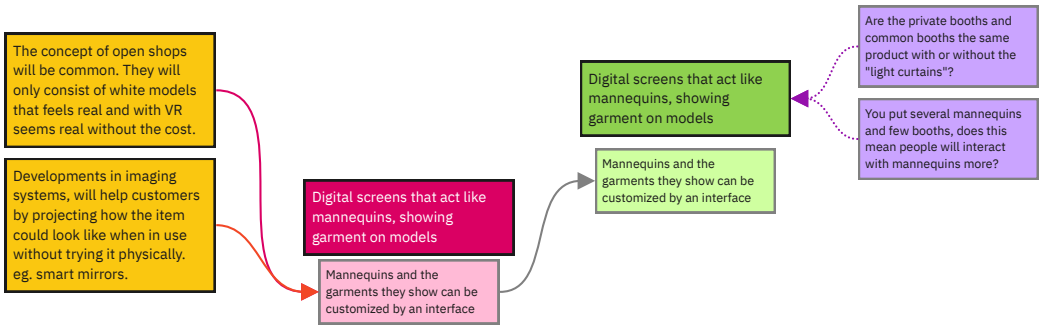


Figure 7.13: Example of progression without world building, from Team 5.

The team used two research findings to develop an arc about a clothing store with mannequins, digitally showing different garments. This arc was carried without much

change to the outcome phase. None of the speculations which made up this arc was discussed in the world building phase, and while the design of the mannequins can be seen as changing throughout the project, the underlying speculation remained the same.

7.2.2.4 Direct Progression from Research to Outcome

The final and the fourth type of progression is carried over from research to the outcome phase, skipping world building and detailing phases altogether. These can be considered as research findings which remained dormant during the project, but was somehow utilized in the final design.

The following example is again from Team 5 (see Figure 7.14).

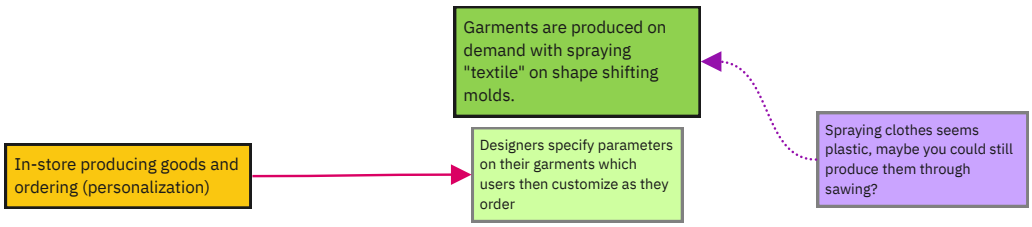


Figure 7.14: Direct progression example from Team 5.

Team 5 had a research finding about on-demand and in-store production of goods. This finding was not utilized in a major arc until the outcome phase, in which the team presented an on-demand garment manufacturing system for their clothing store.

These four types of progressions represent how design students developed and sustained arcs in this project. These are visualized within my theoretical model of world building as shown in Figure 7.15. To summarize, there were two findings from the content analysis. First, there were different approaches in handling the worlds participants built, as they utilized them for their final juries. Second, there were different ways of generating and sustaining arcs throughout the projects. In the next section, I will present the analysis on the participant interviews.

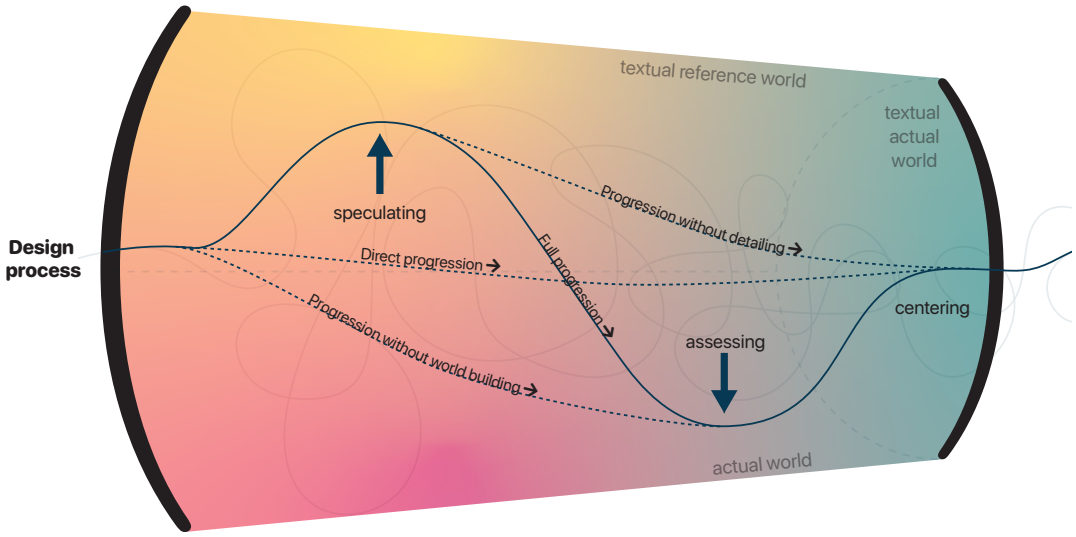


Figure 7.15: Types of arc progressions within world building.

7.3 Participant Interviews

To better understand the world building process, I conducted interviews with the participants of the project. In the consent forms distributed following the workshop, I included a checkbox for participants to give consent for a possible interview. The sheet can be seen in Appendix G. 26 participants (out of the 31 students in the project) filled the consent forms to be part of the research. Out of these 26, 23 participants marked the checkbox, consenting to be contacted for the interview later. All 23 participants were contacted for an interview. The interviews were scheduled around the winter break for the university, so I ended up being able to schedule and conduct interviews with 12 participants. There were three participants from Team 3, two participants each from Teams 1, 2, 4 and 5; and one participant from Team 7. As mentioned before, no participants could be recruited from Team 6, which was therefore excluded from the analysis. The interviews were conducted with remote video conferencing software.

7.3.1 Interview Setup

The interviews were semi-structured and took about an hour each. My goal was to answer the following questions by the answers to these interviews:

1. How does the participant speculate and assess their inspirational and informational findings during world building?
2. How does the participant perceive the world they built, in terms of believability, consistency or coverage?
3. How does the participant's perceptions on the world they built change over the course of the project? How did they decide on the final world?
4. What does the participant think on their personal abilities to build worlds?
5. How was the workshop positioned in their project process? What can be improved to increase its utility?

I had two overall concerns as I designed the interview setup: (1) participants should be reminded of their project process adequately (i.e. what worlds they built in each step of their process), and (2) participants should understand what I mean by the terminology I use, such as immersion and coverage.

To address the first concern, I went through each team's project deliveries, including material from the workshop and subsequent three juries (initial ideas jury, preliminary jury and final jury). Then I generated slides for each team, summarizing the themes they generated on each of these steps. One of the slides can be seen in Figure 7.16. The slides were shown to the participants via screen sharing during the relevant phases of the interview.

To address the second concern, I added steps in the interview structure to warm the participant up to the concepts I would use. In the beginning, I briefly explained what I mean by the term immersive:

> "Now I want to focus a bit in the concept of *immersion*. In story telling, immersion takes the reader from their own world and places them in the world of the story, temporarily enabling them to fell and react as if they were in the story world. Examples include getting a lump in your throat in a sad movie or being physically scared in horror movies."

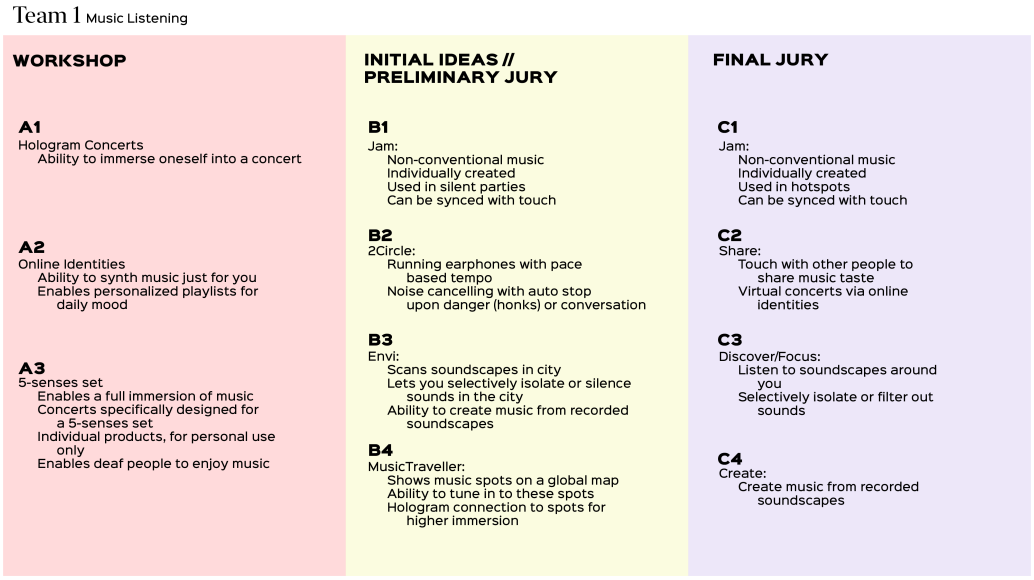


Figure 7.16: A slide used in the interview.

Following this explanation and answering any potential questions, I asked each participant about a recent book they read or a movie they watched, which they would define as an immersive experience and why would they feel like that. This brief discussion helped participants warm up to evaluating their project worlds using believability and immersiveness as a lens.

The structure of the interview was set up in three parts. The first part consisted of inquiring the project's overall world, presented in their final jury. I asked about whether the participant finds this world coherent, believable and consistent. During this phase, I showed the slide (see Figure 7.16) in screen sharing with only the rightmost column visible. This helped the participants remember their final world.

In the second part, I revealed the rest of the columns in the slide about the prior phases of the project: workshop and initial ideas/preliminary juries. I conducted similar inquiries about coherency, believability and consistency about these worlds, asking participants to tell their world building process through these different stages and make comparisons.

In the final part, I asked questions about how they personally felt about world building and future foresight as soon-to-be-designers. I also probed about how they perceive themselves in this regard and what they could do to improve. The script I used during

the interviews can be seen in the Appendix H. Interviews were transcribed and the resulting data was organized using process coding. Objectives, strategies and attitudes regarding the world building activities were noted down and the results were grouped together to form processes. In the following sections, I present the themes deduced from this process.

7.3.2 Pragmatic Dimensions of World Building

In the first run of the analysis, 51 process related items were identified. After thematically similar items were grouped together, 16 themes were defined. These were then put into categories and identified either as themes of speculation or assessment. Table 7.3 shows these themes and their categories. In the following subsection, I present in-depth explanations for each theme.

7.3.2.1 Dimensions in Speculation

All the themes identified within the speculation stage of worldbuilding are grouped within *sourcing*. Sourcing means how participants define where participants initially gather their speculations from. The following themes emerged from the interviews regarding the sourcing.

Using personal experiences

Participants described their personal experiences as a source for their speculations. One participant mentioned her own past experience in sports, as a justification for her speculations on how exercising will be in her future world.

> "Well, to me personally, I believed in our world so much. [...] Because me and my family are very much involved in sports, I think the world we created was very realistic." [17]

Using personal agenda

Some participants described their speculation source as a personal agenda, a trend they wish would happen in the future. One participant accounts how she and her

Table 7.3: Processes and their categories derived from participant interviews.

Stage	Category	Process (Themes)	Description
Speculation	Internal knowledge	Using personal experiences (p. 178)	Participants source speculations from their first-hand knowledge or experience.
		Using personal agenda (p. 178)	Participants source speculations from what they believe the future should be like.
	External knowledge	Using research in technology (p. 180)	Participants source speculations from their research about future technologies.
		Using research in trends (p. 180)	Participants source speculations from their research about future trends.
	Internal and external knowledge	Using local knowledge (p. 181)	Participants source speculations from specific, local forecasts.
Assessment	Social	Convincing peers and tutors (p. 182)	Participants convince team members or course instructors.
	Emotional	Enabling or disabling dystopia (p. 183)	Participants actively seek or avoid dystopic worlds.
	Technical	Being literate in technology (p. 185)	Participants value opinions coming from technically inclined people.
		Grounding speculations via technology (p. 185)	Participants find real technologies that would make their speculations viable.
		Detaching from research (p. 186)	Participants set technical constraints aside when they perceive themselves competent.
	Temporal	Worrying about how futuristic the world is (p. 186)	Participants feel their world is too far-fetched for the target future.
		Worrying about how current the world is (p. 187)	Participants feel their world is not far-fetched enough for the target future.
	Scope	Broadening or focusing foresight (p. 187)	Participants feel more comfortable with broad and encompassing speculations.
		Focusing on worlds or products (p. 189)	Participants are torn between building a world and building product ideas.
		Covering all possible scenarios (p. 188)	Participants feature high number of scenarios to increase believability.
		Merging scenarios to a product (p. 188)	Participants attempt to utilize most aspects of their world in their product ideas.

team wanted people to socialize more in the future and that was the source of her speculations.

> "We believed in personalization throughout the project. [...] And honestly, at some point, we just decided on what we desired and what we didn't desire. For instance, we wanted people to socialize. That's why we kept it as a constraint throughout the project. And we believed that people will socialize.. well, we believed that people need to socialize." [18]

Using research in technology

Participants frequently mentioned how they imagines what technologies will be available in the future worlds. For most of them, speculations were only made if they could describe a technology which enabled this speculation. Some participants relied on current technological findings to make their speculations, as seen in the quote below.

> "Therefore this initial research... [...] I mean, since we were always working on these topics, we were always based on this research. That's why we didn't change any of these [ideas based on this research]. We always took them for granted. Because there are research findings, we assumed they are clean information, so we didn't do any aggressive changes." [19]

The participant described technological findings as "clean information", and that they relied on them firmly for making their speculations. Other accounts mention more flexibility, i.e. extrapolating existing technological findings to define speculative technologies which are still grounded to today.

> "I think it [our world] was believable, beacuse like, we didn't try to change the [current] world too much. Like I said, we imagined what would happen if we took the existing technologies a bit further. That's why I think this is a believable world, an expected world. In fact, it could even be now." [20]

In both cases, participants source their speculations on technological findings they derived from their research. For them, it is a believable world if the speculations are supported by existing technologies.

Using research in trends

Similarly to how participants relied on technological findings to speculate, they also relied on findings about trends. It is common for participants to conduct research on how the activity they were given will transform in the future. One participant accounts how they sourced their speculations on an article describing future trends on co-creation.

> "The reason we did this [a theme in the participant's world], is that when we were doing resaerch on our target user, we found an article from IBM. It said that the generation Z was more inclined to co-creation, and even demanded it. [...] That's why we decided to go in this direction." [21]

Another participant working on the future of shopping, mentions how they found an article on how physical stores will remain to exist in the future. They based their speculation on this finding.

> "Like I said, we read articles and they actually say the brick and mortar stores will still exist. But even now, these stores are not very popular. Compared to online shops. But the articles claimed that people will still shop physically. Mostly for the experience. That's what we relied on." [22]

Using local knowledge

While most participants stated that they relied on research findings for their speculations, one participant gave the following account as a source for speculation, albeit one which they could not pursue.

> "Yes, maybe there could be things we couldn't predict in 20 years. [...] But I had issues with this: we were working with Istanbul as the target and we had to envision Istanbul of 2040. But when we look at IstanbuL's trajectory and what would happen then, for instance we are expecting a major earthquake and it's very plausible. [...] When these probabilities exist and we act like they will not happen and envision other things, it was a dilemma for us." [23]

At first look, this could be regarded as a research finding: a probable major earthquake in Istanbul appears on many respectable sources. However I present this account under a separate title than research, because it represents an internalized source of knowledge. The participant did not do specific research for this source, as it is a

common piece of information for many residents of Turkey. Therefore, I categorize it as between a personal agenda ("we should anticipate this well-known disaster in our future world") and a research finding ("we found out that there would probably be an earthquake and that should be a consideration").

Another participant gave a broader example for this category, by stating that Turkey is different than Europe, so what their findings from western sources would not be entirely compatible in her opinion.

> "Well I think it's very hard to predict the future. Especially for Turkey. Because you know, we are coming up from behind, compared to Europe, so we can't really predict what's going to happen." [24]

I presented five themes which emerged from sourcing speculations: personal experiences, personal agendas, research in technology, research in trends and local knowledge. From the interviews, it was apparent that teams used a mixture of these sources as they speculated, but participants had dominant sources. For example, two participants I interviewed from team 5 focused on two different sources to describe the same speculation: that physical stores would remain. While one participant mentioned a trend research, the other one stated a personal agenda, about how people should keep going to stores and socialize.

I further grouped these themes in two: internal and external sources. Internal sources include personal experiences and agendas, while external sources include research in technology and trends. Local knowledge sits in between the groups, representing a mix of internal and external sourcing. In the next subsection, I will present the themes grouped as assessment.

7.3.2.2 Dimensions of Assessment

In this subsection, I grouped the themes gathered from the interviews regarding how participants assessed their worlds. Eleven groups emerged, which are explained below.

Convincing peers and tutors

Participants mention convincing other stakeholders as a type of assessing their worlds. Both studio tutors and team members are mentioned within this context.

> "We find an idea, a far-fetched idea. And then we have to show it to the tutors, like we did this thing and it'll be a hologram. Then they react like, maybe that's a bit too much?" [25]

While the involvement of tutors in the early phases of a project is to be expected, participants often perceive it as an external constraint: an assessment they were not part of, or agree with. The participant I quoted in sourcing: personal experience (see p. 178), had an elaborate world in mind using her background from sports. However, she mentions that the tutors did not agree with it and therefore it was a hard cutoff: "So yes, I was directed that way, that's all I know." [26].

Another example is the participant I quoted in sourcing: local knowledge (see p. 181). Her focus on the local speculation around a post-earthquake Istanbul was not preferred by the tutors, to her dismay.

> "What kind of touristic artifacts will be destroyed [after the earthquake] and what we can do to show these past artifacts to the new tourists? When we showed these ideas to the tutors, they asked us to ignore it because they thought it would be too negative." [27]

Some participants also mentioned convincing team members as a type of assessment. It was apparent that participants had their own speculations about their future world, but these were not shared amongst team members. These examples show that speculations individual speculations are assessed through discussion within the team.

> "We all had different ideas, for instance I wanted to pursue the game aspect [for the world we were creating]. [28]

> "Because textile was not a direction we loved in the group, including me and another team member. Therefore I personally didn't think about it that much. If it would be other topics [that me and this other member liked], it [the world] would be closer to us, but now this is what the process directed us to." [29]

Enabling or Disabling Dystopia

Participants mentioned evaluating their worlds with whether or not it resembles a dystopia for them. The quote below demonstrates how the participant found their world believable as they created it, but later did not pursue it because they did not want to work with a dystopian world.

> "I mean, the world we created in the workshop was more reasonable and consistent for us. But because we didn't want that future, we generated a different future for the final project." [30]

Another participant states their dismay on how much their world resembles a darker future. She specifically mentions how "scared" they were from this world.

> "We felt so much like we were in a Black Mirror episode. This, I don't know, scared us. [...] That's why we distanced ourselves from it." [31]

In other accounts, participants mention how they also didn't want to develop dystopian futures, yet their product ideas worked better in them.

> "[...] because I really didn't want to add that [how people worked non-stop in their world]. [...] We discussed with the team, like are we really that pessimistic? [...] We didn't have to be that pessimistic, but our product shined more in that world. And we wanted to have it shine." [32]

There were also participants who mentioned how the tutors wanted to direct them away from what they perceived as dystopian worlds, while the team disagreed on this perception.

> "The tutors told us to forget this [world], they thought it was going to be a dystopian world. And were approaching it form a neutral perspective. Say, when we're talking about an earthquake, it doesn't have to be a dystopian world: after the earthquake, [we can think about] what kind of inter-continental travelling will there be Istanbul?" [33]

As seen in the above quotes, some participants had a significant emphasis on identifying their worlds as dystopian. This had an affect on assessment: while some participants did not want to pursue these worlds, some wanted to do in order to "improve" it with their solutions. Nevertheless, the level of pessimism of the created worlds were part of the assessment.

Being Literate in Technology

A common theme emerged from assessment strategies were being interested, literate and knowledgeable in technological developments.

> "Because I didn't know the current technologies that well, for everything I heard, I was likei how can that be possible, it cannot be done! [...] I wish my knowledge in current technology was, like it would be much better if I could research these, if I had the interest." [34]

The participant in the above quote mentions how they could not assess the speculations well, because they automatically dismissed them due to a lack of technological knowledge. They also defined what they lack as "interest" in being more knowledgeable in technology. Being "literate" in technology is also mentioned, exemplified by the quote below.

> "Right now, I can't think of anything but technology, because technology is not only technical, but it also changes how people live. [...] Yes, it is important to be able to read it. To be knowledgeable about it." [35]

Grounding Speculations via Technology

The term "grounding" was used by the participants to describe their separation of speculations and their technological background.

> "We had a hard time. Because we weren't very grounded, and we were worried. What are we going to do? We thought whether we're thinking something that just doesn't exist? Later, we said OK, we are going to do something that exists, we are going to use emerging technologies but it was very to hard to think about how to ground this project." [36]

In the above quote, speculation is used as doing something that doesn't exist, while grounding is used as coming back to the actual world and finding the technological means to realize the speculations. The participant below also uses the same metaphor to describe how they operate in world building.

> "But these ideas are not very probable to realize, I mean technology in 20 years will still abide to the same laws of physics. For instance, most of the

> workshop results, not just ours but other teams' too, weren't compatible with this reality. But maybe this is what a designer should do. First they should get further from their initial position and then come back and be closer to the reality [...]." [37]

Detaching from Research

Similar to grounding speculations, some participants tended to describe speculations as a "detachment".

> "Yes. But then, we separated it [research constraints] and later it was about our imagination. We were able to be detach from research data, and think ourselves." [38]

The contrast between speculations and their supporting technology resembles a cyclic model, in which the participants continuously cycles between grounding to technology and detaching from technology. This understanding will be further explored in Section 7.5.2.

Worrying About How Futuristic the World Is

Participants often mentioned a concern over how their world might be too far-fetched for the given future. They were not confident in their speculations regarding their probability.

> "We had this issue. Do we really fly untethered in the workshop or should we be grounded? We discussed this quite a bit. It was a big challenge for us. And honestly, we didn't believe in this world too much. None of us were comfortable with it. But we had act fast." [39]

These concerns build up on the technological assessment discussed before, about grounding to and detaching from technology. Some participants recount losing their belief to the worlds they created, if they felt that they were out of touch with the reality.

> "We were too far-fetched about this, I mean yes haptic technology exists but our application were so advanced that each module is a very tiny pixel which reaches to the user. And how far will it reach, like even the programming would be so hard. There was no limit here, and we wanted

> to offer something to [future] people and it was so limitless. Even the user experience would be challenging. That's why I think it wasn't very believable." [40]

In the above quote, there is an apparent clash within the participant's narrative: they express a desire to work with a future technology, while not being comfortable on how "limitless" they perceive it to be.

Worrying About How Current the World Is

On the opposite side, some participants recounted concerns over how their world remained too grounded to the actual world.

> "When we had our first ideas, the biggest feedback we got was this: but these are not 2040? These are for now!" [41]

> "Because right now, all these technologies exist. And you're like, is this really 2040?" [42]

It was apparent from the interviews, that a popular feedback from the studio tutors were about questioning the worlds regarding whether or not they were speculative enough. And some participants had a hard time envisioning a future world without their speculations being considered too grounded.

The participant below describes a particular strategy they employed. Instead of attempting to imagine what user needs there could be in their future world, they imagined new opportunities. Regardless, they state that this world was still not immersive for them.

> "Like, I don't think I was ever immersed in our world after the workshop phase. All the time it was like, are we in 2040? Is this 2040? What's going to happen in 2040? We couldn't really progress over a problem definition. We couldn't envision people's problems in 2040. We didn't even know if they would have a problem. That's why at some point, we tried to open a new area that they wouldn't need, like an opportunity, instead of solving a problem. For that, I still think we weren't immersed into this world." [43]

Broadening or Focusing Foresight

Participants defined scope as an important parameter of world building. For instance, the participant below defines a "design context", which includes some features of their proposed solution but not others despite all the features being part of the design.

> "We thought it would be out of context. For instance, we were going to show these features, like you could send a mail, you could take notes. But we thought it would be out of design context." [44]

Merging Scenarios to a Product

Controlling scope was an important aspect of assessing world building among participants. Many participants mention larger scopes, i.e. covering as many scenarios and features as possible, as a way of increasing believability.

> "We worked for making it [our product] encompassing. Because there are multiple ways to define music listening. You create it, you listen to it, you focus on it etc. That's why I remember trying to merge all of these in our world but there was no time to work on everything." [45]

Participants also mentioned their issues regarding this coverage. While the above quote states the lack of time as an example, the quote below states how their team failed to connect these scenarios together.

> "It doesn't really add up. Things [our ideas] are not actually well connected. We kept these ideas too seperately." [46]

Covering All Possible Products

A specific theme on covering as many scenarios as possible was about how this strategy conflicted with multi-purpose computing devices.

> "We are using augmented reality (AR) technology. [...] if AR would be mainstream in the future, then it will be everywhere, there will be other AR products. Then our system should be able to adapt to these other products. Or it should somewhat be distinguished from all these other products." [47]

When participants defined a technology to ground their speculations and attempted to cover multiple scenarios, they had a hard time distinguishing their solutions from

what they believe would already exist in their future worlds. The quotes below from two different participants explain this phenomenon in detail.

> "For instance, this was something I observed in other groups too. They use augmented reality (AR) technologies. Then you start to think. What will the smart phone be like? Can this [our solutions] be integrated in that? I think this is the biggest thing. What we did, started to become an evolution of the smart phone. Then what can be the future of the smart phone, with future technologies... because 20 years of change is not small. Lots of things can change. That's why we didn't really want to go there [...] like we wanted to do a more specialized product." [48]

> "For instance we were using augmented reality (AR) glasses. And we were talking about how widespread they would be in the future. [...] But we were acting like our service will only be accessbile through the AR glasses we design and not an existing one. [...] It's like you have a smart phone, but we design this app and install it in a new smart phone and tell people that they have to buy it in order to use our app. [...] This was an inconsistency we felt throughout the process." [49]

When the participants developed a solution with the assumption that AR glasses would be mainstream, they could extrapolate that speculation to suggest that there would be other AR glasses. It was significant to see that when participants could assess their speculations, through a causal process: "if we do AR glasses for our world, then there should be other AR glasses in our world". Following this realization, participants had two paths. Some lost their immersion to this world, as they believed their particular product can't be in this world; while others tried other design approaches to distinguish their product from the others.

Focusing on Worlds or Products

As a continuation of the previous theme on covering several scenarios, participants expressed a dilemma between developing worlds or developing products.

> "Suppose we are envisioning 2040. Are we imagining the world? Are we imagining the products in that world and designing another one? Or are we imagining like how exercising will change in 2040?" [50]

Some participants stated that they had ideas for products in mind at the initial stages of the project. Only with guidance from the tutors, they had switched their focus to working on world building.

> "But the tutors had directed us to first create the 2040 world, the 2040 Istanbul to be precise. What would happen, what would the people become. And only then this pushes us to solutions." [51]

The above accounts are stating confusion or changing minds mid project. However, in the interviews, I asked a question about whether they believe that they had built the worlds or the products first. The answers to this question almost uniformly described a harmony between creating worlds and solutions. Two answers to exemplify this can be seen below. Both accounts describe a cyclical process in which participants develop worlds and solutions simultaneously.

> "I think they both progressed simultaneously and they complemented each other. We first worked on the idea about instant design, instant solutions, fast solutions. As we were developing these solutions, we realized that the world was compatible with these. So I guess we started from ideas but then the world happened to be consistent with them." [52]

> "I guess both. Because we always tried to balance the world and the product. At one level we were trying to build the world. As we generated things for the world, we added things to the product. Or as the product took shape, the world was also developed." [53]

This concludes the participant interviews. The resulting themes describe the pragmatic concerns of students and further enrich the theoretical model by explaining how speculation and assessment are run through a real world design education project. These are shown on the visual representation of the theoretical model in Figure 7.17. In the next section, I present the results of the workshop evaluation questionnaires.

7.4 Participant Evaluation

At the end of the workshop, a questionnaire for the evaluation of the toolset was distributed to the participants. 26 participants opted to fill the form and the results can be seen in Table 7.4. The following insights were generated from the results:

1. Participants had mixed responses for having a hard time separating inspirational and informational research findings. Despite this, they also value the research

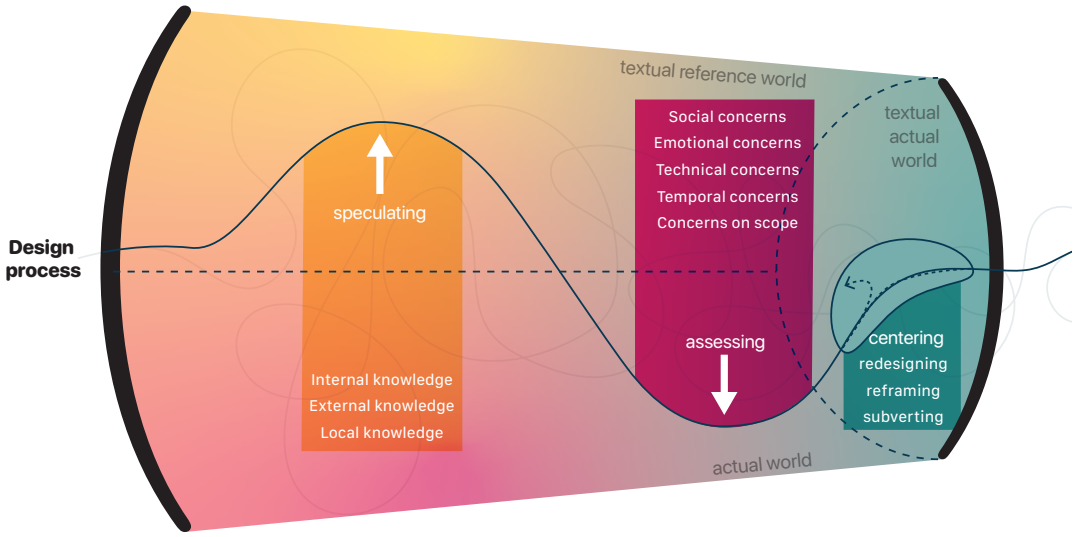


Figure 7.17: Dimensions of speculation and assessment, based on participant interviews.

phase, including evaluating each finding for categorization. I conclude that this exercise's difficulty should be addressed but the exercise as a whole should remain.

2. Participants had mixed responses for finding the world building exercises getting easier towards the end. Most also agreed with timed exercises being more stressful than the rest. These mean that while the new workshop structure with less timed exercises helped with reducing stress, the workshop as a whole was still considered too intensive. This is also corroborated by some answers to the comment section of the survey. The overall structure of the tool will be changed to be more dispersed and less compacted to address these issues.

3. Overall, the toolset was deemed useful and relevant. The results state that participants would be willing to use the toolset in future design projects.

Table 7.4: Results of participant evaluation survey from workshop 3.

Statement	Team 1			Team 2			Team 3				Team 4					Team 5				Team 6				Team 7			Average:	Variance:
	P1	P3	P4	P2	P3	P4	P1	P2	P3	P4	P1	P2	P3	P4	P5	P1	P2	P3	P4	P1	P2	P3	P4	P2	P3	P5		
Research Finding Sheets																												
Finding sheets were useful to me	4	5	4	4	4	4	4	3	5	5	4	4	5	5	4	5	4	3	4	3	4	4	3	5	5	5	4.19	0.482
I had a hard time separating informational and inspirational findings	3	3	3	4	1	2	5	5	3	4	3	2	3	4	1	4	2	2	2	2	3	2	2	2	4	3	2.85	1.175
I had a hard time summarizing the findings for the sheets	3	2	3	4	1	2	2	4	3	2	4	2	2	4	1	4	4	3	3	2	2	2	2	2	2	2	2.58	0.894
Describing the source in my own words helped me think about its credibility	3	4	4	4	4	4	5	3	2	3	4	4	4	3	3	5	3	4	4	4	5	4	3	4	4	4	3.77	0.505
Evaluating each finding was insightful	4	5	4	4	3	4	3	4	4	5	4	3	5	3	3	4	4	4	4	4	4	4	4	4	5	5	4.00	0.400
I use a similar approach when I do research on my own	4	3	3	3	1	3	4	2	2	2	2	2	4	2	4	4	4	4	3	2	2	3	4	2	2	4	2.88	0.906
World Building Exercises																												
Exercises were insightful	4	5	4	4	4	4	4	3	5	2	4	4	5	5	4	4	5	5	4	4	4	4	4	5	4	5	4.19	0.482
Exercises increased my creativity	5	4	4	3	4	4	5	3	5	4	4	4	5	5	3	3	5	4	4	4	4	4	5	5	5	5	4.23	0.505
Exercises became easier to do towards the end	5	5	4	3	1	2	5	4	5	5	4	1	5	5	4	2	3	3	4	3	2	5	3	4	5	3	3.65	1.675
Timed exercises were more stressful than the other ones	5	4	2	5	4	2	5	4	1	4	2	4	5	3	4	3	3	4	3	4	2	4	4	2	4	3	3.46	1.218
I would have done a better job if I was alone	2	1	2	4	5	2	4	1	2	1	1	1	2	1	3	2	3	2	2	2	1	2	2	2	2	1	2.04	1.078
Exercises felt relevant to the design topic	4	4	4	3	5	3	5	4	4	4	5	4	4	4	4	5	5	5	4	3	4	4	4	5	4	4	4.15	0.375
I had a hard time writing coherent and high-quality text	4	2	3	3	1	2	3	2	3	2	3	4	4	2	4	3	2	2	3	3	1	3	3	2	2	2	2.62	0.726
Exercises helped me imagine a coherent future world	5	4	4	4	5	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	5	4	4	5	4	4	4.19	0.162
I would do similar exercises in my future ideation work	3	4	4	3	3	3	3	3	4	5	2	4	4	5	3	4	4	4	3	4	4	5	4	4	4	4	3.73	0.525
World Overview																												
It was hard for me to come up with keywords and insights	2	3	3	2	2	2	4	2	2	3	2	2	2	2	1	1	1	2	1	2	1	2	3	1	1	1	1.92	0.634
I had a hard time with group work in this stage	2	2	2	3	2	2	4	1	1	1	2	1	2	2	1	1	1	2	1	2	1	2	2	2	1	1	1.69	0.542
World building exercises were helpful to generate a world overview	5	4	4	4	4	4	5	4	4	4	4	4	4	5	4	3	5	4	4	4	2	4	3	5	3	5	4.04	0.518
Resulting future world was coherent	3	3	3	4	4	4	3	4	4	5	3	3	4	4	4	4	5	4	4	4	4	4	4	4	4	4	3.85	0.295
Resulting future world was simplistic	3	2	3	4	4	4	2	3	4	3	2	2	3	3	4	4	3	2	3	2	2	2	4	3	4	2	2.96	0.678
Resulting future world was comprehensive	3	3	3	4	3	4	3	3	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	5	2	5	3.73	0.445
Resulting future world was surprising and unexpected	4	4	3	3	3	3	2	2	4	2	2	2	3	4	1	3	2	3	4	2	1	3	2	4	4	2	2.77	0.905
Resulting future world was caricaturized	4	3	3	3	2	3	4	3	4	3	4	3	2	3	4	3	2	3	4	4	4	2	2	5	3	4	3.23	0.665
All future worlds of the class were compatible with each other	3	4	4	3	1	4	4	3	4	4	4	1	2	2	4	4	3	4	4	3	3	4	3	4	4	4	3.35	0.875

7.5 Discussion

I will present the discussion on the findings from this workshop in two parts. First, I will present my insights regarding the world building model. Second, I will present my insights regarding the world building toolset.

7.5.1 Discussion on the Interview Results

In the analysis above, I presented a total of 16 themes in 8 groups which I derived from the participant interviews. In this subsection, I will present my overall insights from these themes.

World building combines internal and external sources in speculation. The interviews reveal that there is an interconnectedness between internal and external sources of speculations. Participants seem to use both research findings and personal convictions together as they speculate for a future world. This finding is in line with how the design literature defines scenario building as inventive (see p. 20): generative research taps into the designer's tacit knowledge to create new findings. In this particular study, there are specific assessments which guide this inventiveness. Participants run their speculations through:

- peers and tutors (social),
- a personal and collective filter about how optimistic or pessimistic they feel about them (emotional),
- how fitting they are to their perception of technological limitations (technological),
- how fitting they are to their specific perception of future (temporal), and
- their broad implications and how they can be consolidated into a cohesive narrative (scope).

While these assessment strategies reveal the specific nature of speculating in the fuzzy front-end, the world building helped increase believability. Multiple participants stated how the workshop, especially the world building exercises, contributed to realizing the research findings as design fictions, and observing their implications.

> "As I said in the beginning, when we were thinking about the news in the world building exercises, we suddenly found ourselves imagining all the negative possibilities of our product. Then we thought about... the daily lives of people in that world, what kind of people they would turn into." [54]

I argue that the interview findings support the findings of my previous workshops, about how world building exercises enable causal reflections within designers (see p. 104 and p. 138). Moreover, I argue that internal and external sources of speculation are not assessed separately with the help of world building done in the workshop. Technological implications of an external source can be assessed by the participant's perception of scope.

For example, multiple teams had reliable research findings on how augmented reality will be mainstream in the future. Based on these findings, they were convinced that there would be personal and general purpose augmented reality applications, similar to today's smartphones. By the end of their world building in which they materialized solutions within these worlds; they decided that their solutions would not be coherent with that future, because their ideas could already be mere software additions to these more ubiquitous augmented reality products, and not separate devices. This results in them losing interest in an augmented reality world despite the fact that their research supports it. In this instance, world building helped causally reflect on factual research findings through personal convictions.

World building is foreign and uncomfortable to designers. From the interviews, it was apparent that world building as a process was confusing and strange for designers at times. For this particular project, participants often mentioned how their perceived end goal was a product. This is why they saw world building, in which they have to imagine the context alone without focusing on a problem, as a challenge.

World building calls for making speculations and when it is conducted by designers, the speculations tend to emphasize products. I further enabled it with the design of my toolset: world building exercises call for a product or service in the second exercise so that the world is built upon them. However, imagining a product that is only imagined for world building and would not be worked on for the rest of the project was challenging.

When the workshop was conducted within the project process had an effect on this issue, according to the participants. As mentioned in Section 7.1.1, the workshop was conducted right after an *activity projection* phase. Participants mention that at that point, they already had some initial ideas in mind, following the activities they imagined. When the workshop started, the timed exercises asked the participants about a product or service in their world. Most participants decided to use the product ideas they had over these activities. One participant described their frustration over the timing of the workshop within the project.

> "I think this workshop should be done after the trends research phase. [...] Because when we did the workshop, we already were circling around some ideas. We had specific things in mind. And we couldn't really take a step back from them, and imagined some other world. We couldn't exactly be free. If the workshop was right after the trends research phase and I hadn't done any other research yet, I could have made a better, more free world." [55]

As the quote above suggests, participants have a hard time in building worlds if they had a product idea in mind. However, some participants stated that they continuously reused the world building exercises later at later stages of the project.

> "Throughout the entire project, we used the world building exercises, reusing those pages you know. Asking those questions over and over again to each other to progress and that was useful for us." [56]

Therefore, there are accounts stating that world building exercises should have been initiated earlier and that they were done continuously, further in the project. Based on these results, I argue that world building should be considered as more diffused and widespread activity within the design process.

Technological literacy is embedded to world building. The third insight gathered from the interviews is how participants assessed their adequacy in terms of technological knowledge. The following quote represents a stance shared by multiple participants.

> "I'm not very good with technology. Like, because I don't know the current technologies well, everything to me was like, that can't be done! [...] I wish my current level of technological knowledge, I mean I wish I could research more, have more interest in that kind of thing." [57]

These participants defined technological knowledge as an "interest" or "literacy". For them, technology was not only a part of their research, a resource to be used in their project. Rather, they defined it as a personal trait or a skill, as in, to be literate and interested in technology. This definition is seen in being used during the assessment: during the interviews of Team 2, the two interviewees were visibly on the different ends of a spectrum, representing this technological interest. One participant vividly mentioned how some of their ideas were not feasible with the technology they know, and how they did not feel safe "making up" technologies to support these ideas. The other participant directly quoted the first participant, stating that because the first participant did not find it believable, they did not as well.

7.5.2 Implications for the World Building Model

This study added two layers to the world building model. First, I elaborated the speculation and assessment processes devised in 5 and 6 with strategies uncovered from the student interviews. Second, I defined a third step of the model, under the title "centering".

The student strategies explored in this study provide an important insight not only for world building but also for exploratory and generative research as a whole. As mentioned in 2.1.1, literature on generative research tends to make hard distinctions between inspirational and informational findings. Based on this literature, I carried this distinction towards my model and toolset as well. From the second workshop on, I encouraged participants to categorize their research findings into these two groups in the research phase.

The interviews in this study however, reveals that these two approaches are often intertwined. Students have personal convictions with how believable they consider their research findings. Moreover, there are pragmatic concerns on which aspects of a textual reference world students want to explore. Many students changed direction over peer actions: not only by direct feedback from group members or instructors, but also from indirect ones, such as noticing that other groups are building similar solutions. Another example would be the participants who found some of their research too dystopic and therefore wanted to focus on other findings. A quote from one of

the workshop evaluation surveys shine a light on how one participant blended the two approaches:

> "I really liked the idea of having inspiring and informative finding together. But I found it quite confusing at start. We had a hard time to see the difference between information and the inspiring ones. We evaluated the information according to how inspiring to us."

When working with unfamiliar contexts, such as futures in this particular project, research findings can be evaluated through personal and pragmatic concerns. These concerns are explored through world building which exposes their implications and allows an assessment. World building therefore offers a way for the participants to be more aware of the sources and the implications of their speculations.

Another outcome of the interviews is the realization of world building being a continuous process. Multiple participants mentioned how they went back and used the world building exercises in the latter stages of the project, as a way of exploring implications of new speculations.

This requires a change in the model to reflect how world building can span to encompass more of the design process. Before this change, my focus was limited on the FFED. This workshop, together with the analysis of the subsequent process within the design process revealed that world building was a broader approach that spanned the entire project from research to the final jury. Therefore, I changed how I presented my theoretical model, from focusing solely on the FFED to covering the entire process. How I updated the visual representation of the world building model can be seen in Figure 7.18.

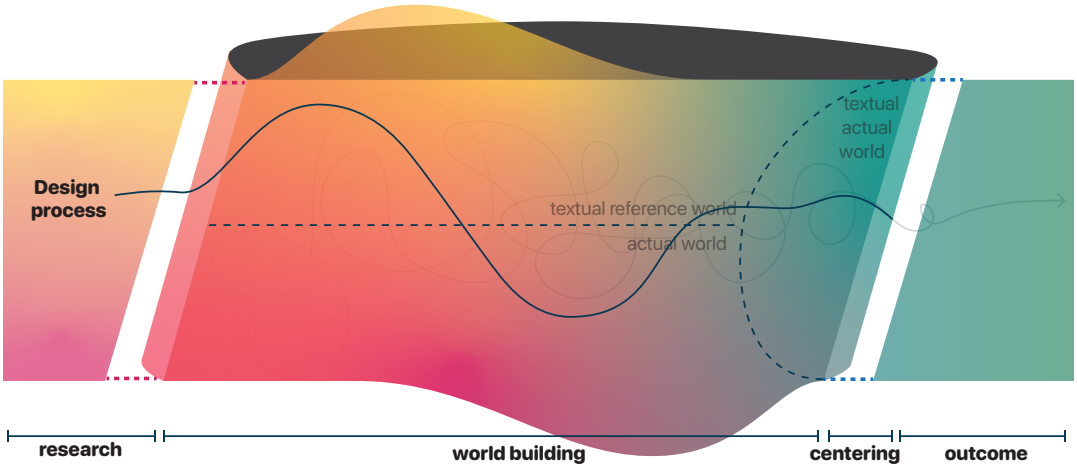


Figure 7.18: A new format for the theoretical model to represent the cyclic nature of world building.

7.5.3 Implications for the WBD Toolset

As mentioned before, this study reveals that world building can be regarded as a continuous process in design. Therefore, the toolset would be revised to reflect this change. Furthermore, the reflection phase was still problematic in this study, in the sense that it was not used in a consistent manner by the participants. Based on this, I conclude that its purpose and usage was not communicated clearly enough. These two items will be discussed further in the subsections below.

7.5.3.1 WBD Toolset for Continuous Use

Up until now, I defined WBD as a stand-alone exercise which would be conducted in the early phases of a design project. In this study, it was positioned after the research and before the idea generation phases. However, I also encouraged participants to keep their workshop deliverable on a board or on the wall (see 159). The reason for this was to keep the worlds visible throughout the project so that the participants would be able to position their design efforts for them.

The study however revealed that participants did not keep their worlds the same throughout the project. Not only the teams conducted centering, in which they changed either the focus or the world itself (see 165), they also followed different progressions some of which did not utilize the worlds (see 172).

Therefore, I concluded that the WBD toolset should be designed in a way to be used multiple times throughout the design process. The workshop as a stand-alone step to start building worlds after the research will remain, but the exercise flow will be reconsidered to allow continuous usage. This will allow the toolset to be more versatile. The final version of the toolset will be presented in Chapter 8.

7.5.3.2 Changing the Reflection Phase

The reflection phase designed for this version of the toolset involved conducting a PEEST analysis and creating a design brief for the textual world. However the results were generally inconsistent with each other. Most teams conducted the PEEST analysis for the actual world, restating their research findings about how the future will be for their project. They did not reflect the specifics of the worlds they had just built in the previous phase. Moreover, the insights were generally limited in terms of specificity. Most insights were too generalist to be utilized in directing an idea generation phase. This observation covers the fictional design brief as well. The generated briefs were generally not focused on specifics and remained generic (see 7.5).

There are two reasons I identified for these issues in terms of execution. The world building part of the workshop is very intensive, so participants were tired by the time they reached the reflection phase. The instructions on how the PEEST analysis should be done for the worlds they just generated, and not necessarily for the actual world were also not clear.

Regardless of problems in execution, the reflection phase was also not conceptually relevant for extracting more insights from the world building phase. Interviews revealed that the utility of world building was more dispersed: participants could explore implications of their speculations throughout the project. There was no utility in summarizing the world generated in the world building phase. Therefore, I concluded

Table 7.5: Fictional design briefs from workshop 3.

Team	Fictional Design Brief
1	This team work project takes you to individual listening music experience. The aim is to design a service or product that increase people's experiences while they are listening to music through their senses (at least 3 senses and 3 types of technology should be involved in one product/service). You should consider 5 and 95 percentage of users.
2	For this project you are responsible for design propositions related to the new Holo technology and its supplementary product: SSM. The technology is spreading globally but Turkish market is currently excluded, your aim is to implement the tech in the context of entertainment. Grading criteria: Social sustainability, intergenerational sharing.
3	Design the interaction between users and sense in the context of meeting the basic human needs.
4	In 2040, since people are living individually and they spend so much time in virtual reality, VR addiction is becoming more and more common. In addition to this, returning to real world causes depression, anxiety and alienation from the real world. You are required to find a solution to decrease alienation and adapt people to real world again, without using losing the advantages of VR technology.
5	Design an interactive system that provides people with options like getting informed buying, borrow/renting, trying products integrated to this system.
7	Situation: People in Istanbul (2040) suffer from less personal space and spend a long time in transit which increases stress and the need to relax. Brief: Offer possibilities to relax in transit, while considering technological improvements and environmental conditions, reducing reusing and recycling.

that the reflection phase should be removed as it's currently implemented. Instead, a new component for the toolset will be designed, to enable participants to continuously reflect on their project world, by using the constructs extracted from the interviews. This change, along with others will be presented in Chapter 8.

7.6 Concluding Remarks

In this chapter, I presented the design, application, results, analysis and reflections on the third workshop of the study. Conclusions of this chapter is presented by answering the questions asked in the beginning of the chapter:

> Question 1.E: What are the pragmatic concerns of design students for world building, and how do they affect the speculations and assessment made by the design students?
> Question 2.C: How can pragmatic concerns of design students affect the world building processes,and how can the WBD toolset be finalized in light of these concerns?

For Question 1.E, I extracted 16 themes from the participant interviews. Based on these themes, I conclude that the participants use either internal knowledge, external knowledge or both as they speculate for textual worlds. Then they use social, emotional, technical, temporal or scope-based strategies to assess these worlds. Furthermore, I identified different approaches used to develop arcs throughout the design process and defined a step in the world building model called centering. This represents the ways students aligned their textual worlds and the actual world, through changing their solution, its context, or the textual world itself.

For Question 2.C, I argue that design students blend informational and inspirational research findings through personal and pragmatic lenses as they speculate. World building then becomes a continuous way to explore these speculations and reveal implications. The toolset should be iterated in a way to allow continuous usage throughout the design process. Furthermore, the toolset should be compatible with the speculation and assessment strategies revealed in the interviews. Therefore the final toolset should allow continuous world building, with research and reflection steps that take

personal and pragmatic concerns into consideration.

This concludes the third study of my dissertation. In the next chapter, I present my final discussion and conclusions on the world building model and the WBD toolset.

CHAPTER 8

DISCUSSION AND CONCLUSIONS

In this chapter, I present my conclusions, as well as my final discussion regarding my research. The chapter will summarize my process and my findings, followed by my reflections on the study and recommendations for further research on the topic. As with the rest of my study, I group my conclusions into two parts. First in Section 8.1, I present the conclusions regarding the world building model. In Section 8.2, I present the conclusions regarding the toolset I designed throughout this study. The following two sections present my personal reflections on the research process (Section 8.3), and the limitations of the study (Section 8.5).

At the end of each field work chapter, I presented answers to the sub questions asked in the beginning of said chapters. In Table 8.1, I provide the answers I came up with based on the results of my studies.

8.1 A World Building Model for Designers

In this dissertation, I built a model of world building for designers using different domains of literature and different research approaches. The results of all these approaches come together to form an accessible model, explaining the process and considerations of world building in design. I grouped these results in six layers: each layer represents the findings from a particular study, using a particular research approach and domain. In this section, I will explain these six layers, which together form the world building model: (1) exploratory and generative research in the FFED, (2) three-world structure, (3) process wave, (4) speculation, (5) assessment, and (6) centering (see Figure 8.1).

Table 8.1: Answers to the research questions.

	Research question	Answer
1	**How can a theoretical model describe and represent the world building process of design students when working with future contexts?**	World building in design education is a cyclical process which covers the entire design progress and it runs through a speculation phase to create textual reference worlds, an assessment phase to compare speculation to the actual world, and a centering phase to blend the two phases in a textual actual world.
1A	What are the elements of world building in design education based on relevant literature?	Props, speculations and arcs are identified as elements of world building. Props can be regarded as metaphorical or causal based on how they are generated. They can be described or prototyped based on how they are presented.
1B	How are these elements generated?	Metaphorical props establish fictional truths and causal props develop them within the generated world. Creation of prototyped props are dependent on the medium familiarity.
1C	What are the different approaches in the world building process for sustaining certain narratives?	Using arc progression maps, I identify primary arcs, temporary emergent arcs and permanent emergent arcs.
1D	How do the properties of speculations affect the resiliency of narratives design students generate during world building?	Prototyped props more often generate emergent arcs while described props sustain them through the world building process. Metaphorical props establish and justify arcs, while causal props develop them through narrative.
1E	What are the pragmatic concerns of design students for world building, and how do they affect the speculations and assessment made by the design students?	Design students use either internal knowledge, external knowledge or both as they speculate for textual worlds. Then they use social, emotional, technical, temporal or scope-based approaches to assess these worlds.
2	**What are the properties of a toolset for openly enabling world building to be used by design students when working with future contexts?**	A toolset to enable world building in design education should help students identify inspirational and informational findings in their research, understand how fact and fiction can blend in together, create consistent and immersive speculations using familiar fictive artifacts, and assess them through open processes.
2A	How do these elements affect the world building processes in design education?	Toolset should encourage causality and consider medium familiarity, by including better defined questions in world building exercises.
2B	How do different approaches used by design students to progress their generated worlds, affect the perception of these worlds?	Participants find textual reference worlds with higher number of sustained arcs more believable.
2C	How can pragmatic concerns of design students affect the world building processes, and how can the WBD toolset be finalized in light of these concerns?	The WBD toolset should allow continuous world building, with research and reflection steps that take personal and pragmatic concerns into consideration.

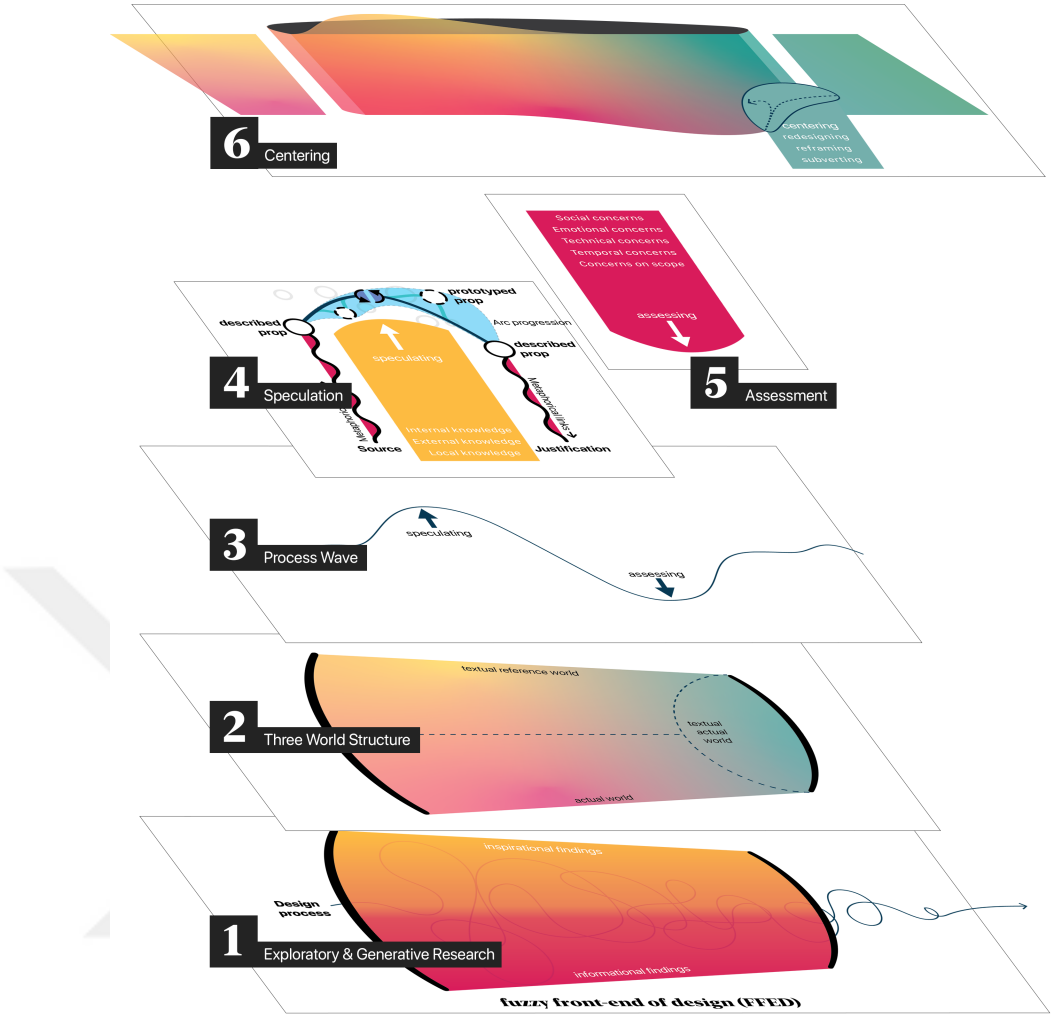


Figure 8.1: The six layers that make up the theoretical model of world building in design education.

8.1.1 Findings of Exploratory and Generative Research

Generative research in design defines two types of approaches: research that informs the design and research that inspires the design (Sanders, 2005) (see Section 2.1.1). When working with unfamiliar contexts, designers are often not in possession of complete and comprehensive information. Therefore they make use of inspirational research, using designerly ways of knowing to conduct relatively less tenacious and exploratory research. These findings emphasize experimentation and draw from imagination.

Designers are able to combine these approaches, including their findings into coherent insights, which enable them to create believable contexts for their problem space. This process is further corroborated by future studies, in which an insight is generated by gradually combining two branches of knowledge: one from structured past information and information to trigger inspiration from relevant experience (Rodríguez et al., 2006).

Based on this literature from exploratory and generative research in design, and insight generation in future studies, I defined two types of research findings for designers, regarding the future contexts: informational findings and inspirational findings. Informational findings are those which are directly related to the problem space, providing constraints and justification to potential speculations. Inspirational findings are those which can be considered ambiguously related to the problem space by the designer, providing inspiration and unexpected triggers for the potential speculations. These two types of research findings are not mutually exclusive and they represent a range. Since the designer can not be expected to judge the validity of each research finding they come across, their perception plays a role in categorizing their findings within this range.

8.1.2 Three-World Structure

I utilize literature from the domain of media studies and design theory to create my second layer in the world building model. World building is extensively discussed in media studies and I used the three-world structure proposed by Ryan (1991) to generate this layer (see Section 3.2.1). The three-world structure proposes that there is an actual world, representing the reader's current and physical world. Then there is a textual reference world, the world created by the author to tell a narrative. Finally, there is the textual actual world. This is a combination of the two previous worlds, representing how the reader juxtaposes events or existents of the textual reference world to their actual world.

I repurposed the three-world structure form media studies to design, in order to frame the generative research activities from the first layer. A textual reference world implies a possible world in which the designer's inspirational findings reside. The de-

signer envisions a future context using their inspirational findings, building a textual reference world. Their informational findings on the other hand constitute an actual world, representing how the designer perceives the current state of things regarding the design space. As the designer progresses through the design process, they combine the two worlds, drawing inspiration and considerations from them. This lets them create the textual actual world, in which the designer proposes their solution. The three-world structure is the second layer of the world building model.

8.1.3 Process Wave

The progression of designers through the worlds described as the first two layers constitutes the third layer: a process. This process is represented as a wave, which travels through the textual reference world, creating speculations. It then dips into the actual world, to assess the speculations using informational findings. Finally, it centers within a textual actual world, blending the two types of findings.

I started visualizing the process wave linearly as it represented a design process with a beginning and an end. The fact that it is a wave shows how designers work with the fictional and the factual knowledge in succession as they create a blend in between. The model shows one length of the wave (one dip each in the two types of worlds), but in an actual design process, there could be multiple times a designer utilizes fictional or factual knowledge before they settle on their textual actual world.

8.1.4 Speculation

The first step of the process wave is defined as speculation. Speculation is the phase in which design students ideate about their future context, creating their textual world. I explored the speculation phase in my first study: Chapter 5. In this study, I once again used concepts from media studies to identify the components used by the designer to conduct world building. This time, I utilized props, as defined by Walton (1990) (see Section 3.1.3). To initiate world building, I employed action research and designed a toolset for the students to use. The results of this toolset were analyzed using a blend of qualitative content analysis and process coding. Based on this analysis, I used the

concept of props to frame the ideas generated in the workshop.

An analysis of the props generated in the workshop revealed two dimensions. First, props were created by metaphorical or causal links. Props with metaphorical links are created by linking themes from the actual world to the designer's textual reference world. Causal props are created by cause and effect relationships between themes that already exist in the textual reference world. Furthermore, I identified two types of props based on how they are presented: descriptive props which explain the speculation and prototyped props which demonstrate it.

Most props can be thematically grouped together to tell a narrative. I called these groups arcs, after story arcs found in all narratives. Each arc represents a holistic speculation to define the textual reference world. I observed from the results of my first study that metaphorical props are used for establishing arcs, while causal props are used to reflectively develop it.

In the third study, the participant interviews over a real-world educational project revealed that the participants used personal experiences, personal agendas, technological research, trends research and local knowledge as sources for their speculations. These sources imply that speculations are made through a mix of research and personal convictions which were entangled together.

8.1.5 Assessment

The second step of the process wave is defined as assessment. Assessment is a continuation of speculation: design students evaluate their speculations and maintain some of them, disregard others, and generate new ones. Using the concept of arcs as defined in the previous study, I conducted a second study in which traced the progress of the participants by seeing which arcs were sustained and which were not.

Based on the analysis of the second study, I identified primary arcs: arcs that were dominant in the majority of the world building process. As opposed to primary arcs, there were emergent arcs which were generated after the primary arc was established. Emergent arcs helped participants enlarge their textual reference world, either temporarily or permanently (see Section 6.3.6 on p. 135).

My analysis also revealed a transition from speculation to assessment. Participants often generated new arcs from metaphorical props, based on knowledge from their actual worlds during the speculation phase. Some of these arcs were sustained by causal props during their life, via creating new narratives within the textual reference worlds. Design students then finalized these resilient arcs to ideate on products or solutions, by metaphorical links. Therefore, I concluded that there were metaphorical links when design students moved from the actual world to the textual reference world for speculation and when they moved back for assessment. Any progression in-between was developed causally (see Section 6.4.1.2).

A peer evaluation during the second study also revealed that participants perceived worlds with a higher number of dominant arcs more believable. While the study's size is not enough to generalize such an insight, I argue that causal development results in more reflection during the world building, which in turn creates more coherent speculations (see Section 6.4.2.1).

In the third study, the participant interviews over a real-world educational project revealed that the participants assessed their speculations through their peers and tutors (social), a personal and collective filter about how optimistic or pessimistic they feel about them (emotional), how fitting they are to their perception of technological limitations (technological), how fitting they are to their specific perception of future (temporal), and their broad implications and how they can be consolidated into a cohesive narrative (scope). These results show that there are pragmatic concerns in the assessment phase dictating which arcs would be sustained throughout the project (see Section 7.3.2).

8.1.6 Centering

The third step of the process wave is defined as centering. Centering represents the blending of the textual reference world and the actual world to create the textual actual world. This phase was explored based on the result of the third study. Based on the analysis of these results, I concluded that there was a continuity of the world building phases, which were initiated during centering.

Some participants made changes to the context they were focusing on within their textual actual world, as well as changing their design solution. Others made major changes to their worlds, effectively repeating the world building process again. Centering, therefore, implies the concluding phase of a world building effort; however, it also represents a decision point in which the participants decided to continue using their textual actual world with minor modifications, or generate a new one through major modifications. A final representation of the theoretical model can be seen in Figure 8.2.

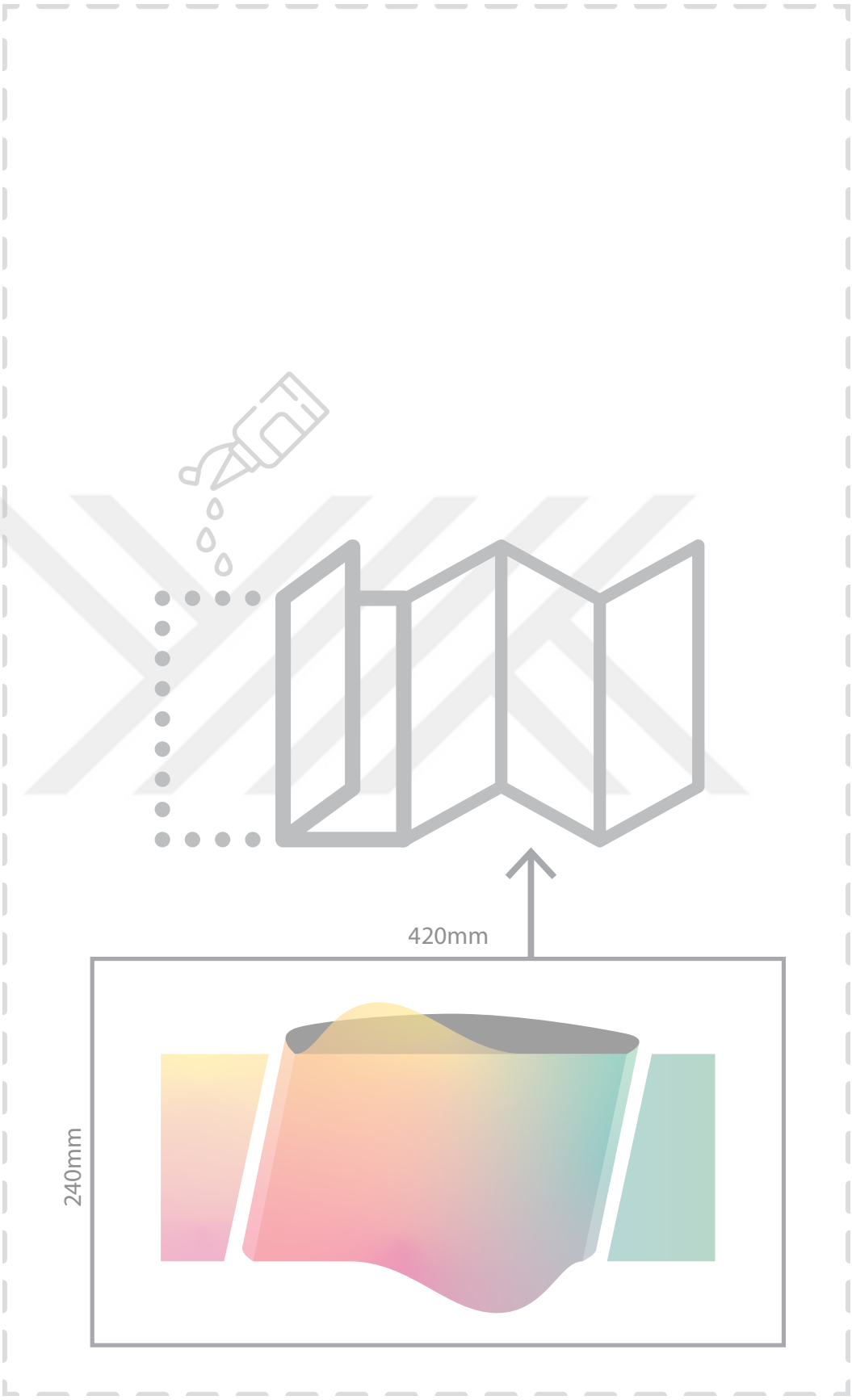
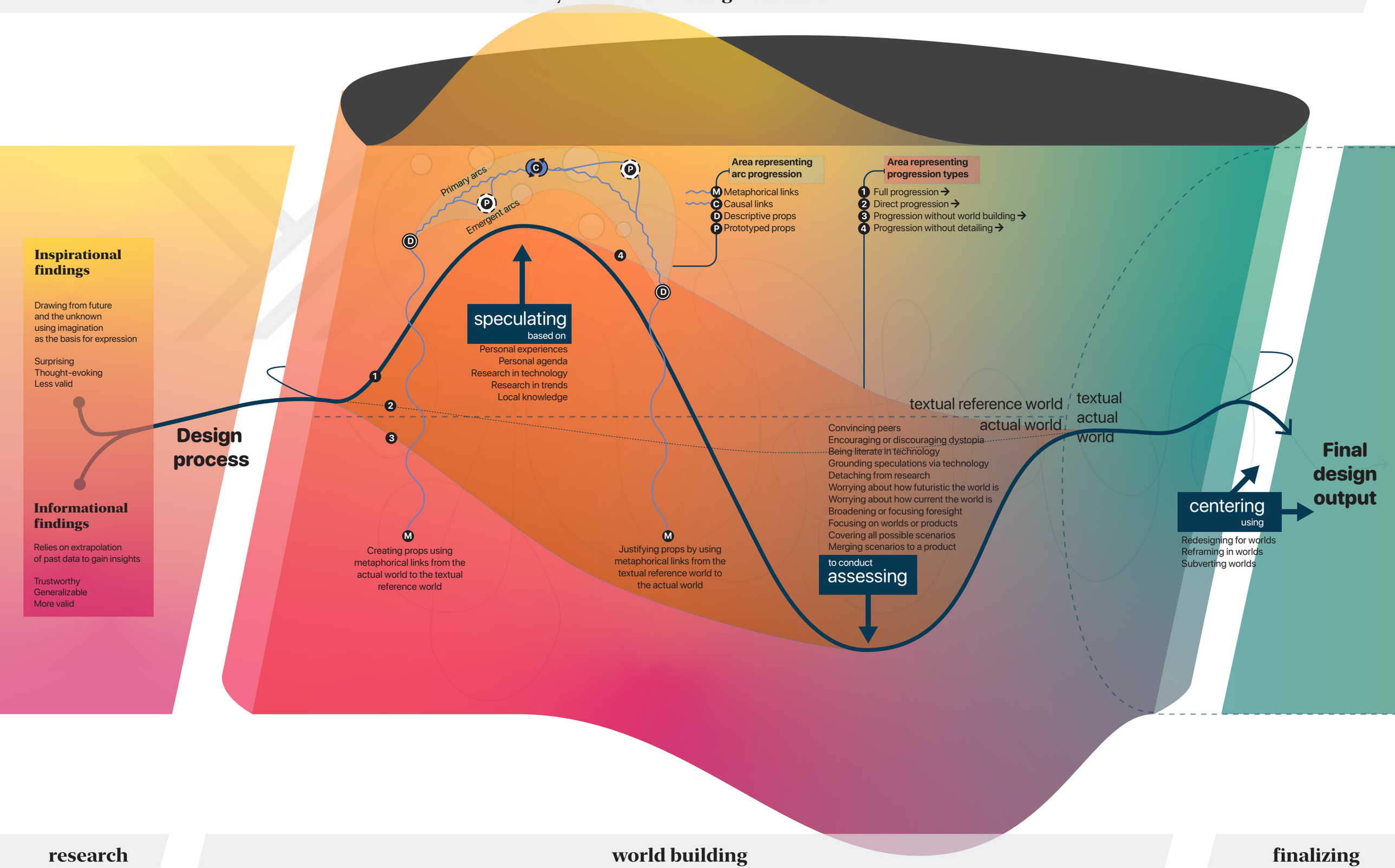


Figure 8.2: Final representation of the theoretical model.



research | world building | finalizing

8.1.7 Contribution to Literature

In this section, I present my world building theoretical model's contribution to the literature. As mentioned before, I follow the definition of Achinstein (1962) to define my work as a theoretical model by explaining how it fulfils the four characteristics he assigns to theoretical models: (1) providing assumptions, (2) describing how a system works, (3) utility for a specific context, and (4) using analogies. In the following subsections, I will explain what my proposed theoretical model about world building in design provides in these characteristics.

8.1.7.1 Providing Assumptions

A theoretical model should be based upon the researcher's assumptions about a phenomenon. I had multiple assumptions about how world building is done in design education, at different stages of my work. Before I started the field work, my assumption was that design students built fictional contexts for themselves in the FFED, especially if their problem space is out of their reach. Therefore I assumed that the generation of these fictional contexts would bear resemblance to the creation of fictional worlds in the media, with differences I would find out about.

Through the studies I conducted, my assumptions also evolved. After the first study, the results indicated to me that the created worlds were not complete and coherent like a movie world would be, but rather were patched from different, sometimes incompatible speculations. I decided to understand more about fiction as a conceptual entity, in order to analyze the smaller components of worlds.

Based on this new literature, I identified props and arcs as the inner mechanisms of world building and conducted the second study. These two studies changed my assumptions about the theoretical model of world building in design: instead of thinking of it as an initial step of the design process, I conceptualized it as a longer process. Designer did not only build worlds but assessed and changed them during the process as well.

The final study revealed to me that world building had different interactions with

other phases of the design process and that design students had several pragmatic concerns on how they built and assessed their worlds. The final model's assumption is the following: Designers working for future contexts continuously alternate between generating a fictional world and assessing it through actuality until the alternation reduces to a third world which is a combination of fiction and fact.

8.1.7.2 Using Analogies

Theoretical models use analogies to explain their target phenomenon. Defining context building within the design process as world building enabled me to use a different body of literature to frame how designers operate with fictional knowledge. The literature regarding world building and fiction making has its distinct set of attributes, such as believability, coherency and coverage, as opposed to design's heavy focus on the real world and actual problems. The design literature about generative research is still very cautious with using words which might be alluded to fiction as a source for design.

There are good and historically valid reasons for design to avoid fictional sources. The emergence of user centered design took decades to convert design from a top-down, visionary operation to a bottom-up one with grounded, real-world concerns. Approaches in design therefore still emphasize factual and real data over speculative ones. Even design fiction, as mentioned in Section 2.3.2, is mostly used for eliciting peer opinions rather than being used as a basis for general-purpose design tools.

I argue that world building is a good analogy for what designers do as they work with future contexts. It undoubtedly implies that the work being done is fictional. However, it also frames fiction within constraints which are familiar to anyone who consumes media, such as believability, coherency and coverage. Drawing parallels between designing unfamiliar contexts and world building will enable designers to embrace fiction as a valid resource and will help them to reflect on the qualities of the futures they generate.

8.1.7.3 Describing How a System Works

A theoretical model explains how a complex phenomenon works by attributing mechanisms or inner structures to it. I used terminologies and concepts from different bodies of knowledge to identify and analyze worlds, generated by design students. The model further explains how individual speculations and arcs are created and sustained; as well as practical considerations of students at each phase.

Since the model uses a local setting as a source of observation, as well as my intervention as the researcher to initiate world building; it is far from a complete representation of world building in design. However I argue that it is a solid starting point for understanding how design students work with fiction.

As I described in Chapter 1, my observations in the design studios I participated to were that students had different approaches in generating contexts in the processes. The model attempts to explain how fictional props and arcs are built at a micro-level, as well as pragmatic concerns of students at a macro-level. While these mechanisms were observed in limited and intervened settings, the model's explanation can be used a basis for analyzing different projects in other settings; with or without intervening with the WBD toolset. Such research will improve the model's ability to explain how design students work with future contexts.

8.1.7.4 Utility for a Specific Context

Finally, a theoretical model provides utility for a specific context. I previously described how it is useful to explain context generation as world building, as it enables designers and researchers to utilize different bodies of knowledge. Another utility of the model was the development of the WBD toolset. The toolset was developed for creating the model, but its final incarnation is also a practical application of the model into design. The final version of the toolset makes use the model's process wave, as well as utilizing student concerns as assessment criteria and distinct exercise sets based on prop properties. In turn, I expect that using the toolset by different researchers and tutors in their own settings will continue to feed and improve the model.

8.2 World Building for Designers (WBD) Toolset

By using action research as my main approach for this study, I developed a tool to enable world building, titled world building for designers (WBD) toolset. In this section, I will briefly recall the development stages of the WBD toolset, present the final version after the last study and elaborate its limitations and future development potential.

8.2.1 Development

The WBD toolset had been iterated for each of the three studies conducted in this dissertation. Before the first study, I conducted a thematic analysis on a select set of television shows to identify the instruments of world building. These were converted into a set of world building exercises and grouped as micro and macro elements. During the first study, each exercise was shown to the participants for a set amount of time and participants generated answers to the exercises with sticky notes.

After analyzing the results of the first study, I grouped the results as prototyped and descriptive. Furthermore, I concluded that prototyped props enabled more causal development in the textual reference worlds and should therefore be encouraged. In order to enable more prototyping, I decided to enhance the world building exercises with follow-up questions, so that the participants could develop more causality within each exercise. Another insight from the first study was that mediums which are more familiar to the participants were better prototyped. I used this insight to make changes to the inventory of exercises and introduce exercises with more familiar mediums to designers.

The WBD toolset in the second study was planned in phases. A research phase in the beginning was introduced to familiarize participants to the concepts of informational and inspirational research; as well as providing a warm-up for the topic. A reflective phase in the end introduced presentations and peer evaluation for participants to interact with each other's worlds. Furthermore, the world building exercises were now printed out so that the filled exercises would be easier to see and remember throughout the process.

After analyzing the results of the second study, I had two insights. First, the timing of the exercises was deemed too stressful for the participants. The timing caused some of the exercises to be skipped or filled halfway through, especially towards the end of the exercise set. Second, the order of the exercises was observed to be an issue. I observed that some of the exercises were more suitable for prototyped props and if they were given too early in the process, students did not have established arcs for which they would create prototyped props. Rather, they prototyped new arcs out of necessity and these new arcs were too similar in-between the groups.

To iterate the toolset based on these insights, I grouped the world building exercises into two: descriptive exercises and prototyping exercises. This allowed me to also improve timing-related issues, by giving the set of descriptive exercises first and time them while giving the set of prototyping exercises later with no timing. I used this approach in the third study. This approach, together with the fact that it was applied within a real-world design studio project helped increase the amount and quality of props generated in the prototyped exercises.

Another change from the second study to the third was the reflection phase. The first two studies had diegetic prototyping as a summative exercise at the end, designed as a reflection phase. The second study revealed that participant skills in terms of production played too much role in building these prototypes, and therefore the prototypes did not always live up to their expectations. A new reflection phase was implemented in the third study, inspired by the PEST analysis. participants were expected to note down major changes of their worlds regarding political, environmental, economic, technological and societal aspects. To finalize, they were expected to develop a design brief for this world. This new reflection phase was not completed consistently by the teams, possibly because the toolset's guide was not clear enough, or the workshop as a whole was too tiring for them to concentrate well on this last step. Regardless, the phase did not work well.

A final change from the second study to the third was the presentation of the worlds. The second study's printed sheets were useful for keeping the worlds in mind for the participants of each team. However, the only element presented in between the teams were the diegetic prototypes of the reflective phase. The results of the world build-

ing exercises were not shared amongst different teams. This was stated by multiple participants in the evaluation sheets as a problem. A change in the third study was a board setup: printouts were designed and used so that each team would build their worlds on a wall or board. Each output from the workshop from research to world building and reflection were designed to be stuck to these boards in a certain layout. This was done so that all participants involved in the workshop would have a chance to see other's work.

Based on this history of development, I identified two dimensions which were successful and carried over to the final version of the toolset: world-building phase and research phase. I also identified two dimensions which need improvement: reflection phase and presentation. Furthermore, I have one dimension to add based on the results of the third study and the theoretical model: continuous world building. In the next section I will present the final version of the toolset, after which I will elaborate how each of these dimensions were utilized and improved.

8.2.2 Final Version of the WBD Toolset

In this section, I will present the final version of the WBD toolset. The WBD toolset involves 3 phases: (1)research, (2) kickstart, and (3) world building. The third phase, world building includes 3 inner-steps: (a) speculate, (b) assess, and (c) design. These steps are visualized on a singular board layout, which is to be used during the entirety of the design process. The simplified flow of the toolset's application can be seen in Figure 8.3.

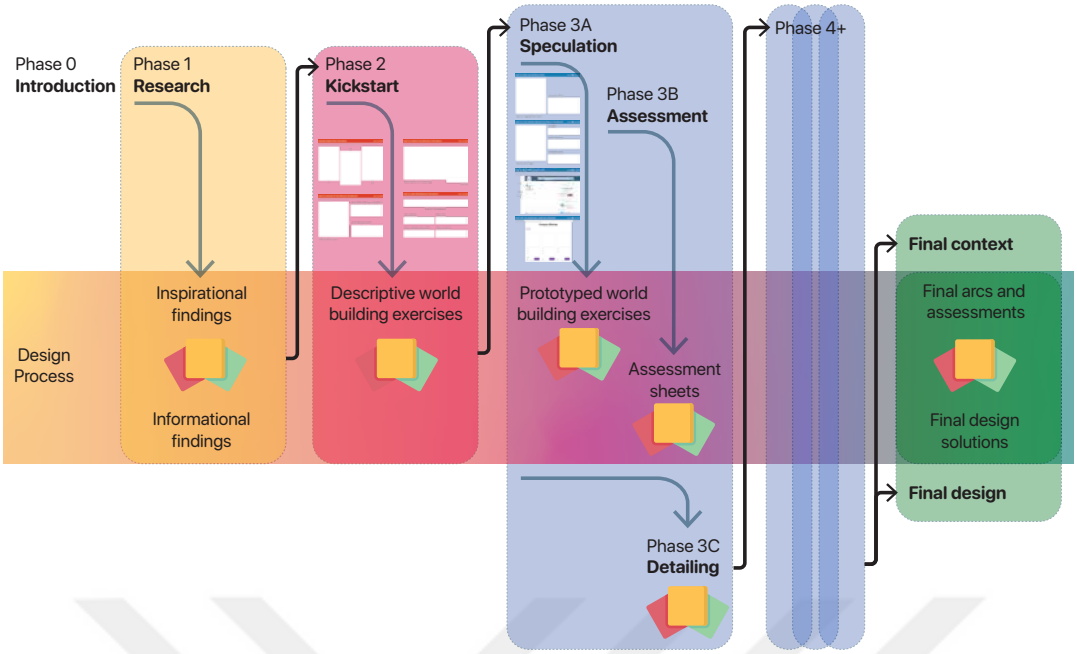


Figure 8.3: Toolset flow.

As I am completing this dissertation, we are living through the COVID-19 pandemic which caused most educational institutions to go remote. This is why I am designing the final version of the toolset as a digital board through a web app called Miro. Miro is a collaborative whiteboard service and is already being used by educational institutions to conduct interactive and collaborative lessons or workshops. This is suitable for WBD as well, as it is mostly text based, requires collaboration and it involves building boards out of individual elements. Therefore I implemented the final version of the toolset as a Miro template, complemented by a printable version for those who do not want to use Miro. Both versions will be published online for future use, and forking by other design educators for their own iterations. Both the board and the toolset includes ample instructions to enable design students using the tools without any moderation.

In the following subsections, I will present the toolset's application by following its three aforementioned phases. A screenshot from the Miro template of the toolset can be seen in Figure 8.4, while the both the Miro template and the printable version can

be accessed online[1].

8.2.2.1 Phase 1: Research

In the research phase, participants are expected to conduct research on their own means and record their findings into separate research finding sheets (see Figure M.1 in Appendix M). As with the previous versions of the toolset, each research finding demands a brief description of the finding, a description of the source in the participant's own words, and the citation of the source.

Once the research is complete and the finding sheets are filled, participants will place them on the designated space on the design track. Design track is a horizontal bar that spans the entire width of the board, on which various output from the process will be placed. As with before, the upper end of the board represents inspirational findings while to bottom end represents informational findings. Participants should take to opportunity to discuss each finding and its plausibility, as they decide where in the scale it belongs.

8.2.2.2 Phase 2: Kickstart

The kickstarting phase is for running the first four timed and descriptive world building exercises. The exercises remain the same from the previous version of the toolset (see Figure M.2 in Appendix M). The time given to these exercises can be adjusted by the course conductor based on the total available time. However it should be no shorter than 5 minutes for each exercise to keep the application feasible, and no longer than 15 minutes each so that the participants do not create too high fidelity descriptions, constraining them too much in the latter stages.

[1] WBD toolset is open-sourced and available at https://github.com/emrecaglarid/WBD-Toolset under the GNU General Public License v3.0.

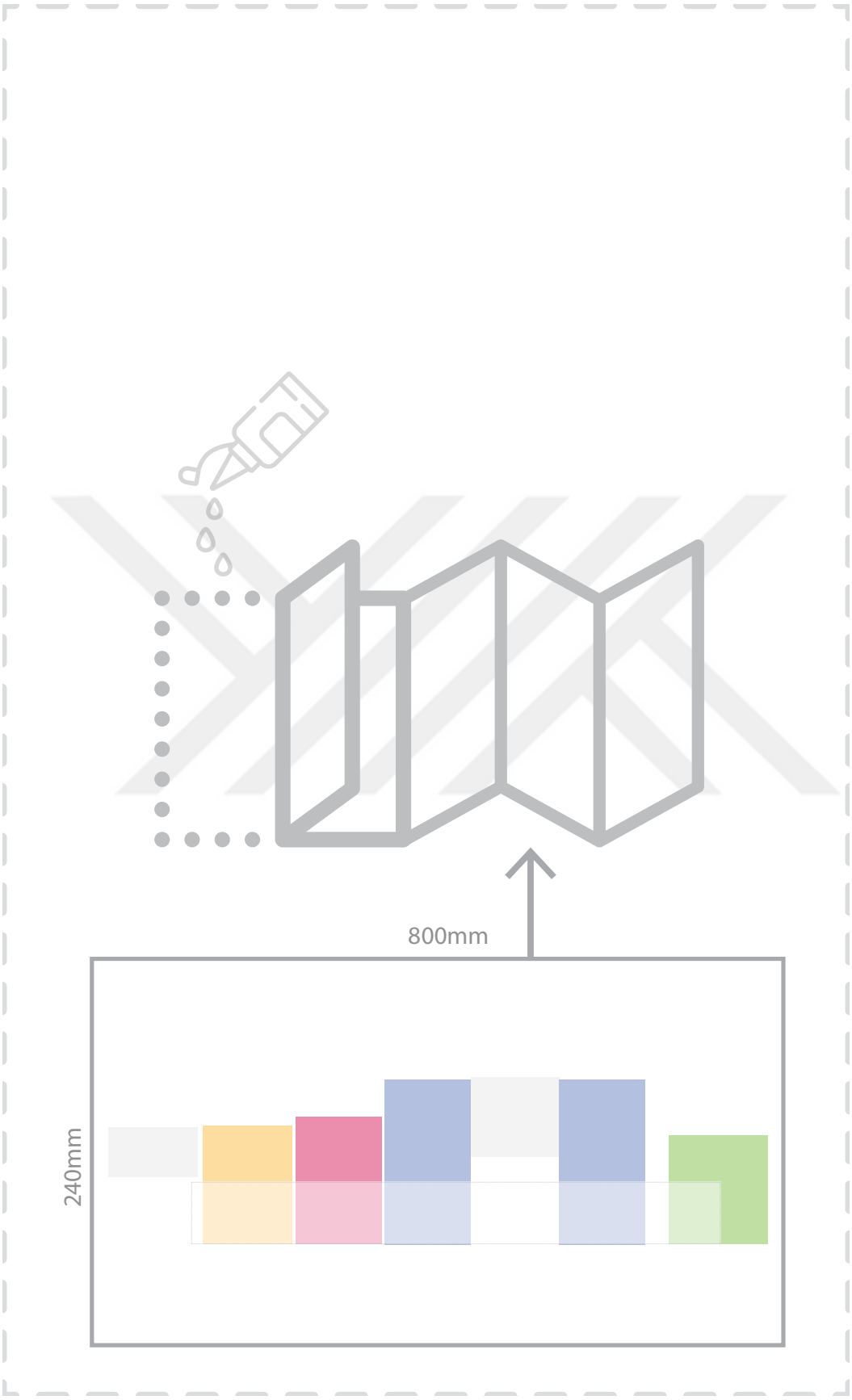


Figure 8.4: Toolset board layout from Miro.

STEP 0:

introduction

This is the ***world building for designers*** booklet. It will help you build future contexts to use in your design project.

Start by writing your target year and theme or focus below.

YEAR:

FOCUS:

TEAM:

STEP 1:

research

The first step is to conduct and organize your research. Summarize each finding in the sheet and write down your source below. Sources are both to be described, and cited. See the example sheet below.



Once filled, place each finding sheet in the board below. Upper end of the board is for inspirational findings. These can include findings from popular culture, editorials, personal opinions and even science fiction. Lower end of the board is for informational findings. These can include scientific articles or well-cited web sources. Discuss each finding as a team to agree where to place them.

Remember that this is not a strict categorization. The aim is to reflect on your findings and recognize how plausible you find them.

Ready? Grab a copy of the sheet below to start filling out your findings and placing them on the board below.



STEP 2:

kickstart

Now it's time to start building your first world for you future context. Below are four exercises: complete them in order: from 1. to 4.. The exercises will be timed by your instructor, so plan accordingly.

Remember that the world you are generating here does not necessarily represent your final world. It will be iterated, or even completely changed. Focus on your research findings and develop the first things you come up with.



Once done, place the filled exercises below on the design process track.

STEP 3.A:

speculate

Browse the exercises supplied above in the world building exercises frame. As a team, pick at least 6 of these exercises to fill. Grab copies from the box and place them in the area below to work on. Each exercise will materialize a different part of your future world. Follow the instructions from your tutor in terms of timing.

STEP 3.B:

assess

As a team, overview the exercises you filled above. Imagine the future world you are building. Then, use the arc sheets below, to summarize at most three arcs from your fictional world. Each arc should represent a major theme or a difference from the current world.



Place your filled arc sheets in the fictional track below.

After the arcs are placed, use the assessment sheets below to assess each arc. You can do this as a group or you can do it individually. You don't have to use all the assessment sheets but try to use as many as possible. When finished, move your arcs and their assessments vertically in the board to indicate how plausible and realistic they sound.



STEP 3.C:

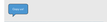
detail

With your group, review the arcs you generated and how you assessed them. Now it's time to generate design ideas for your context. Follow your tutor's instructions on how to conduct the design process. Place the results of your work on the design track, towards the top-right.



Grab a copy from any of these exercises for Step 3.A. The last one is customizable for your own world building needs.

world building exercises











STEP _.A:

speculate

Browse the exercises supplied above in the world building exercises frame. As a team, pick at least 6 of these exercises to fill. Grab copies from the box and place them in the area below to work on. Each exercise will materialize a different part of your future world. Follow the instructions from your tutor in terms of timing.

STEP _.B:

assess

As a team, overview the exercises you filled above. Imagine the future world you are building. Then, use the arc sheets below, to summarize at most three arcs from your fictional world. Each arc should represent a major theme or a difference from the current world.



Place your filled arc sheets in the fictional track below.

After the arcs are placed, use the assessment sheets below to assess each arc. You can do this as a group or you can do it individually. You don't have to use all the assessment sheets but try to use as many as possible. When finished, move your arcs and their assessments vertically in the board to indicate how plausible and realistic they sound.



STEP _.C:

detail

With your group, review the arcs you generated and how you assessed them. Now it's time to generate design ideas for your context. Follow your tutor's instructions on how to conduct the design process. Place the results of your work on the design track, towards the top-right.

final world:

Now it's time to stabilize your world and design solutions. Create your final arcs which describe your future context in the middle and your final design solutions below them. Do a final critical assessment to see if they are consistent. Discuss and present this assessment alongside your design solutions.



final design:

Design process track

Inspirational findings

Informational findings

Project end

8.2.2.3 Phase 3.A: Speculating

The world building phase has the same set of prototyped exercises from the previous version of the toolset (see Figure M.3, M.4, and M.5 in Appendix M). Similarly, participants would be free to choose any exercise to complete within a given time; including utilizing the empty sheet for creating their own prototyped props.

8.2.2.4 Phase 3.B: Assessing

In this phase, participants will use the arc sheets to summarize their generated world after reviewing the world building exercises they had generated (see Figure M.6 in Appendix M). Each arc sheet is expected to be filled by combining multiple props into a reduced theme. Arcs should be summative, and change-based: they should describe what major detail is different in this new textual reference world compared to the actual world.

After the arcs are written, participants will place them on the track, based on their assessment. More far-fetched and less plausible arcs are to be placed on the upper hand, while more grounded and plausible arcs are to be placed on the bottom end; similar to how research findings were placed. The arcs will then be assessed by the participants using the assessment sheets (see Figure M.7 in Appendix M). These are created based on the pragmatic concerns identified in the last study and should enable a critical self-reflection on the generated worlds. Assessment sheets can be filled individually or as a group; and they will be placed below their respective arcs.

8.2.2.5 Phase 3.C: Detailing

Detailing represents the conventional design process in the project. It was not conceived as a structured step within the WBD tool, as different tutors and different projects will call for different processes for ideation, development and presentation. However, the world building process is to be run at least twice, therefore the design process should be divided into steps to be more compatible with the toolset.

For example, the project described in the last study had two milestones during the

design process: an initial ideas jury and a preliminary jury. When using the final version of the toolset within this project, each detailing phase can cover one of these milestones. In this case, after an initial phase of speculation (Step 3.A), the results of the initial ideas jury will be put in the detailing phase (Step 3.C). Then the world building phase will be conducted again, this time the detailing phase will be used for the preliminary jury results (Step 4). As a result, this project will have two rounds of world building before the students will generate their final solutions. The outcomes of the detailing phase are to be placed below the design track for each cycle.

8.2.3 Contribution to Design Education

In this section, I conclude the potential contributions of the toolset to design education. The purpose of this dissertation was not to develop a toolset and evaluate its utility. However, in the process of conducting action research, the WBD toolset proved useful to me for conducting world building workshops. Therefore, I present the toolset as one of the outcomes of this thesis and present my insights on its potential utility for design education. I argue that the WBD toolset can be useful in introducing a new lens for the design students to use when working with futures.

This lens involves an interdisciplinary approach to combine generative research practices with concepts from fiction and world building. The toolset makes it clear to design students that they are working with fiction, enabling them to be more flexible in their speculations. It also introduces a cycle of speculation and assessment, which can enable design students to generate habits for self-reflecting on what makes a speculation more viable in different contexts; improving their abilities to generate better speculations over time. These claims however will need to be evaluated in further research.

It is also possible to combine the WBD toolset with existing forecasting methods such as the delphi method, or different types of trend analyses. Forecasting was not an angle of investigation in this research and therefore I refrain from making specific recommendations; however it would be appropriate to integrate forecasting techniques to the speculation phase, in conjunction with the world building exercises.

Another outcome for this toolset is that just like the theoretical model, it can make the FFED, an otherwise ambiguous process more clear for the design students. While the processes followed in this toolset do not cover every possibility of a chaotic fuzzy front-end, it can give an overall structure to it. This in turn can allow design students and tutors to develop their own strategies for speculation, assessment and centering for different projects and contexts.

8.3 Reflections on the Research Process

In this section, I present my reflections on the research process under two titles. First, I evaluate my action research approach using the previously presented criteria on its validity. Second, I discuss action research's effects on the flexibility of the resulting theoretical model.

8.3.1 Evaluating Validity

In Section 4.2.2 (p. 71), I identified three forms of validity for action research to evaluate my research process. These were outcome validity, process validity, and dialogic validity. In this section, I present my reflections on each of these evaluations and reflect back on my research process.

I argue that the practical outcomes of my research, in the form of the WBD toolset satisfies an assessment of its outcome validity. Not only was the toolset used successfully in a real-world design education project, it was also utilized over request in two different institutions after my analysis was complete. While the purpose and the setup of this study are not to evaluate the toolset's performance, I conclude that this research generated useful outcomes.

I provide two different angles for increasing the process validity of the research. First, I kept two different tracks in my research goal, one for establishing the theoretical model, and one for improving the toolset. Keeping these tracks separate with their own relevant research questions helped me keep each of them in check. On the one hand, my focus on the theoretical model helped me not to rely too heavily on the

results of the toolset's success. On the other hand, focusing on the toolset helped me not to get lost on a theoretical path which does not consider actual and pragmatic concerns.

While I argue that this two-track setup is important for process validity, I also consider that the results were not completely united. The research process provided two outcomes which fed one another, but they are still separate. One possible solution was to conduct more field research, which would be beneficial to better unite the results of the theoretical model and the toolset through more and better varied data. Another option was to focus on one of the tracks. An observation based research methodology could have been applied to explore existing approaches in design education. Likewise, a research through design approach could have been applied to design a toolset and measure its performance. However, I argue that when working on a topic which is relatively under utilized in the field, my two-track approach provides more relevant data.

Finally, I started my field research with Nagihan Tuna, a colleague from the same institution who was working on design fiction herself. While our research goals were different, we had commonalities in terms of our research domains and methodologies. This gave us a chance to create a critical friendship, casually reviewing each other's work and helping each other in the field. I argue that this improved my work's dialogic validity, as it provided another researcher's critical lens and knowledge.

8.3.2 Action Research and Flexibility

Due to the way my research was constructed, the theoretical model is tightly built: the results of each step were used to guide how the next step was carried out. As a result, the final model is water-proof, there is little playroom for my earlier findings, without disrupting my latter findings. I present this as a limitation since it limits the flexibility of the model, especially for understanding contexts that are different from where I conducted my research on.

However, I also argue that this was an unavoidable side effect of using action research. My research focus changed during the different phases of my field research, guided

by the findings of the prior stages. This can only be feasible when these prior findings are anchored down, so that new questions can be asked. As a result, I argue that conducting action research to uncover and theorize a process means that the results will be tight and locked down, rather than being open and flexible.

8.4 Reflections on the Topic

One of the most prominent implications of this study is how fiction can and should be better identified and openly included in design education, as a means of conducting design work for the future contexts. On the one hand, fiction is studied in detail as part of design fiction and design philosophy, both of which are discussed in previous chapters. However design literature heavily implies that fiction is not an embedded part of a design process, nor it is openly categorized as "fiction". Design fiction is often treated as a creative exercise which is strictly contained within limits, and not as a generic method of the design process.

This is how I first approached my research topic as well, by containing world building as a creative exercise to be done in the beginning of a design project. However, by the end of my study, it became clear to me that design students have both pragmatic and implicit approaches towards a distinction of factual and fictional information. Not only they often blended these together, they had a hard time identifying their inflictions which guide these separations.

In light of my literature review, I find these insights to be caused by a lack of recognition about fiction in design education. Openly recognizing and internalizing fiction in ordinary design processes would open up a rich body of knowledge to help build and evaluate it. Some of this knowledge was generated in the scope of this dissertation, but once fiction and world building is an explicit part of a design process, other theories and approaches from media studies, future studies and even design theory would be available to design students. I find this to be especially valuable in design education projects regarding future contexts, because in my own experience, it is very possible for design students and tutors to be confined in a discursive space in which their arguments are judged by personal convictions. Utilizing the literature of making

understandable, accessible, believable, consistent fiction would help open up this discursive space; allowing more studies like this dissertation to observe and document world building practices and methodologies.

8.5 Limitations and Recommendations for Future Research

The major limitations of this study is that my field studies were all done in the same institution within a small range of time. While there were participants from different institutions, they were not the majority. Therefore I conclude that the model I build reflects a limited group's understanding and approach towards my inquiries. However, as I implied in the section above, I consider that this study presented one model of world building in design education, and that there should be others. World building is used in different capacities in all forms of design. Therefore it would be a future research opportunity to explore how other types designers (especially practitioners) approach world building in their own work. It would be valuable to conduct further research into different types of design tasks, such as ones not explicitly focused on future contexts. Utilizing the model of world building from this study in these different contexts can shine more light on how designers organize their speculations and assessments when approaching different kinds of problems.

While I considered action research as a suitable approach for this research, it also introduced certain limitations. Since I developed the initial toolset for the workshops, the results were also dependent on it. Therefore it would be not possible to consider the theoretical model as a distinct outcome from my interventions, and as a result, this study does not provide a grand theory of world building in design education.

On the one hand, I argue that such a grand theory would not be feasible to create, nor useful because of the localized nature of design problems. On the other hand, attempts of creating these case-specific models focusing on different institutions, design problems or participant expertise would be useful in understanding how world building is conducted. Moreover, it would also be beneficial to use an interdisciplinary approach, collaborating with researchers from futures and media studies. While I employed some relevant literature from these domains, a truly interdisciplinary study

would provide a richer understanding on how design, futures and fiction blends together.

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Appendix A

ORIGINAL QUOTES

Quotes from Chapter 5

[1] Pc-Coffee-Maker içinde kişilik kartı bulunduran, kahve demlemeye yarayan bir pişirme aleti. [...] kişilik kartları bakımından beşe ayrılmaktadırlar. Bunlar, mutlu hizmetçi, sadık arkadaş, huysuz amca ve ...

[2] Kişiye özel karakter tasarlamak. Kişinin karakter analizi.

[3] T.C. Anayasa Mahkemesi: Yasa 54352...3 numaralı yasa gereği, 03.05.2025 tarihinden itibaren PC-Coffee-Maker ile kötü konuşmak, hakaret etmek, sosyal ve dini inançlarını alaya alan yorumlarda bulunmak yasaklanmıştır.

[4] Makinelerin sigortalı çalışmaları zorunlu. Rüşvet teslim etmek yasak. Makineler vergiye bağlanıyor.

[5] Çok uyumsuz. Hem çalışmıyor hem de geçimsiz. Söylene söylene bütün mutfak robotlarımı kovdu evden. Sakın almayın. Paranıza yazık.

[6] Bir kota üzerinde PC içeren cihazla vakit geçiren bireylerin rehabilitasyona alınması.

[7] T.C. Anayasa Mahkemesi: Yasa 54352...3 numaralı yasa gereği, 03.05.2025 tari-

hinden itibaren PC-Coffee-Maker ile kötü konuşmak, hakaret etmek, sosyal ve dini inançlarını alaya alan yorumlarda bulunmak yasaklanmıştır.

[8] Bir kota üzerinde PC içeren cihazla vakit geçiren bireylerin rehabilitasyona alınması.

[9] Makinelerin sigortalı çalışmaları zorunlu. Rüşvet teslim etmek yasak. Makineler vergiye bağlanıyor.

[10] Finlandiya: Hak hukuk adalet. İsviçre: Başka sorunları yok.

[11] Yasa: Kahve makinası evde kullanıcıyı sensörleri yardımı ile dinleyebiliyor. Hacklenmesi durumunda dışarıdan bir yabancı evi dinleyebilir. Bu durumu düzenleyen yasal bir düzenleme yapılabilir. En çok hacklenen ülke İngiltere olduğu için burada çıkmıştır.

[12] Bill: "İzlanda'da (yine öncü oldu!) personalzied core'lu ürünlerle evlenmek yasal hale getirildi. Yasaya göre herhangi bir anlaşmazlık durumunda vatandaş ve bilgisayarlar haklarını koruyabilmek için mahkemeye başvurabilecek, hatta boşanma davası talep edebilecektir.

Quotes from Chapter 6

[13] All rights reserved. Illegal bir şekilde üretildiği tespit edildiği durumlarda üretimden sorumlu olan kişilerin el fonksiyonlarının geçici bir süre boyunca engellenmesini sağlayacak untissuet ürünü uygulanacaktır.

[14] Salgılanan hormonlar yardımıyla algılar ve ona göre insan duygularını kontrol eder.

[15] Kıyafet etiği: Hangi organik hücrelerden yapılmış kıyafetleri giymek etiktir?

[16] Solüsyon: Kıyafetin çürümemesi ve gün boyunca giyilebilir olması için 24h, 48h, 1 hafta vb. Seçenekleri bulunan sıvı bir ürün.

Quotes from Chapter 7

[17] Ya ben kendi adıma söylemek gerekirse ben çok inanmıştım. [...] Şu anda benim ailem ve kendim özel olarak sporla çok ilgilendiğim için yarattığımız dünyanın ben gerçekçi olduğunu düşünüyorum.

[18] Proje boyunca personalization'a inandık. [...] Ve projenin bir aşamasında neler isteyip neler istemediğimize karar verdik açıkçası. Mesela insanların sosyalleşmesini istiyorduk. O yüzden proje boyunca buna da inandık. İnsanların sosyalleşeceğini de... yani sosyalleşmesi gerektiğine de inandık.

[19] O yüzden en başta yapılan bu araştırmalar... [...] Yani, hep bu konulardan ilerlediğimiz için hep araştırmayı temel alıp ilerledik. O yüzden bunu, buna dair hiçbir şeyi değiştirmedik. [...] Hep onları mutlak bir şekilde yani onları değiştirmeyeceğiz diye varsaydık. O çünkü araştırma sonuçları, net bilgiler olarak varsaydığımız için, bence çok agresif bir değişiklik olmadı.

[20] Bence inandırıcıydı çünkü yani dünyayı çok değiştirmeye çalışmadık. Dediğim gibi olan teknolojiler daha gelişse ve hayatımıza uyarlansa nasıl olur üzerinden gittik. O yüzden bence inandırıcı bir gelecek yani, beklenen bir gelecek. Hatta gelecek şu an bile olabilir.

[21] Bunu yapmamızın da sebebi biraz daha kullanıcımız kim diye araştırırken IBM'in bir makalesine denk geldik ve burada z jenerasyonu ve sonraki jenerasyonların aslında co-creation'a çok yatkın hatta buna karşı bir talep olduğunu söylüyordu. [...] Ondan ötürü biraz daha böyle bir şeye yönelmiştik biz de.

[22] Dediğim gibi makaleler okuduk ve makalelerde aslında mağazaların olacağı söyleniyor. Şu anda bile mağazalar o kadar değer görmüyor. Online shopping'den sonra. Ama okuduğumuzda hala insanların mağazalara gideceği söyleniyordu. Ve daha çok deneyim için gidecekleri söyleniyordu. Biz aslında bunlardan yola çıktık.

[23] Evet belki 20 sene sonrası için bir şeyler yapacağız ve bizim öngöremediğimiz şeyler de olabilir. [...] Sadece ben şunda çok zorlanmıştım mesela. Bize çalışma yeri olarak İstanbul'u vermişlerdi ve İstanbul için 20 sene sonrasını öngörmemiz gerekiyordu. Ama İstanbul'un gelişmesini ve işte 20 sene sonraki alacağı şeylere yani baktığımız zaman işte atıyorum büyük bir depren bekleniyor aslında onun olması çok olası. [...] Böyle gerçeklikler varken bunları elimine edip yani sanki olmayacakmış gibi öngörüp farklı şeyler öngörmeye çalışmak şey ikilemi yaratıyordu.

[24] Ya aslında çok zor bir şey bence geleceği tahmin etmek. Çünkü özellikle de yani Türkiye'de tahmin etmek biraz zor. Çünkü hani biz diğer daha Avrupa ülkelerinden falan biraz daha böyle geriden geldiğimiz için ne olup biteceğini kestiremiyoruz.

[25] Bir fikir buluyoruz. Biraz uçuk bir fikir oluyor bu sefer. Ve bu sefer de hocalara gidip bunu göstermemiz, hocam böyle böyle bir şey yaptık hani mesela, hologram çıkacak bir anda öyle konuşacağız gibi bir şey diyoruz. Hani çok mu uçtunuz acaba gibi tepkiler aldık bazen de gibi.

[26] Yani evet böyle yönlendirildim. Bilmiyorum.

[27] [Depremden sonra] Ne gibi değerler yok olur ve gelen turistler, bizim konu üzerinden değerlendirecek olursak gelen turistleri gene İstanbul'un o eski değerlerini eski şeylerini görmek için gibi bir şeyler götürdüğümüzde işte bunu biraz daha olumsuz olacağını düşündükleri için göz ardı etmemizi istediler.

[28] Hepimizin aklında çok daha farklı şeyler vardı mesela ben daha fazla oyun üzerine

gitmek istedim.

[29] Çünkü ee, yani tekstil aslında grupta özellikle iki kişinin, benim de dahil olduğum diğer bir arkadaşımızın da çok üzerine, çok sevdiğimiz bir konu değildi açıkçası. O yüzden buna dair çok fazla şey de düşünmemiştim şahsen. Biraz bence ötekiler olsaydı bizim kafamızda bir fikirden oluşan bir şey olurdu fakat burada şu son geldiğimiz noktada aslında süreç bizi buna yönlendirdi bence.

[30] Yani çalıştayda yaptığımız gelecek bize daha mantıklı ve tutarlı geldi. Ama öyle bir geleceğin olmasını istemediğimiz için final projesi için başka bir gelecek kurguladık.

[31] Artık kendimizi o kadar çok Black Mirror bölümlerinde hissettik ki. Bu bizi biraz bilmiyorum hem ürküttü bence [...] Ondan ötürü bundan biraz uzaklaştık.

[32] [...]hiç isteyerek yapmadım çünkü o eklemeyi [insanların gelecekte durmaksızın çalışacaklarını]. [...] Bu kadar mı karamsarız arkadaşlar diye çok tartıştık kendi aramızda ama. [...] Çok karamsar olmamıza gerek yoktu ama karamsar bir dünyada o ürün daha çok parlıyordu. Onu daha çok parlatmak istedik birazcık.

[33] Bunları boş verin ve biraz daha distopyaya giden bir şey olduğunu düşünüyordu hocalar. Ki biz hani nötr yaklaşıyorduk hani. Atıyorum mesela deprem söz konusu olduğunda tamamen distopya olmak zorunda değil, deprem olduktan sonra nasıl bir travelling, işte seyahat, kıtalararası seyahat aktivitesi olur İstanbul'a.

[34] Yani ben şu an ki teknolojileri bu kadar çok bilmediğim için, bana her şey böyle aa nasıl böyle bir şey olabilir bence bu yapılamazdı. [...] Keşke evet şu anki teknoloji bilgim, araştırabilsem böyle şeyleri ilgim olsa çok daha iyi olurdu yani benim için.

[35] Şu an ben teknolojiden başka bir şey düşünemiyorum çünkü teknoloji sadece teknik

olarak da kalmıyor işte dediğim gibi insanların yaşayışını çok değiştiriyor. [...] Evet bunu okumak önemli bence. Bu konuda bilgi sahibi olmak.

[36] Çok zorlanmıştık o zaman. Yani çünkü çok ayaklarımız yere basmıyordu, o yüzden haliyle tedirgindik. Ne yapacağız? Hiç mi olmayan bir şey diye düşünüyorduk. Sonrasında hani evet var olan bir şey yapacağız, öncü teknolojileri kullanacağız ama hani nasıl ayaklarını yere bastırabiliriz bu projenin ikileminde çok kaldığımızı hissetmiştik etkinlik boyunca.

[37] Ama bu fikirlerin gerçekleşmesi çok da mümkün olan şeyler değil pek çoğu ya da teknolojinin 20 yılda geleceği nokta hala aynı fizik kanunlarına bağlı olarak gerçekleşecek. Mesela workshopta çoğu yapılan, sadece bizim de değil pek çok insanın yaptığı şey aslında bu gerçekliğe uymayan şeylerdi. Ama o tasarımcının belki yapması gereken bir şey. Bir ilk başta, ilk durduğu noktadan uzaklaşmak sonra geri adım atıp biraz daha gerçeklere yaklaştırmak [...].

[38] Evet. Ama ondan sonra, onu [araştırma sonuçlarını] ayırdık ama ondan sonrasında yine birazcık hayal gücümüze de kaldı açıkçası. Şeyden kopabildik yani, somut işte araştırma verilerinden biraz kopup kendimiz düşünebildik.

[39] Şey sıkıntısı vardı. Workshopta gerçekten uçmamız mı gerek, yoksa ayaklarımızın yere basması mı gerek şeyini çok tartıştık biz. Hani o bizi zorlayan şeylerden biriydi. Bu dünyaya da çok inanmamıştık açıkçası. Hepimizin çok içine sinen bir dünya değildi. Ama hızlı hareket etmemiz gerekiyordu.

[40] Fazla uçtuk biz bu konuda yani haptic teknoloji evet kullanılabilecek bir teknoloji ama biz öyle bir şey sunduk ki kullanıcılara, yani her bir modül çok ince pikseller halinde size ulaşıyor. Ve onun ne kadar ulaşacağı belli değil, böyle bir programlama o kadar zor ki yani. Bunun bir sınırı yoktu ve biz insanlara belli şeyler sunalım dedik ama sunduğumuz şeyler de çok fazla uçsuz bucaksız yani. Kullanıcıyı öyle bir deneyime

sunmak bile zorlayıcıydı. O yüzden bence olabilirliği düşük olarak bakıyorum.

[41] İlk fikirleri yapmaya başladığımızda tabii doğal olarak en, yani aldığımız en çarpıcı eleştiri şeydi. E bu çözümler 2040 değil ki. Şu ana uygun ki mantığıyla bir kritik almıştık.

[42] Çünkü hali hazırda o teknolojilerin hepsi var. Ve siz diyorsunuz ki bu gerçekten 2040 mı?

[43] Yani şöyle ben kendimi yeterince proje süresince workshop 'tan sonraki aşamalarda girebildiğim düşünmüyorum. Sürekli 2040'ta mıyız? Bu 2040 mı? 2040'ta ne olacak? Sonuçta böyle bir problem üzerinden ilerleyemiyorduk. 2040'taki insanların problemlerini anlayamıyoruz. Ya da problemleri var mı onu dahi bilmiyoruz. O yüzden hiç belki ihtiyaçları olmayan yeni bir alan, bir fırsat oluşturmak gibi bir çözüme yönlenmeye çalıştık bir noktada. O yüzden hala kendimi içine girmiş olarak görmüyorum.

[44] Biraz context'in dışına çıkar diye düşündük. Hani şey özelliği gösterecektik mesela. Mail atabilirsiniz, not alabilirsiniz özelliği. Yani ama onun biraz tasarım context'inden çıkacağını düşündüğümüz için.

[45] Biz başından beri çok kapsayıcı olmasına sanırım çok uğraştık. Çünkü müzik dinlemenin çok fazla yönden tanımı vardı yani. Onu yaratmanız onu paylaşmanız, onu dinlemeniz, ona odaklanmanız vesaire gibi. O yüzden bunların hepsini bir yerde, bir süre çok birleştirmeye çalıştığımızı hatırlıyorum bir dünya içerisinde ama hem projemiz yeterince hani o kadar çok bir şey yapmaya zaman vermediği için.

[46] Çok tutarlı bir şey olmuyor. Çok birbirine bağlantılı da sayılmıyor aslında. Buradaki fikirleri çok ayrı ayrı tutmuşuz.

[47] Şimdi biz AR teknolojisini kullanıyoruz. [...] eğer AR gerçekten yaygın bir teknoloji olacaksa o zaman her yerde olacak ve bunun için başka ürünler de olacak. O zaman işte bu ürünlere de adapte olabilecek bir sistemimiz olması gerekecek. Ya da bir şekilde kendini ondan ayırt etmeli bizim ürünümüz diye düşünüp daha şey yapmaya çalışmıştık ürünü.

[48] Ya şöyle diyebilirim mesela bu genel olarak diğer gruplarda da gördüğüm bir şeydi. AR teknolojisini kullanıyor. O zaman insanın şeyine şu geliyor, aklına. Telefon ileride nasıl olacak? Bu onun içine entegre edilen bir şey olabilir mi? Galiba en büyük şey şuydu. Yaptığımız şey birazcık gelişmiş bir telefona kayıyordu. O zaman işte ileride telefon nasıl olacak, ileride teknolojiler... çünkü 20 yıl gerçekten az bir süre değil yani. Çok değişebilir. O yüzden oralara çok girmemeye çalıştık olabildiğince [...] yani daha işte duruma göre özelleşmiş bir ürün yapalıma yöneldik.

[49] Mesela biz AR gözlükleri kullanıyorduk aslında. Ve bu gözlüklerin ee ileride hani 20 sene sonrasında belki de çok yaygın olabileceğini aramızda konuşsak da süreç boyunca. [...] Ama biz yine de ayrı bir gözlük sanki insanlarda ayrı bir AR gözlüğü olmayacakmış da bizimkini alıp anca o sisteme, o servise öyle erişebileceklermiş gibi düşündük. [...] İşte telefon varken tekrar bir telefon tasarlayıp içine bir aplikasyon yerleştirip o aplikasyonu kullanmak için bu telefonu almanız gerekiyor dememiz gibi bir şey. [...] Ya öyle bir şey tutarsızlık hissetmiştik hep birlikte bu sonuna kadar.

[50] Şimdi 2040'ı hayal ediyoruz tamam. Mesela burada biz o dünyayı mı hayal ediyoruz? Dünyadaki şeyleri mi hayal edip o dünyaya mı bir ürün tasarlıyoruz? Yoksa mesela şey de hayal ediyor uyuz? 2040'ta egzersiz anlayışı nasıl değişecek?

[51] Ama işte hocalarımızın falan yönlendirmesi de önce bir 2040 dünyasını, hatta 2040 İstanbul'unu yaratmamız gerekti. Ne olacağını, insanların neye dönüşeceğini. Ve bence bu bizi ancak öyle çözüme itiyor.

[52] Bence ikisi aynı anda ilerledi ve birbirilerini tamamladılar gibi oldu. Biz başta şey fikriyle ortaya çıkmıştık hani anında tasarım, anında çözüm bulma, hızlı çözüm bulma. Bu fikri geliştirirken bir anda baktık ki aslında dünya da buna bir noktada uyuyor. Yani biz sanırım biraz fikirden başladık. Dünya ona biraz da tutarlı bir şekilde oturmuş oldu.

[53] Ya aslında her ikisi de. Çünkü biz iki tarafı da sürekli dengelemeye çalışıyorduk. Bir yandan dünyayı kuruyoruz. Dünyada olması gerek şeyleri yerleştirdikçe ürüne eklemeler yapıyoruz. Ya da üründe bir şeyler olduğu zaman dünya kurgusu da haliyle daha çok şekilleniyordu.

[54] Dediğim gibi başlarda mesela sizin yaptığınız workshop etkinlikleri ile beraber çıkacak haberleri falan düşünürken bir anda kendi aramızda bu ürünün gidebileceği bütün kötü yönleri düşündük. Şey yapabileceği yönleri düşündük. Dünyadaki insanların günlük hayatlarının nasıl insanlara dönüşeceklerini.

[55] Bence bu workshop biz hangi aşamada, trends research kısmını atlattıktan sonra olması gerekiyor. [...] Çünkü bu workshop'u gerçekleştirdiğimiz zamanda hali hazırda belli fikirlerin üzerinden dönüp dolaşıyorduk zaten. Ve kafamızda belli şeyler vardı. Ve ister istemez onlardan uzaklaşıp başka bir dünya hayal edemedik. Tamamen özgür olamadık yani. Ama eğer trend research kısmından hemen sonra olsaydı ve ben bu proje hakkında hiçbir şey araştırmamış olsaydım bence çok daha güzel böyle özgür bir dünya yaratabilirdim.

[56] Bu gibi şeyleri [dünya kurgusu egzersizlerini] biz projenin sonuna kadar yani o kağıtları çıkarıp koyup veya işte. O soruları sürekli birbirimize sorup ilerletmeye çalıştık ve bence çok faydasını gördük.

[57] Benim teknolojiyle aram çok iyi değil. [...] Yani ben şu an ki teknolojileri bu kadar çok bilmediğim için bana her şey böyle aa nasıl böyle bir şey olabilir bence bu yapıla-

mazdı. [...] Keşke evet şu anki teknoloji bilgim, araştırabilsem böyle şeyleri ilgim olsa çok daha iyi olurdu yani benim için.

Appendix B

ANALYSIS OF WORLD BUILDING ELEMENTS FROM TELEVISION SHOWS



Figure B.1: Elements identified in the show: Westworld



Figure B.2: Elements identified in the show: Better Than Us

Appendix C

DIEGETIC PROTOTYPES FROM WORKSHOP 1: SECRET LIFE OF OBJECTS



Figure C.1: Team 1's diegetic prototype from Workshop 1



Figure C.2: Team 2's diegetic prototype from Workshop 1

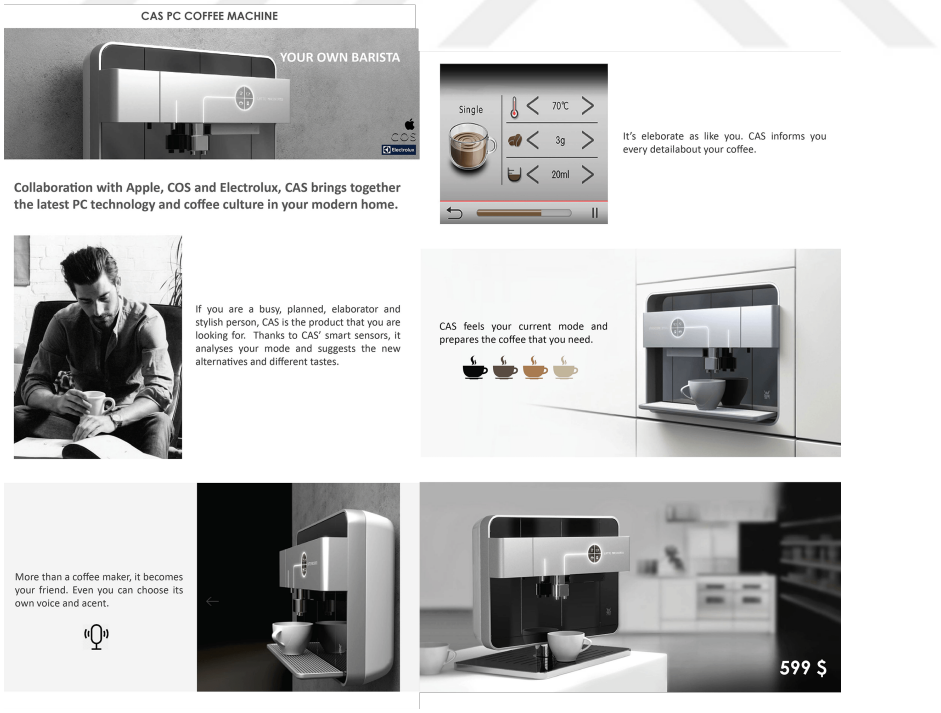


Figure C.3: Team 3's diegetic prototype from Workshop 1



Figure C.4: Team 4's diegetic prototype from Workshop 1

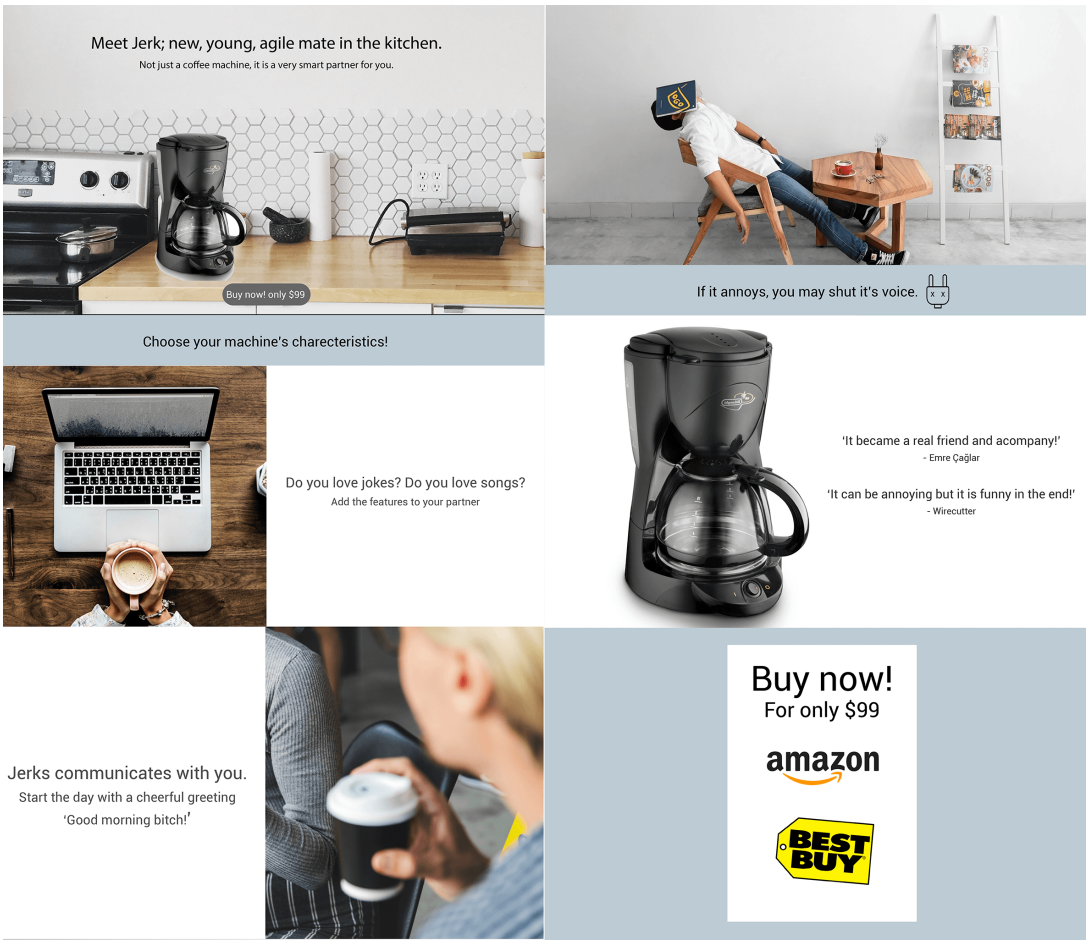


Figure C.5: Team 5's diegetic prototype from Workshop 1

Appendix D

WORLD BUILDING EXERCISES FROM WORKSHOP 2: ORGANIC DESIGN

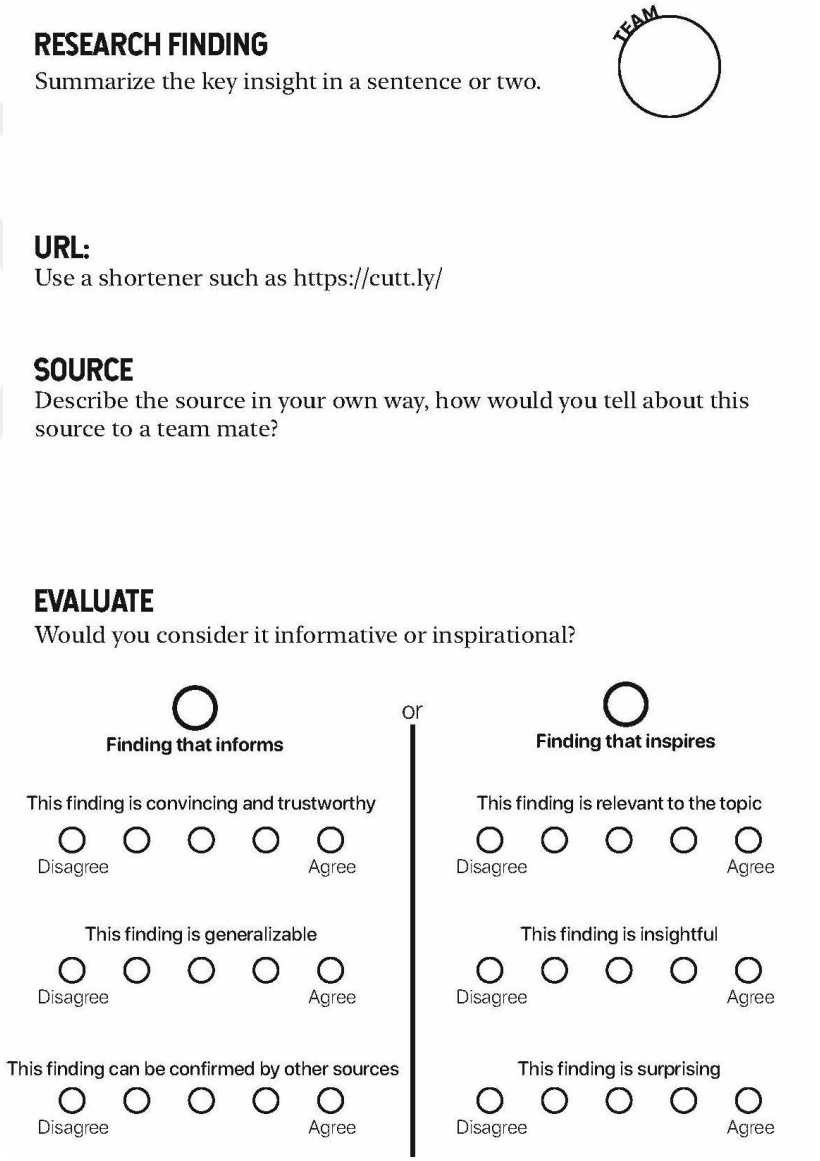


Figure D.1: Research Finding Sheet, from Workshop 2

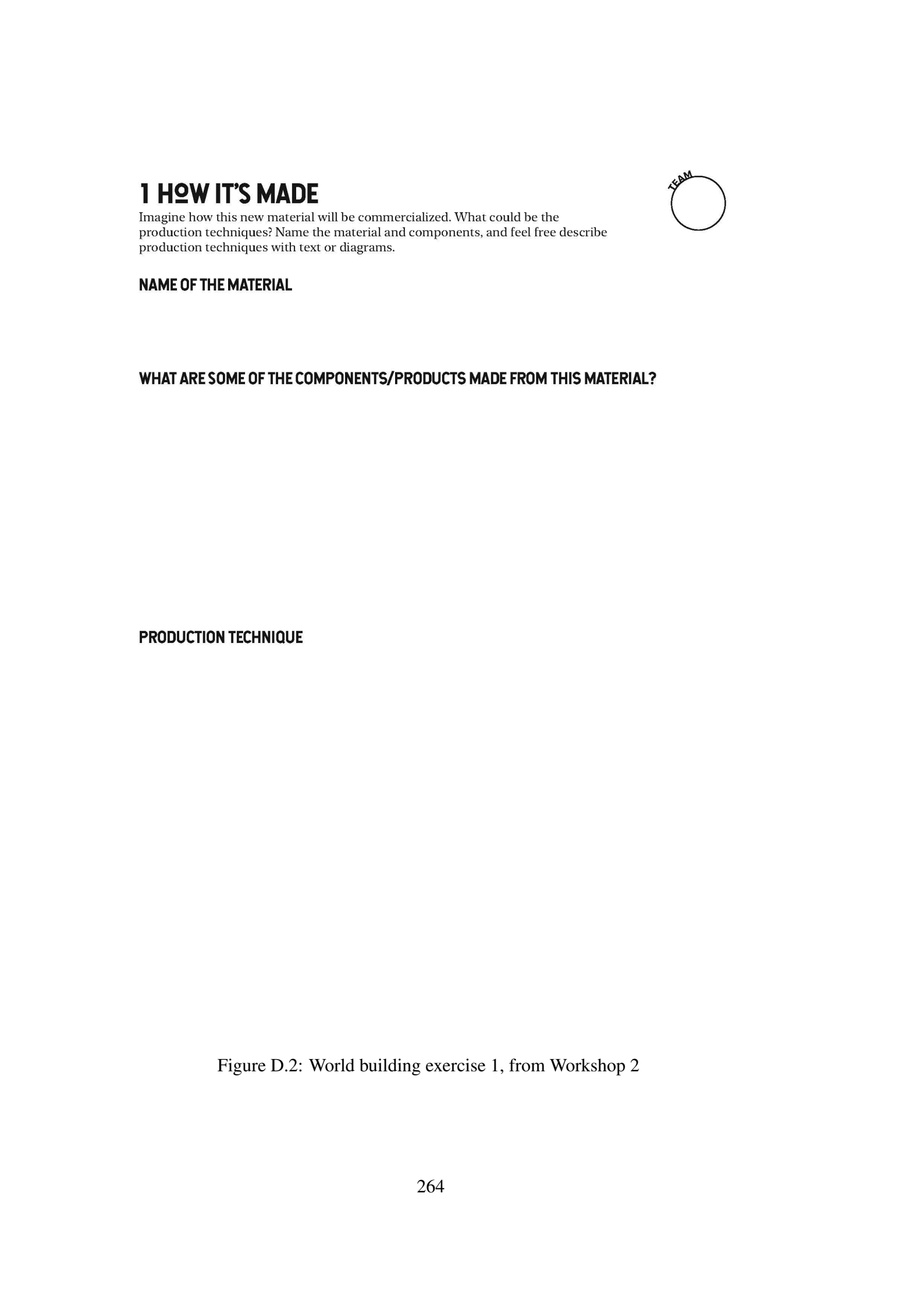


Figure D.2: World building exercise 1, from Workshop 2

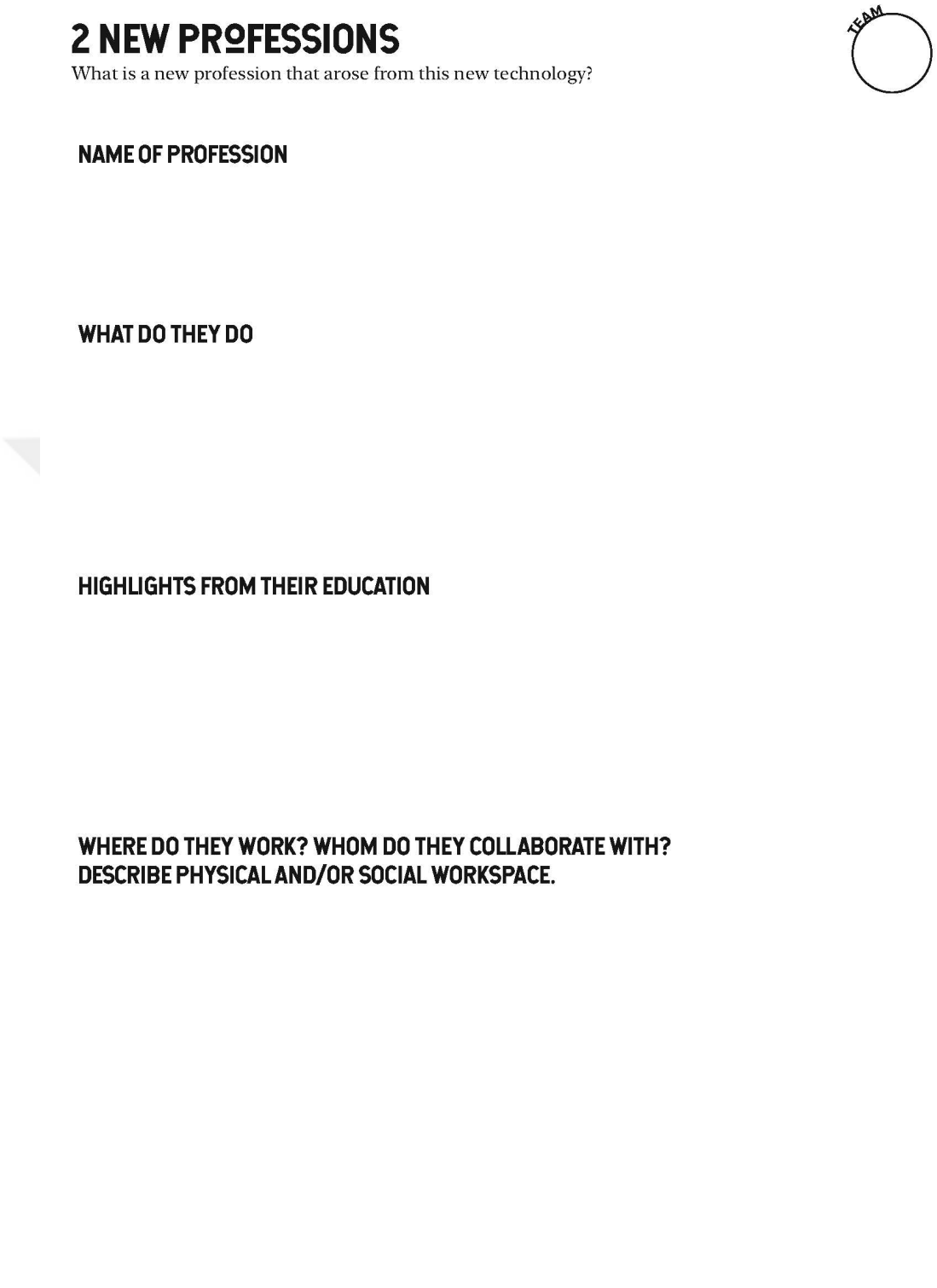
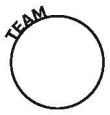


Figure D.3: World building exercise 2, from Workshop 2

3 BRAND IDENTITY

Imagine the company or institution that is a major player in this field.



NAME AND LOGO

SLOGAN

BRIEF HISTORY

Figure D.4: World building exercise 3, from Workshop 2

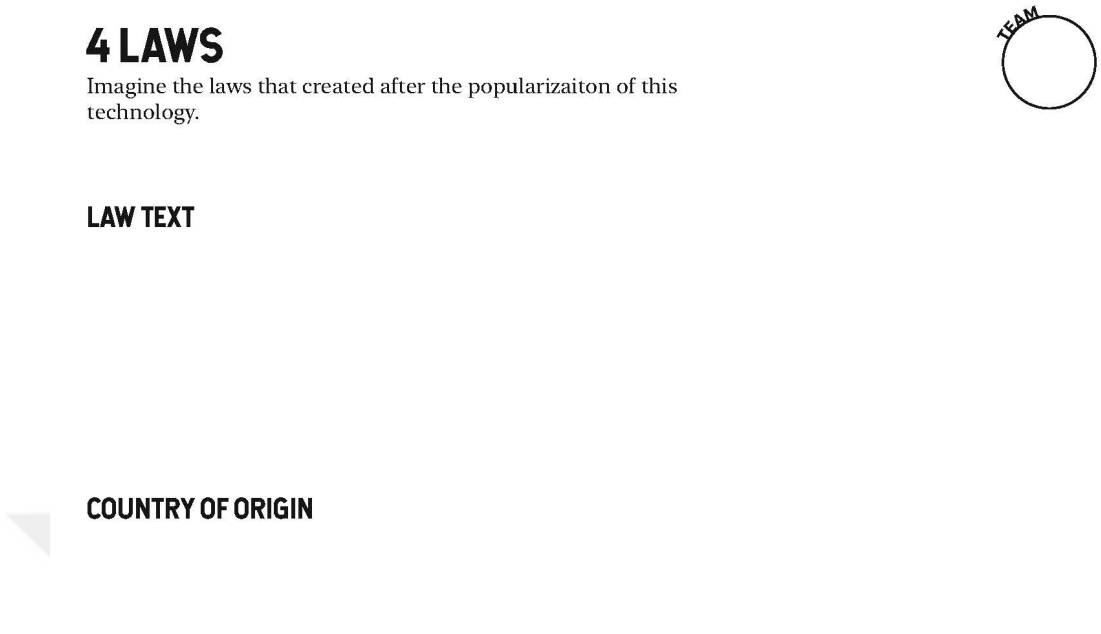


Figure D.5: World building exercise 4, from Workshop 2

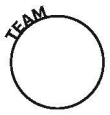


Figure D.6: World building exercise 5, from Workshop 2

Figure D.7: World building exercise 6, from Workshop 2

7 STORAGE

How will materials, components or products made by this technology be stored?



WHERE AND HOW IS THE RAW MATERIAL STORED?

Figure D.8: World building exercise 7, from Workshop 2



Figure D.9: World building exercise 8, from Workshop 2

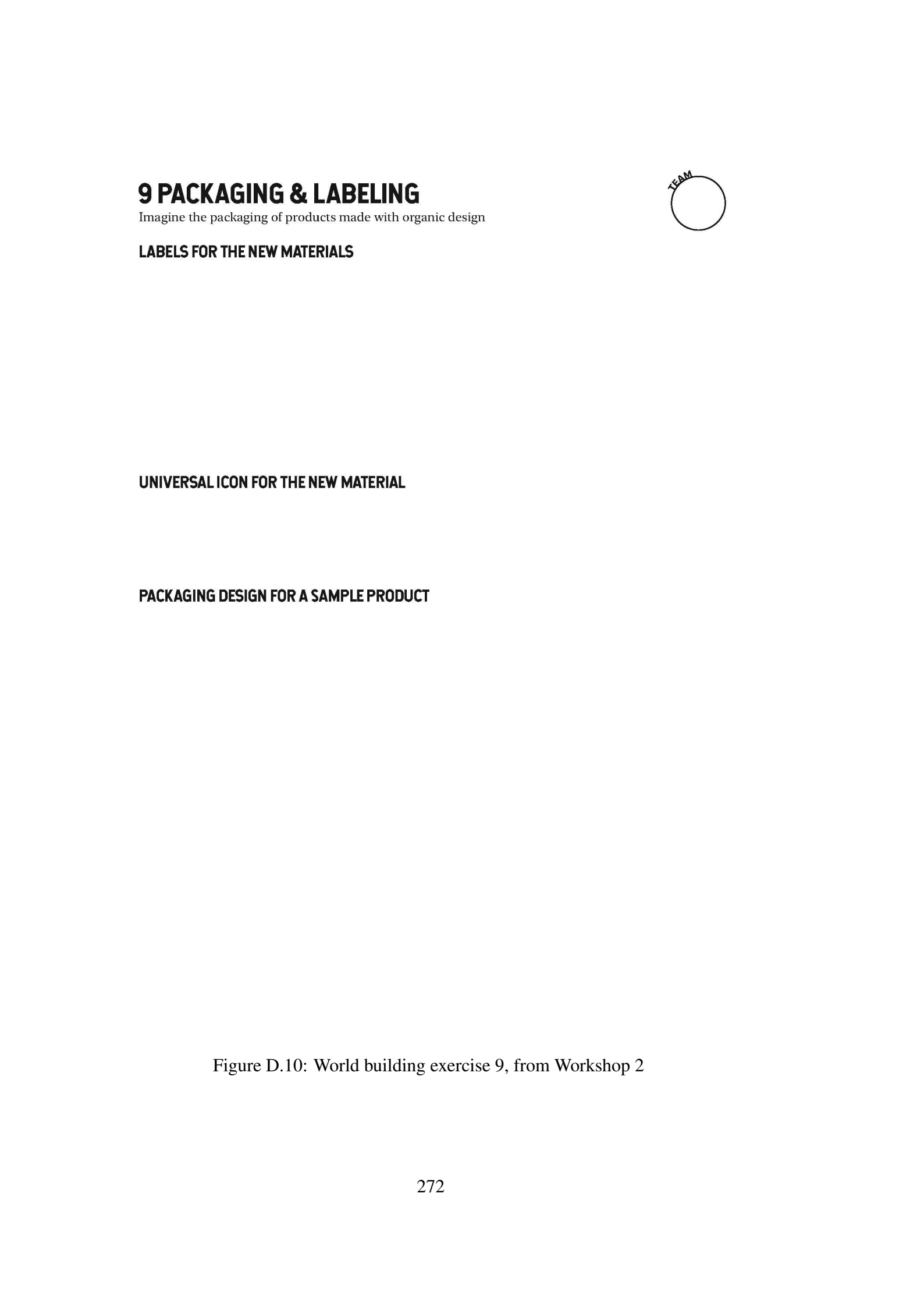


Figure D.10: World building exercise 9, from Workshop 2

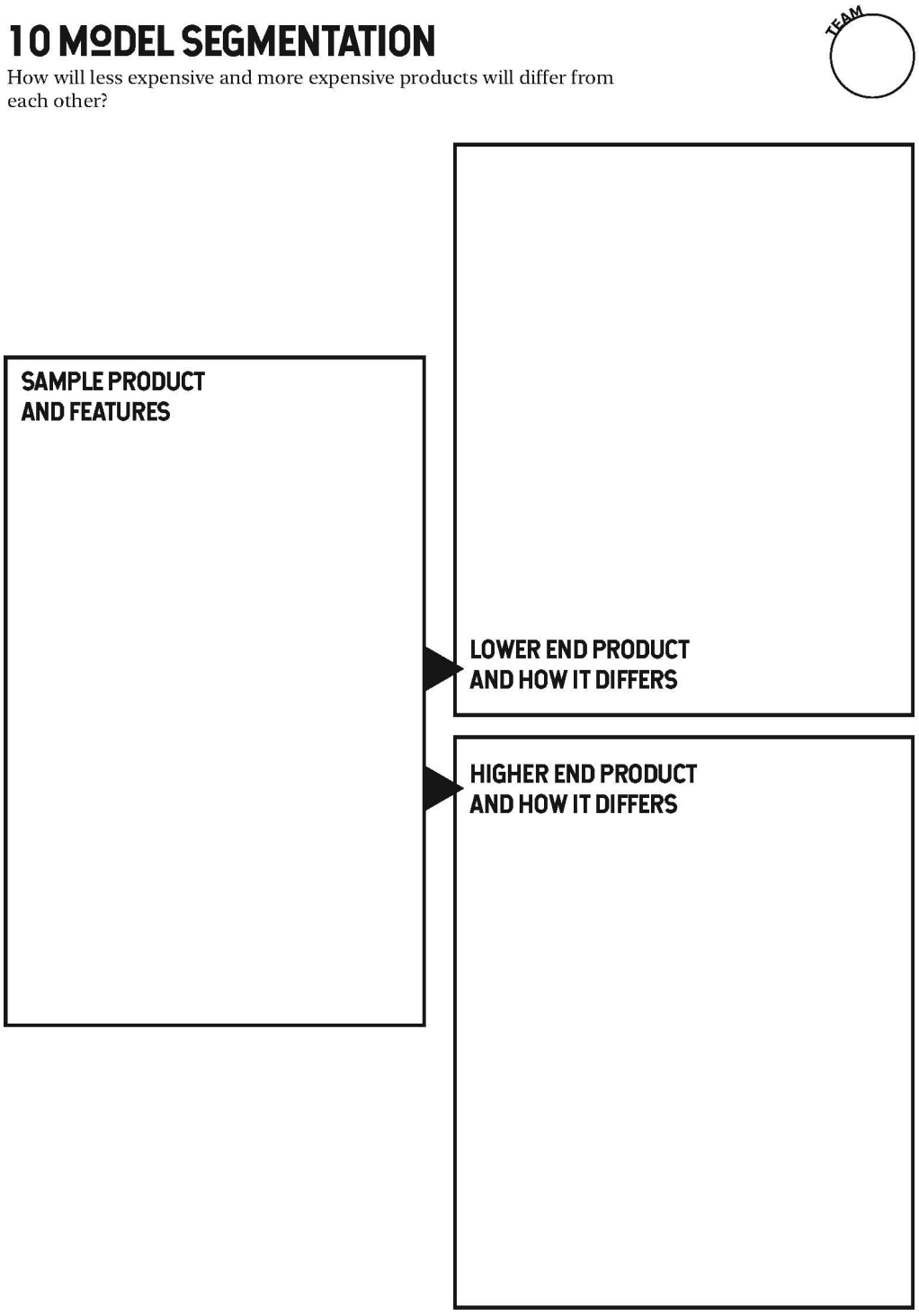


Figure D.11: World building exercise 10, from Workshop 2

11 FUNCTIONALITY

Describe one scenario in which organic design will solve a problem by a novel functionality.

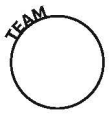


Figure D.12: World building exercise 11, from Workshop 2



Figure D.13: World building exercise 12, from Workshop 2

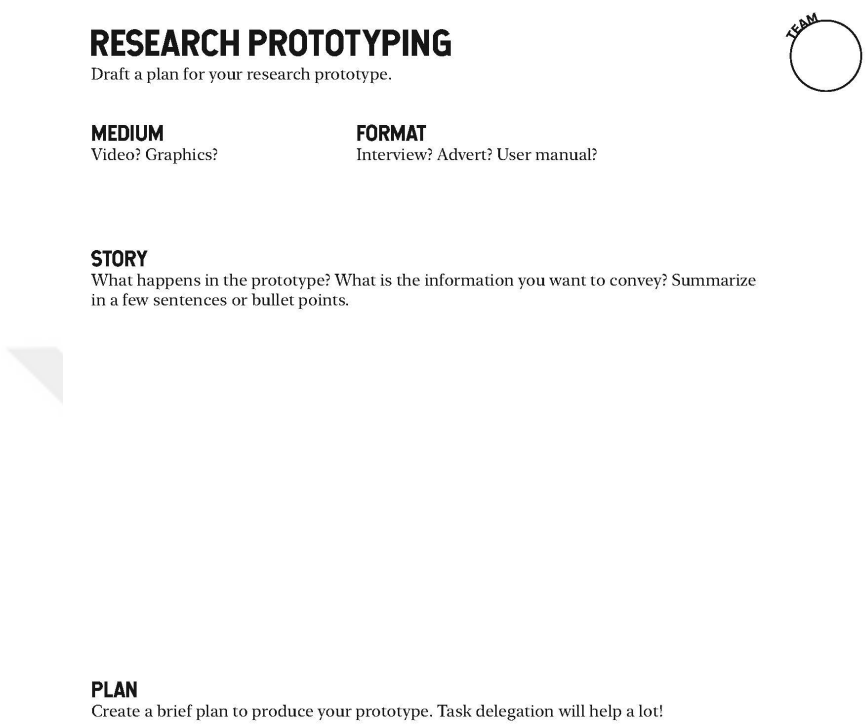


Figure D.14: Research Prototyping Sheet, from Workshop 2



Figure D.15: Peer Review Sheet, from Workshop 2

Appendix E

ARC PROGRESSION MAPS FROM WORKSHOP 2: ORGANIC DESIGN

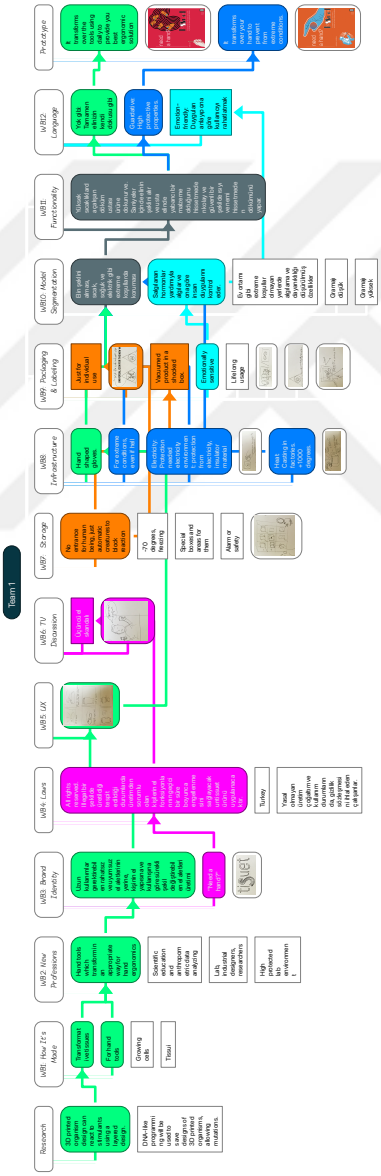


Figure E.1: Progression map for Team 1, Workshop 2

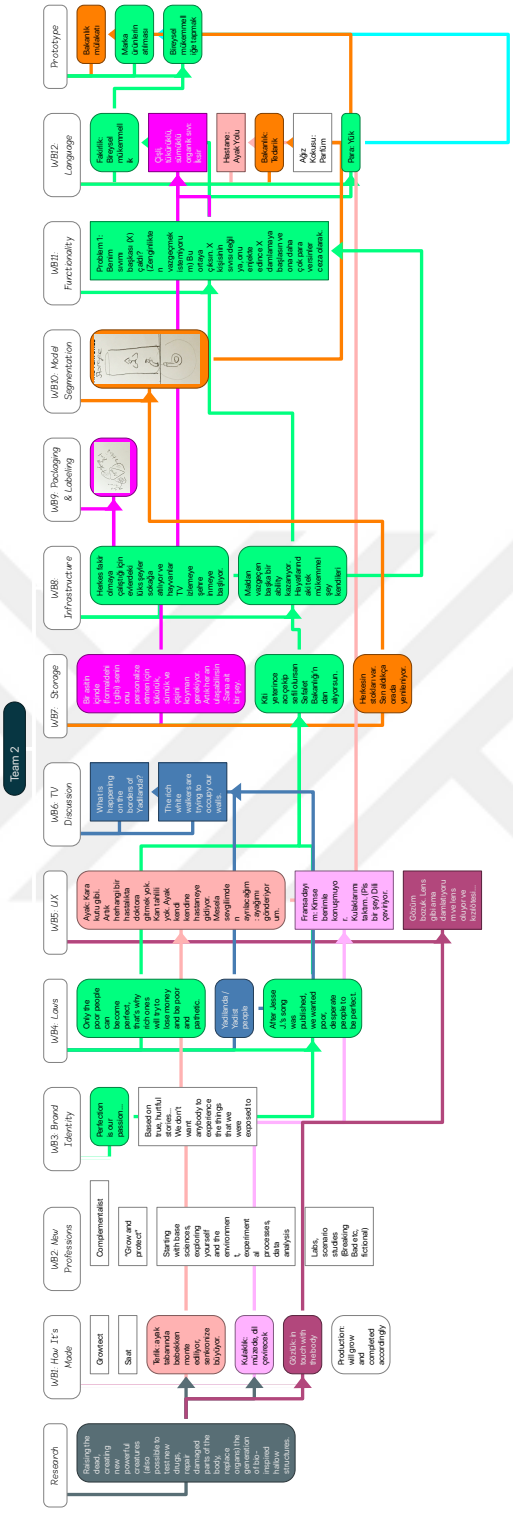


Figure E.2: Progression map for Team 2, Workshop 2

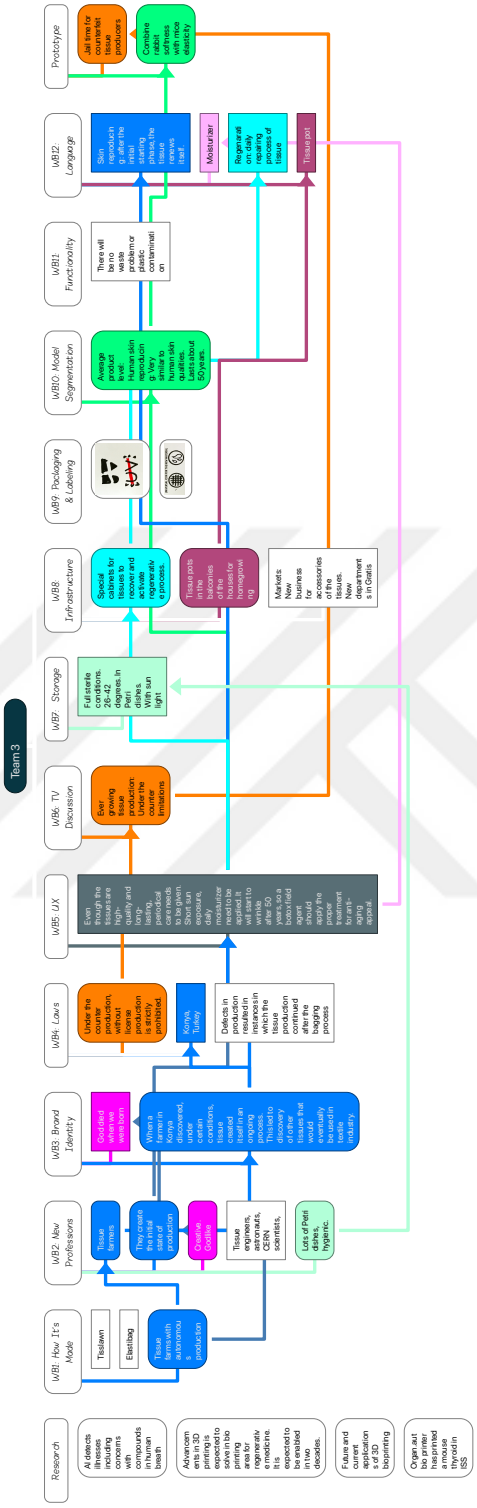


Figure E.3: Progression map for Team 3, Workshop 2

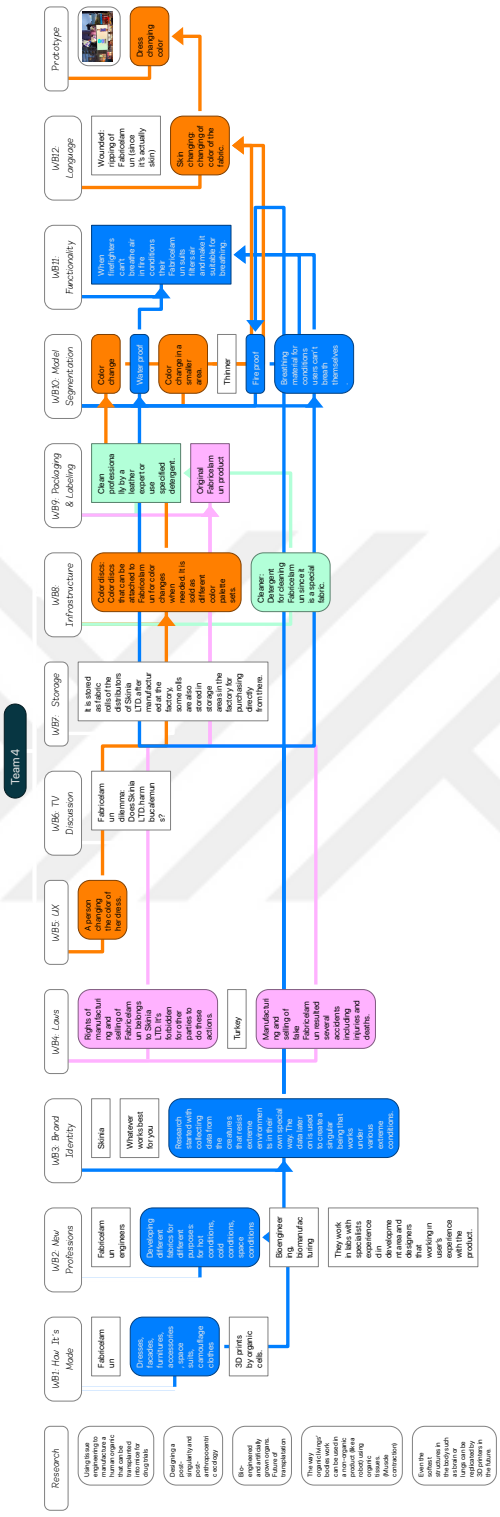


Figure E.4: Progression map for Team 4, Workshop 2

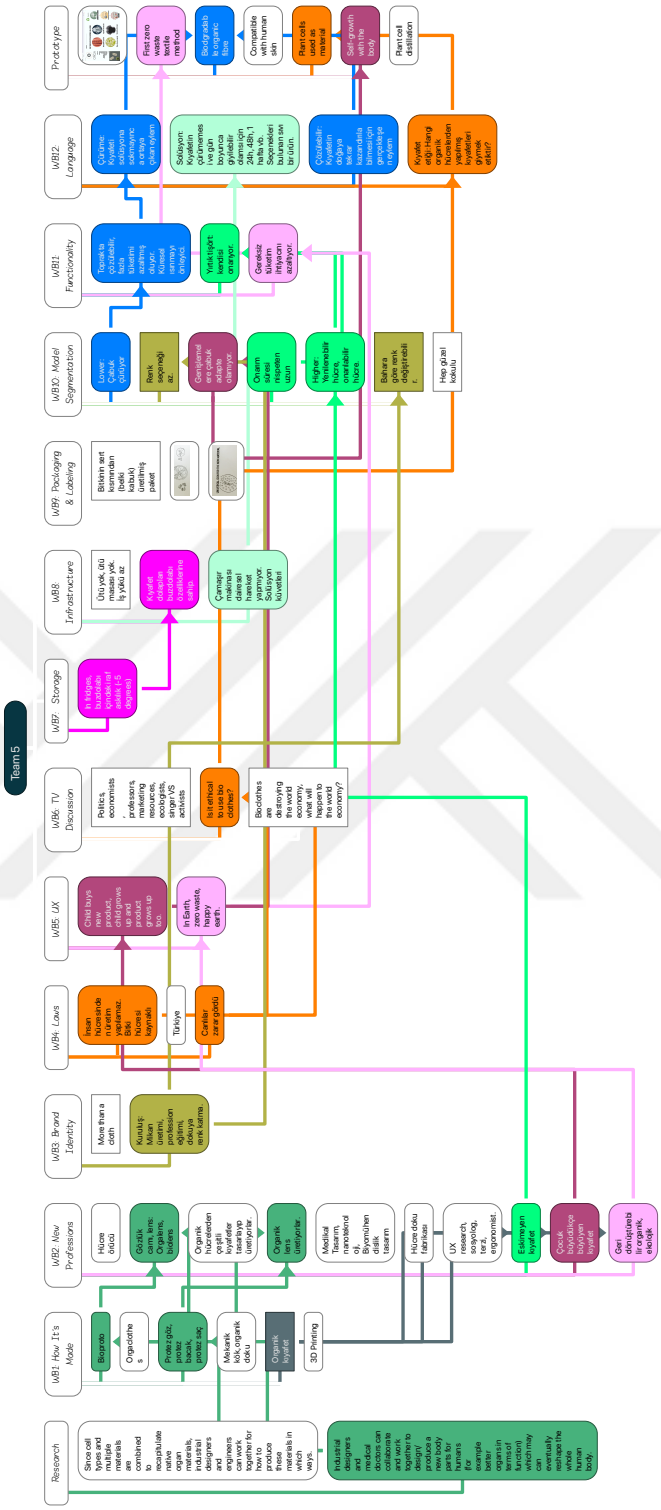


Figure E.5: Progression map for Team 5, Workshop 2

Appendix F

PROJECT BRIEF FOR THE STUDIO CLASS

Middle East Technical University | Faculty of Architecture | Department of Industrial Design

INDUSTRIAL DESIGN STUDIO 4

ID401 Industrial Design V
2019-20 Fall Semester

PROJECT 2 – DESIGN BRIEF

'FUTURE OF ... IN 2040'

The year is **2040**...

How will some of our most familiar activities – **shopping, exercising, cooking, intercontinental travelling, music-listening, relaxing, designing, gaming** – be different twenty years from now? This project requires you to forecast the future of one of these activities (to be assigned to you).

You will visualise concepts for new products, services, places and infrastructure that will surround the activity. **Working in groups**, you will carry out high-quality research, set directions for conceptual design thinking and generate amazing ideas.



www.agilitypr.com/wp-content/uploads/2019/10/future-1-1080x542.jpg

You will create a **future design vision** and explore **usage scenarios** relevant to your assigned activity. Thorough consideration of a wide variety of **trends** and **future forecasting** will be vital. You are then expected to design the **products and services (physical + digital)** that will accompany the activity in 2040.

You will place your users of the future into spaces that bring your design concepts and their interaction to life as a complete system: for example, at work, in outside-work environments, or in future places of habitat.

On completion of the project, you are required to take your audience on an inspirational journey, showing a glimpse of a convincing future for your assigned activity that can serve as a source of information for designers and companies creating strategies for future generations of products and services.

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Figure F.1: Briefs distributed to students for the project, page 1 of 2

PROJECT STAGES

The project will run for seven weeks including the final jury. It will be managed through workshops, in-class exercises, take-home assignments, design critiques and juries – shown in the project timetable. On **Thursday 21 November**, there will be a special '**Designing (for) Story Worlds**' workshop facilitated by Emre Çağlar and Res. Asst. Nagihan Tuna: ***"you will rapidly create fictional artifacts of a potential future world based on your research, becoming comfortably engaged in them for developing your initial ideas."*** The following components of the project are assessed.

Individual Design Challenge	**5%**	**Individual**
Trends Research	**5%**	**Group (Peer Assessed)**
Activity Projection	**5%**	
Initial Ideas Jury	**5%**	
Preliminary Jury	**10%**	
Final Jury	**20%**	
Project Development Portfolio	**5%**	
TOTAL	**55%**	

To make the grading process fair, the group components of the project will be **peer assessed**. This means students will receive a **proportion** of the awarded group grade, based on their **individual** contribution to the project as assessed by **group members.** Students assessed as having a high relative contribution will receive a higher grade, whilst students assessed as having a low relative contribution will receive a lower grade. Further details will be provided later.

TRENDS RESEARCH (5%): IN-CLASS ACTIVITY & TAKE-HOME

The starting point for the project is to become familiar with major **general trends** that will shape the world in 2040. Each group will be assigned **one category** of trends to research, presenting their findings to the class on **Monday 11 November**.

Hint: explain what the trend is about/involves, why it is important, and what practical effects it may have on designed products and services. A vast quantity of information is available on the Internet to assist you in this assignment and open-up new trends under each heading.

Sustainability Trends, e.g. • Energy and resource conservation and reuse • Pollution reduction • Food and water – safety and shortages • Harnessing natural resources	**Societal Trends, e.g.** • Ageing (100-year life) • Online life vs real life • City vs country vs ocean • Home for living and working • Technology backlash	**Design and Creation Trends, e.g.** • Industry 4.0 (5.0?) • Bespoke, customized, personalized • Repair culture • Hacking • 3D printing
Technology (Smartness) Trends, e.g. • Robotics • Artificial Intelligence • Autonomy • Internet Of Things • Sensors • Big Data	**Technology (Extending Human Capability) Trends, e.g.** • Medical treatments / cures • Neural product interfaces • Body tech	**Technology (Personal Computing) Trends, e.g.** • Wearables • AR/VR • Cloud computing / storage • Online identity • Cybersecurity

Prepare your submission as an informative and graphically attractive A2 (portrait) colour poster. Bring the A2 print-out to the start of the studio on **Monday 11 November**. Upload a high-resolution **PDF version to ODTU Class by 13:00 on Monday 11 November**, using the filename **GROUPX-TRENDSRESEARCH.PDF**. To gain a proper foundation for the project, it is essential that ALL students listen to ALL presentations and take notes. There will be opportunity for clarifications and questions.

Figure F.2: Briefs distributed to students for the project, page 2 of 2

Appendix G

CONSENT AND EVALUATION FORM FOR WORKSHOP 3

Designing (for) Story Worlds Workshop

Hi!

This is Emre Caglar, a PhD candidate in METU Industrial Design.
This is a consent form, regarding the workshop you will be a part of, during the ID 401 course on November 21st, 2019. This workshop is part of my doctoral studies in METU Department of Industrial Design that aims to investigate the role of fiction and immersion in generative research practices and develop tools to utilize them.

Data Collection
During the workshop and its presentations, the workshop conductor will be recording video and audio. The material you create during the workshop, such as the worldbuilding exercises, will also be recorded. The raw data as a whole will not be shared with any third parties under any circumstances, and all the physical outcomes and digital data accumulated throughout the workshop will only be used for academic and non-profit purposes.

Your Consent
Participating this workshop is part of your ID 401 studio course. However, inclusion of your workshop data in my research is not, and it's optional. If you agree, the analysis of your data will be used in my PhD thesis, and related publications. Please review the options below and tick the ones you consent to.

You may use the data I generated in this workshop, as part of your research.	◯ Yes
You may use my name to credit my work in your thesis and related publications.	◯ Yes
You may contact me for further inquiries about the workshop. (This is not a commitment; you may still reject later.)	◯ Yes, email:

These do not waive your legal rights or release the researcher and/or involved institution(s) from their legal and professional responsibilities. You are free to withdraw from the study at any time or change the conditions of your consent.

Thank you for your contribution!

Contact Me
If you have any further concerns related to the workshop process and outcomes, and their use, please contact:

Emre Çağlar, PhD Candidate
Department of Industrial Design
Faculty of Architecture, Middle East Technical University
+358 44 944 6726
caglaremre@gmail.com

Researcher
Emre Çağlar

Participant

Team Number:

Figure G.1: Consent and evaluation form for Workshop 3, page 1 of 3

Below is a questionnaire to get your feedback about the workshop. It's optional, but would be highly appreciated by the researcher.

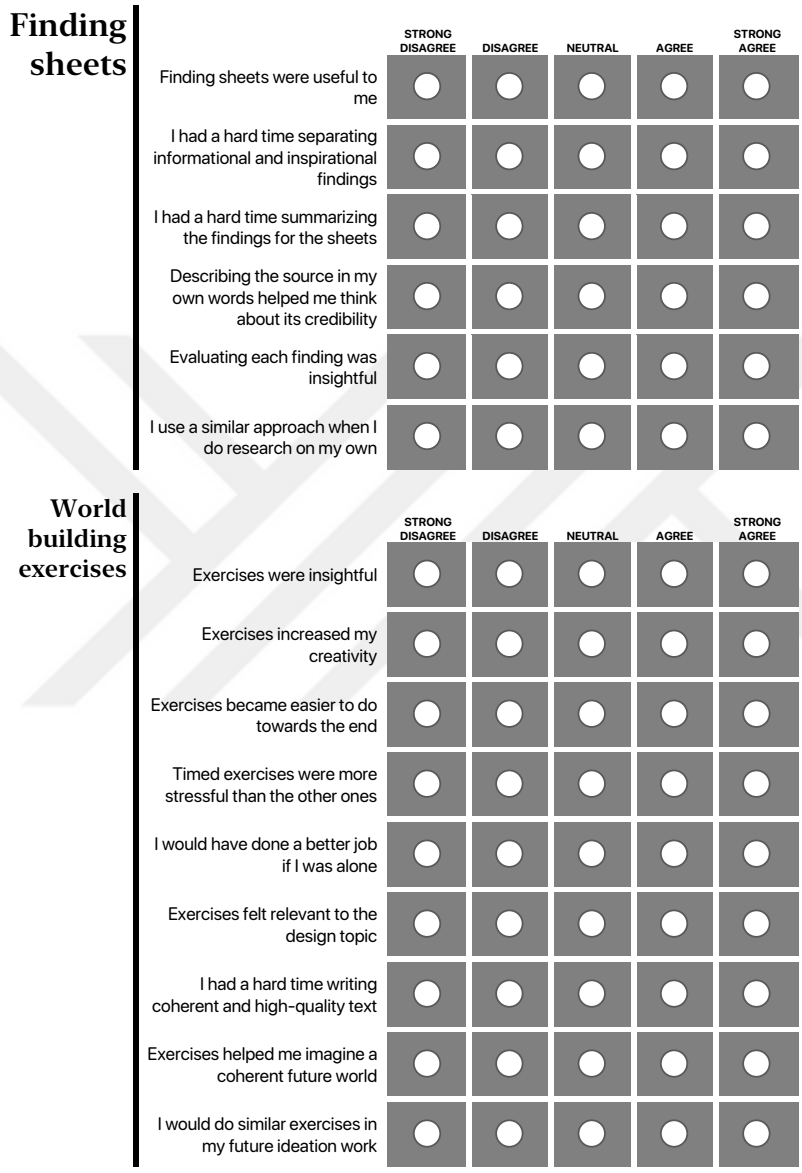


Figure G.2: Consent and evaluation form for Workshop 3, page 2 of 3

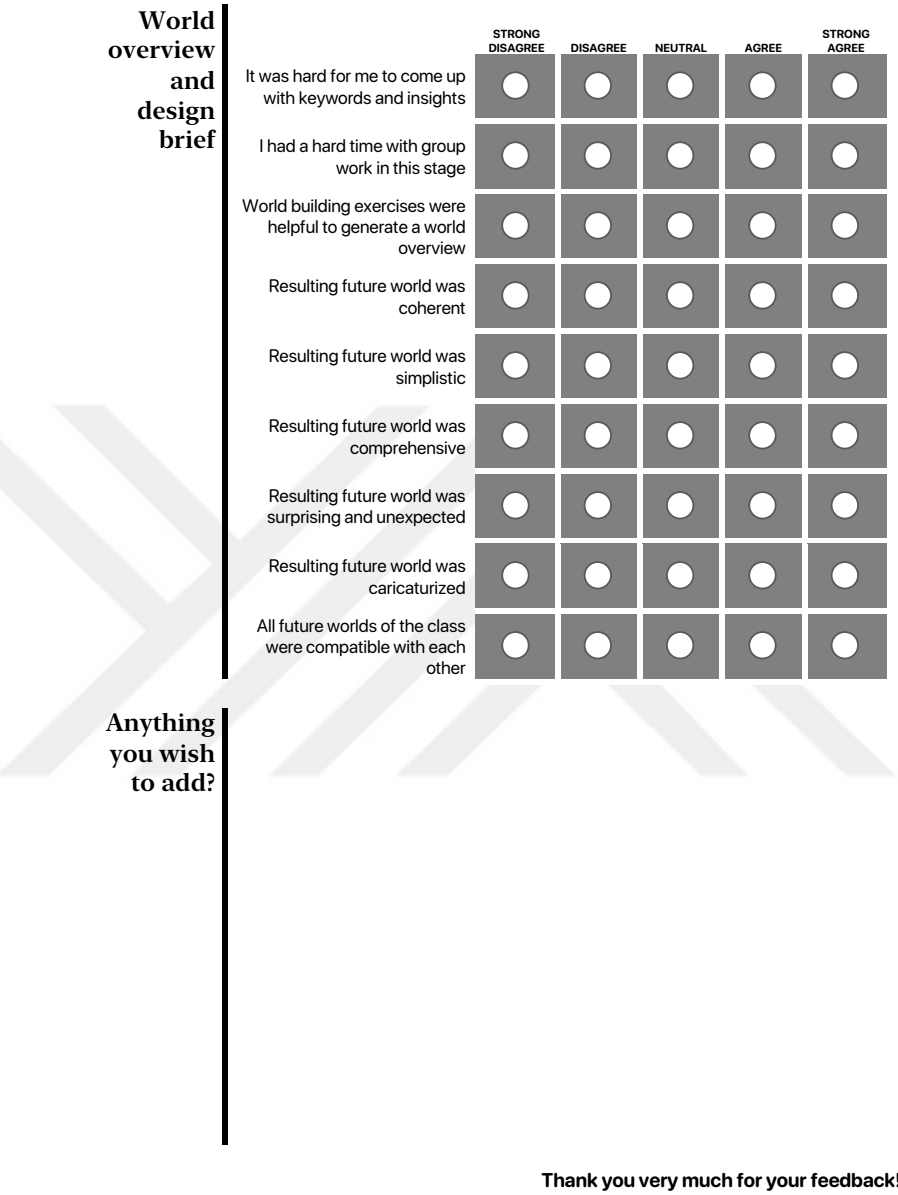


Figure G.3: Consent and evaluation form for Workshop 3, page 3 of 3

Appendix H

WORKSHOP 2 INTERVIEW QUESTIONS FOR PARTICIPANTS

H.1 Original Turkish Text

Merhabalar,

Öncelikle ses kaydı alacağım, senden de ricam eğer mümkünse kendi tarafından da telefonuna ses kaydı alman. İzninle başlıyorum.

Bu röportajı doktora çalışmamda geliştirdiğim *Design (for) Story Worlds* aracıyla ilgili geri bildirim almak için yapıyorum. Röportajın ana amacı çalıştayın bu proje sürecinde işe yarayıp yaramadığını gözlemlemek. Röportajın içeriği sadece bende kalacak, ama analizini akademik amaçlarla ve anonim olacak şekilde danışmanım ve ID 401 hocalarıyla paylaşacağım.

Bu projenizde gelecek senaryoları üzerinde çalıştınız. Projede daha aşina olduğunuz yönler vardı, örneğin Türkiye bağlamında geçiyordu ve aşina olduğunuz aktiviteler ile ilgiliydi. Ama zaman olarak 20 yıl ileriye baktınız, ki dünyanın değiştiği hızı düşündüğünüzde bu oldukça uzun bir süre. O yüzden araştırmalarınızı gelecek tahminleriyle birleştirmeniz gerekliydi.

Soru 1 Öncelikle projenin bittiği bugünden geriye bakınca, geleceği öngörme işini nasıl yaptınız, sizce bu anlamda iyi bir iş çıkardınız mı?

Şimdi *immersive* kavramı üzerinde durmak istiyorum. Hikaye anlatıcılığında sürükleyici ve kapsayıcı hikaye dünyaları okuyucuyu kendi dünyasından alıp kurgusal dünyaya yerleştirir ve geçici olarak tepkilerimizi kurgusal dünyadaymış gibi verebiliriz. Hüzünlü bir filmde boğaz düğümlenmesi ya da korku filmlerinde gerçekten

irkilmek bunların örneği.

Soru 2 Senin hatırladığın ve kapsayıcı bir dünyası var dediğin bir kurgu ürünü var mı?

Şimdi projeyi hatırlayalım. Burada final ürününüze dair benim hazırladığım bir gruplama var. Projenin tüm içeriği değil ama önemli olduğunu düşündüğüm kısımları grupladım. Bunu bir hikaye dünyası gibi düşünelim ve bunlar da hikayenin ana kolları. Buna bir göz at lütfen.

(Kutuyu sola kaydır)

Soru 3 Bariz eksik ya da yanlış olduğunu düşündüğün bir kol var mı?

Soru 4 Bu geleceği ve bu gelecek için kurguladığınız dünyayı bir film ya da kitap gibi düşünelim. Sence bu dünya inandırıcı bir dünya mı?

Soru 5 Tutarsız tarafları var mı?

Soru 6 Sence kapsayıcı bir dünya mı? Çok yönlü düşündüğünüzü söyleyebilir misin?

Soru 7 Bu dünyada sizin eklediğiniz veya öngördüğünüz en önemli tek bir olgu ne?

Soru 8 Kurguladığınız dünya mı sizi çözüme yönlendirdi yoksa çözümün etrafına mı bir dünya şekillendirdiniz?

Soru 9 Dünyanın içine girebildiğinizi düşünüyor musun? Sence çözüm üretme açısından bu dünya size fayda sağladı mı?

Şimdi çalıştayda kurguladığınız dünyaya dönelim. Aynı şekilde aldığım notları görebilirsin.

(Kutuyu sağa çek)

Soru 10 Bariz bir eksiklik ya da yanlışlık var mı?

Soru 11 Sence bu kapsayıcı bir dünya mıydı? Tutarlı mıydı?

(Kutuyu ortaya çek)

Soru 12 Bu dünyadan proje boyunca taşıdığınız bir kısıt, olgu ya da fikir oldu mu?

Soru 13 Sence iki dünya arasında fark var mı? Neler var?

Şimdi tüm proje akışına bakalım. Orta sütunda initial ideas jürisinden aynı şekilde aldığım notlar var.

(Kutuyu kaldır)

Soru 14 Sence bu çalıştay ve çalıştayda kurguladığınız dünya en çok ne konuda sizi yönlendirdi?

Soru 15 Proje boyunca değişen bir öngörü ya da tahmininiz oldu mu?

Soru 16 Sence bir tasarımcı olarak gelecek değişimleri ve sonuçlarını öngörebilmek önemli mi?

Soru 17 Bunu yapabilmek için neye ihtiyacın olduğunu düşünüyorsun?

Soru 18 Eklemek istediğin bir şey var mı?

Çok teşekkürler! Ses dosyasını göndermeyi unutma lütfen. Sevgiler.

H.2 English Translation

Hi,

I will be recording the session, and if you can, please record your own end with your phone. With your consent, I begin.

I'm doing this interview to receive feedback for the tool I'm developing as part of my doctoral studies called *Design (for) Story Worlds*. The main objective is to observe the ways this tool contributed to the project process. The contents of your answers will only be seen by me but the analysis will be shared with my adviser and the instructors of the course, after taking adequate measures to anonymize your identity.

In this project, you worked on future scenarios. There were dimensions of the project that you were more accustomed to. For instance, it was set in Turkey and it was about activities you probably experienced. But you looked towards 20 years in the future, which is a long time considering how fast the world changes. Therefore, you had to

combine your research with foresight.

Question 1 Looking back from now, how do you think you were in doing foresight, do you think you had done well?

Now I want to focus a bit in the concept of *immersion*. In story telling, immersion takes the reader from their own world and places them in the world of the story, temporarily enabling them to fell and react as if they were in the story world. Examples include getting a lump in your throat in a sad movie or being physically scared in horror movies.

Question 2 Do you remember anything you've seen or read and considered immersive in this sense?

Now let's remember the project. Here's a group of notes I took about your final product. It's not the entire content but things I considered your main points. Consider your project as a story world and there are the arcs. Please take a look.

(Reveal final project notes)

Question 3 Anything major missing or wrong?

Question 4 Consider this future and the world you created for this future as a film or a book. Do you think this world is believable?

Question 5 Anything you remember as inconsistent?

Question 6 Do you think it was wide? Would consider it well-explored?

Question 7 What is the one major foresight you added in this world?

Question 8 Did the world you created led you to a solution in the project or you weaved a world around a solution you thought before?

Question 9 Would you say you were thinking within this world? Do you think the world contributed to you for generating design solutions?

Now let's go further back to the world you created in the workshop. See the notes I took like the ones from your final project.

(Reveal workshop notes)

Question 10 Anything major missing or wrong?

Question 11 Do you think this world was wide and well-explored? Was it consistent?

(Reveal mid-project notes)

Question 12 Did you carry any constraints, concepts or ideas from this world throughout the project?

Question 13 Do you think the two worlds are similar? What differences are there?

Now let's see your ideas through the entire project. The middle column includes notes I took from your initial ideas and preliminary juries.

(Reveal the entire board)

Question 14 In what ways do you think the workshop and the workshop world guided you through the project?

Question 15 Do you have insights and foresight that changed throughout the project?

Question 16 Do you think it's valuable to foresight changes and their consequences in the world as a designer? How?

Question 17 What do you think you need in order to get better at this?

Question 18 Anything you would like to add?

Thank you very much! Please remember to share the audio recording from your end.

Appendix I

WBD TOOLSET'S WORLD BUILDING EXERCISES FROM WORKSHOP 3



Figure I.1: Descriptive world building exercise, 1 of 4

Figure I.2: Descriptive world building exercise, 2 of 4

Figure I.3: Descriptive world building exercise, 3 of 4

Figure I.4: Descriptive world building exercise, 4 of 4

Figure I.5: Prototyping world building exercise, 1 of 10

Figure I.6: Prototyping world building exercise, 2 of 10

Figure I.7: Prototyping world building exercise, 3 of 10

Figure I.8: Prototyping world building exercise, 4 of 10

What is the Wikipedia article of this product or service?

You may use the two articles given as examples.

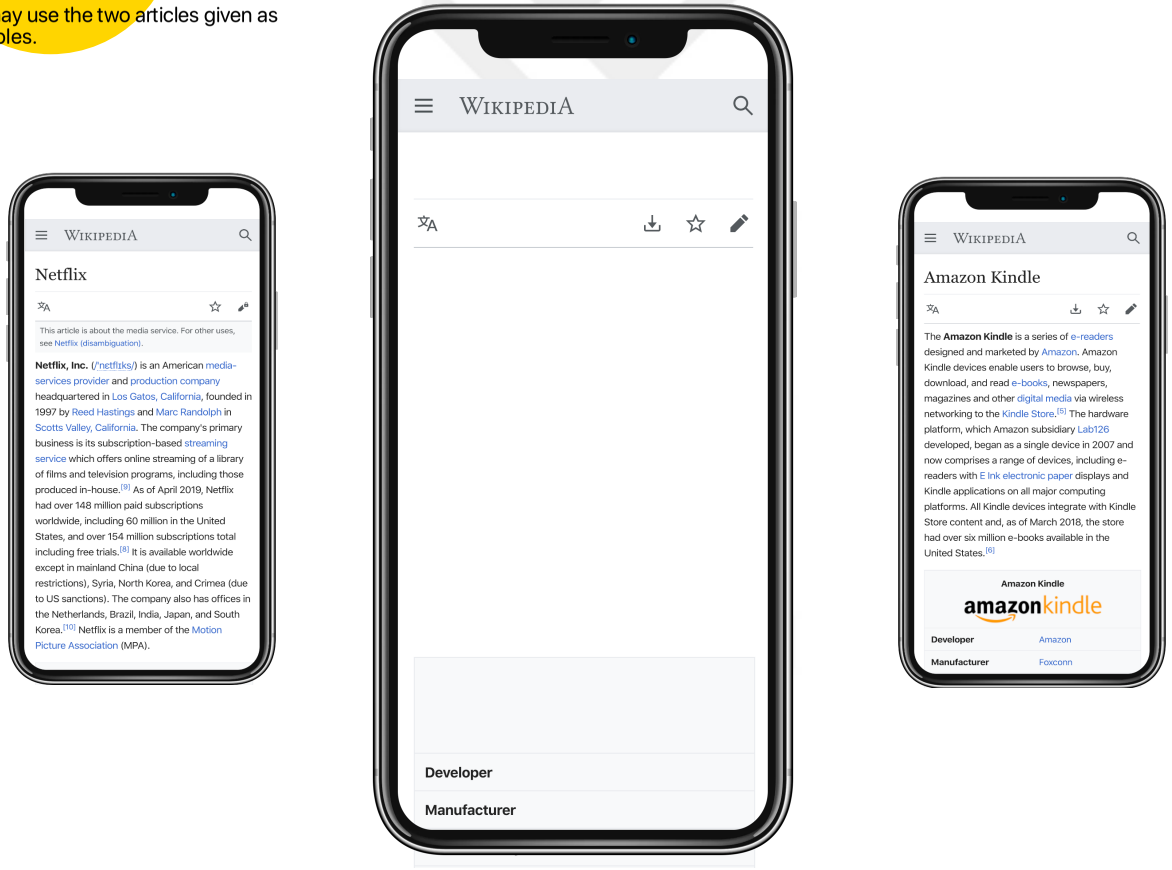


Figure I.9: Prototyping world building exercise, 5 of 10

Figure I.10: Prototyping world building exercise, 6 of 10

Figure I.11: Prototyping world building exercise, 7 of 10

How does design education change to adapt to this world?

Imagine a new elective course in our department.

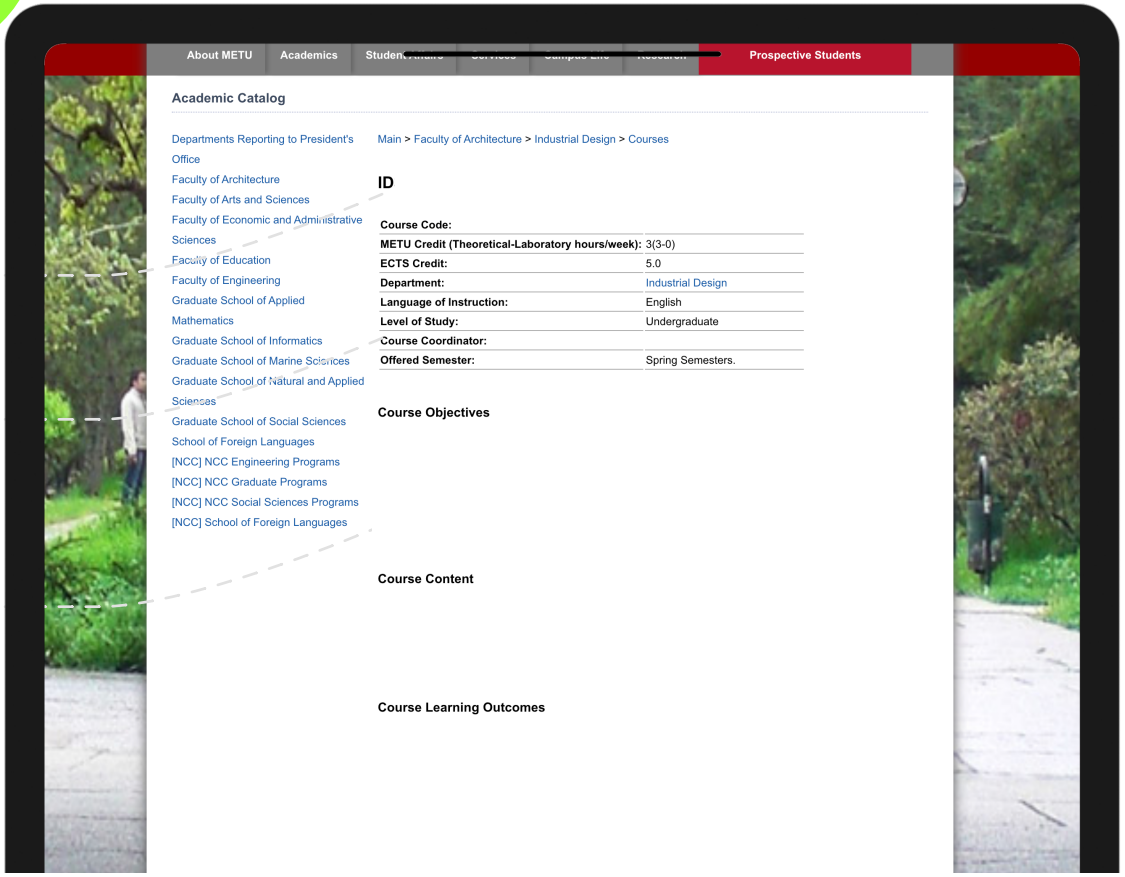


Figure I.12: Prototyping world building exercise, 8 of 10

Figure I.13: Prototyping world building exercise, 9 of 10

Figure I.14: Prototyping world building exercise, 10 of 10

Figure I.15: Custom world building exercise

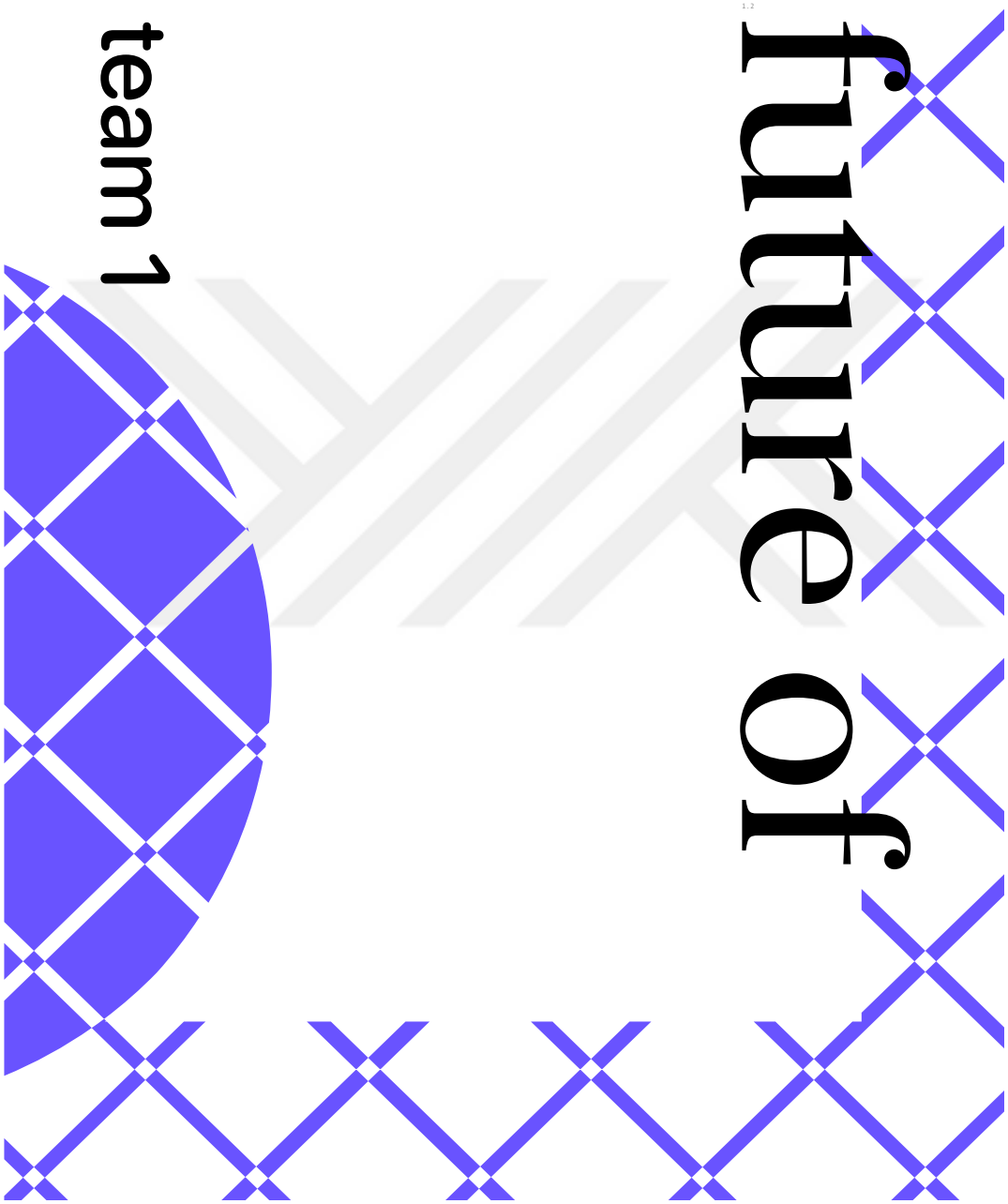


Figure I.16: Sample board title card

Figure I.17: Research board labels

Figure I.18: Research finding sheets

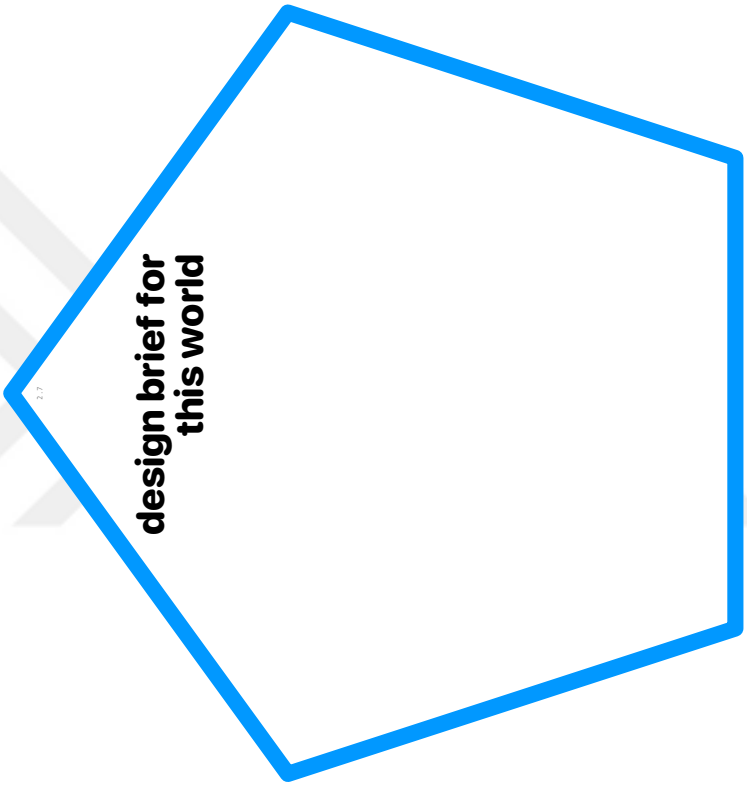
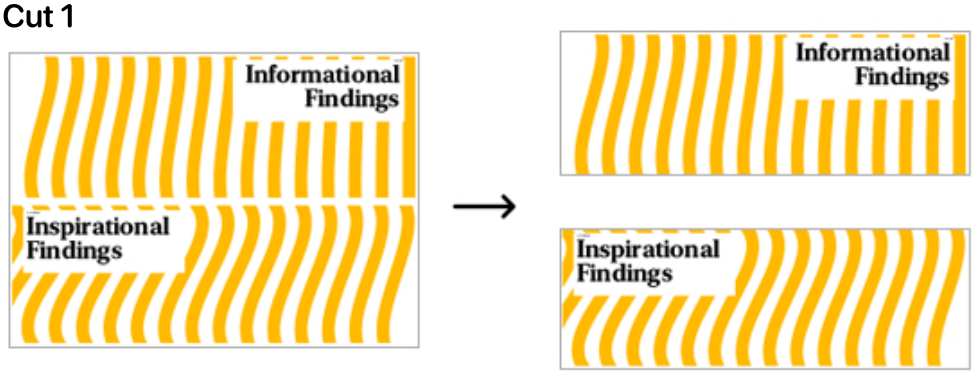


Figure I.19: Design brief sheet

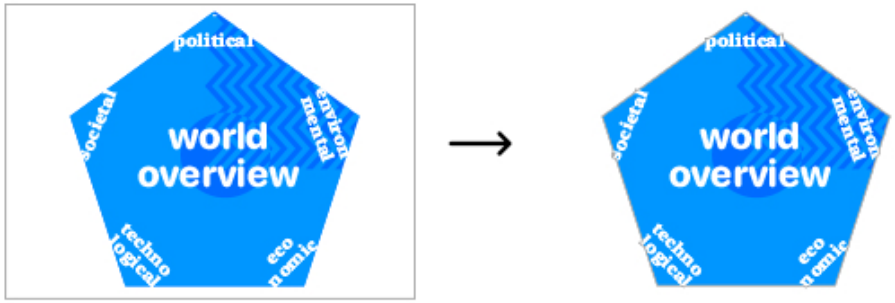
Cut 1



A4 Printout (7 copies)

Cut horizontally (Total: 14 pieces.)

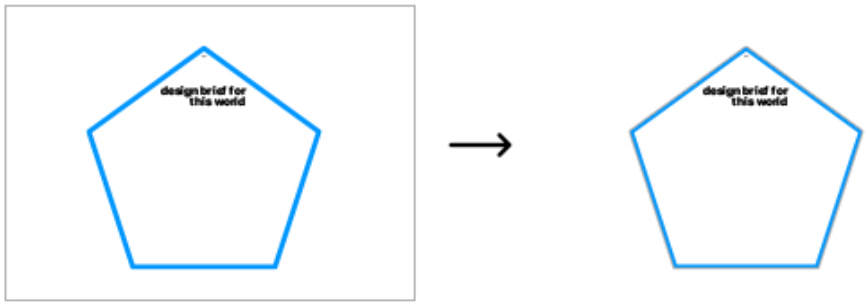
Cut 2



A4 Printout (7 copies)

Remove the pentagon (7 copies)

Cut 3



A4 Printout (7 copies)

Remove the pentagon (7 copies)

Figure I.20: Trim guide for the printouts

Appendix J

WORKSHOP PRESENTATION SLIDES FROM WORKSHOP 3

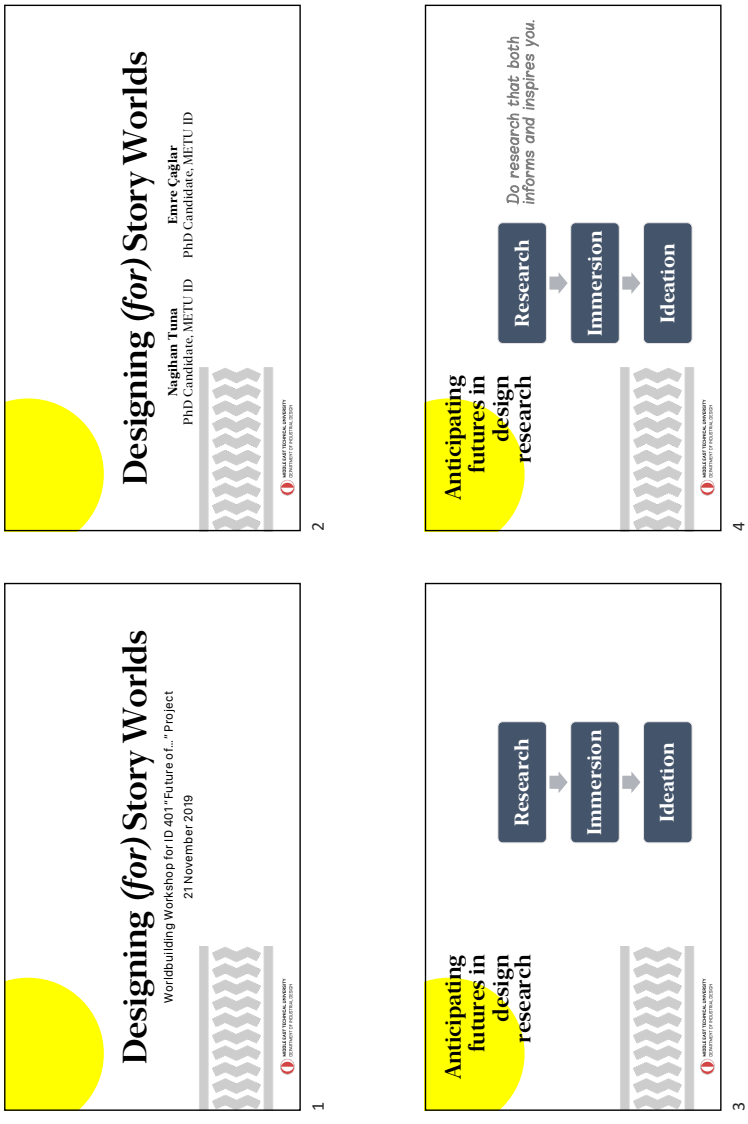


Figure J.1: Presentation slides, 1 of 6

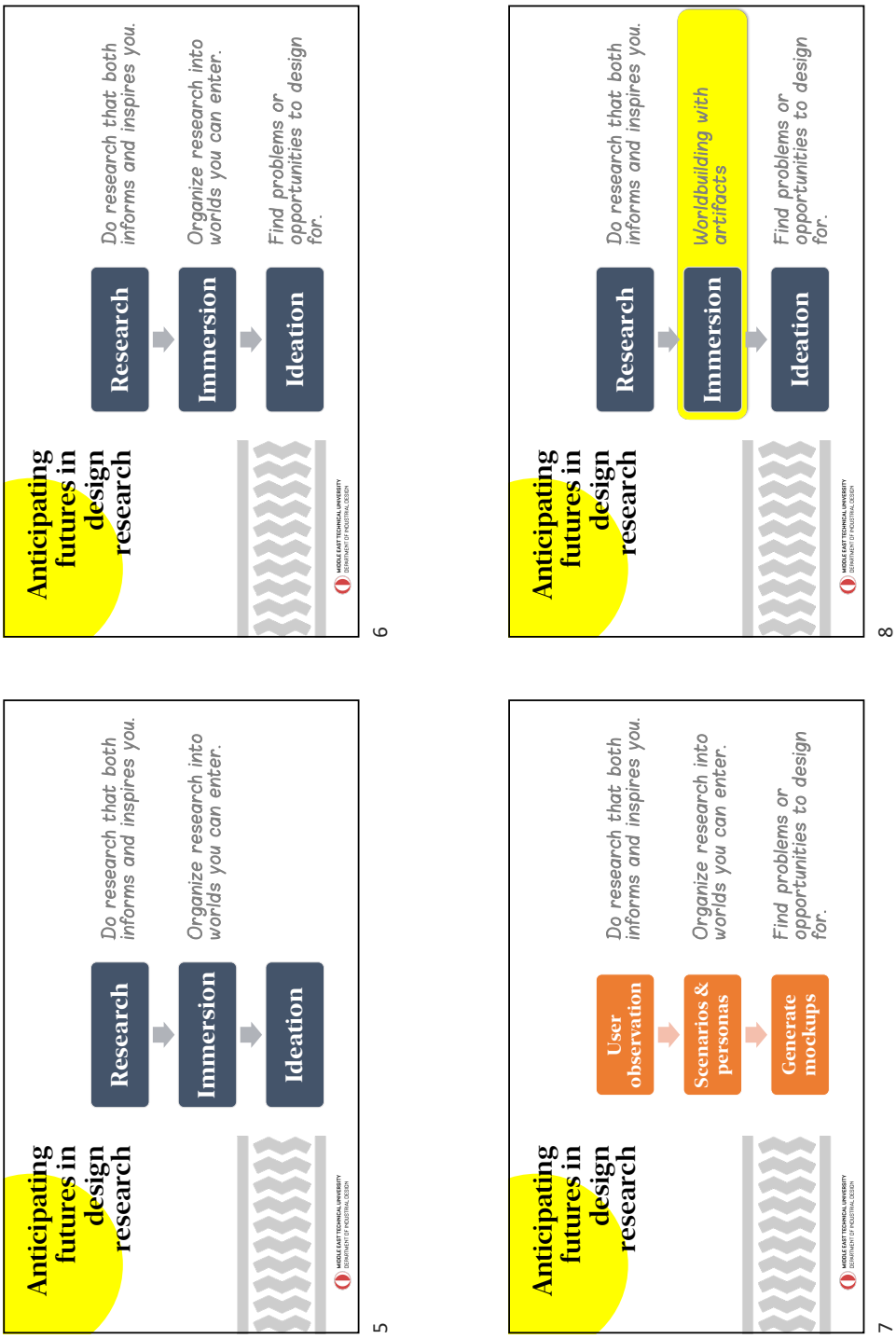
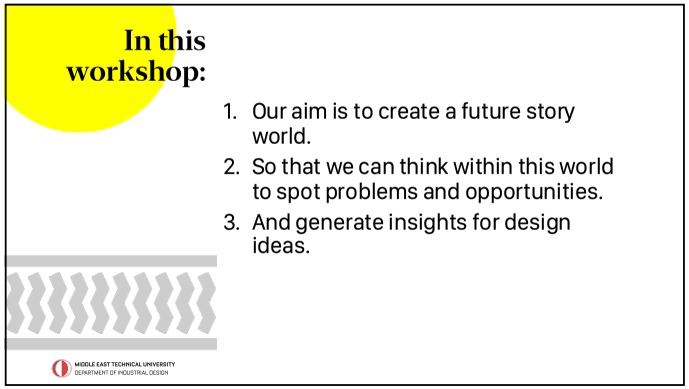
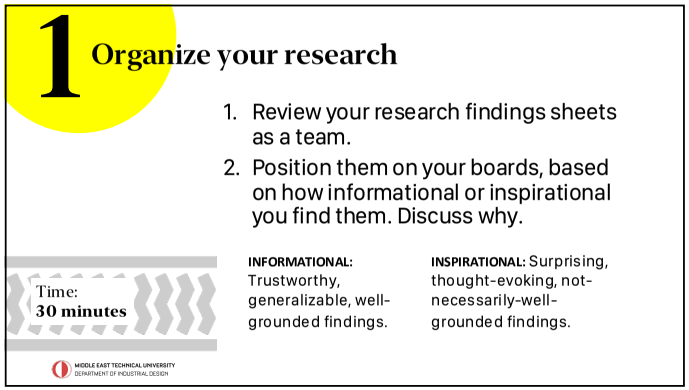


Figure J.2: Presentation slides, 2 of 6







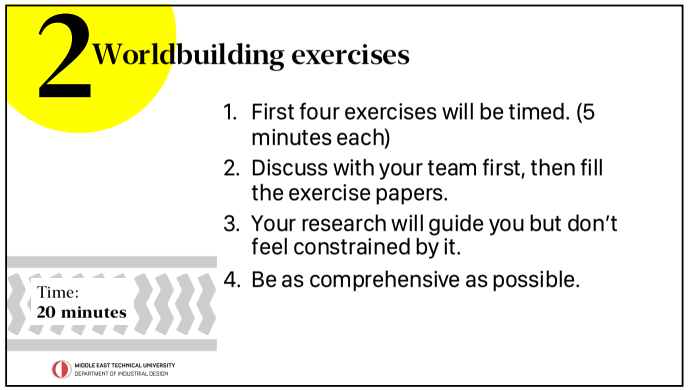


Figure J.3: Presentation slides, 3 of 6

Figure J.4: Presentation slides, 4 of 6

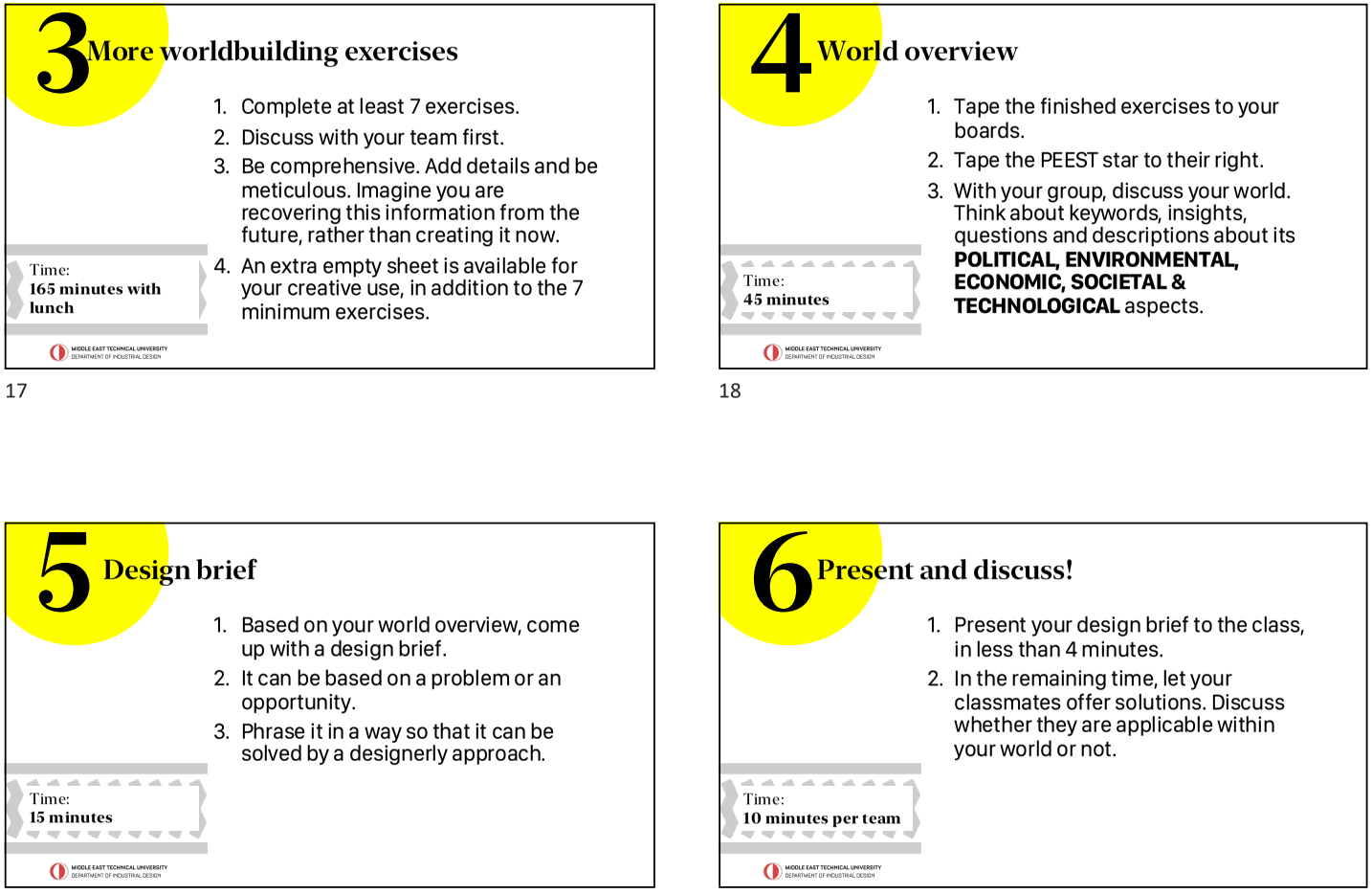
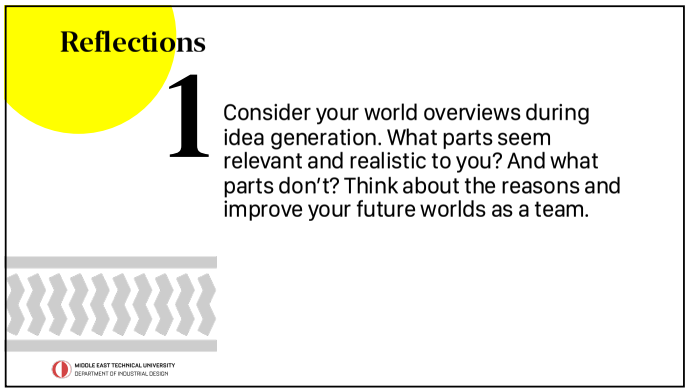
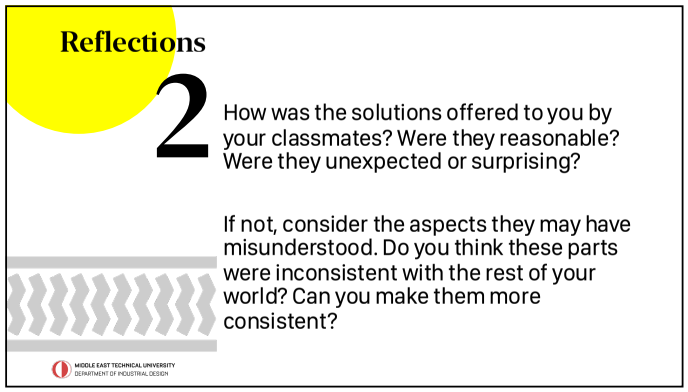


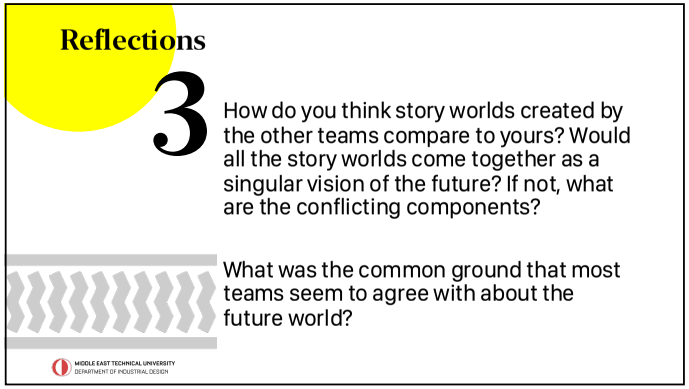
Figure J.5: Presentation slides, 5 of 6



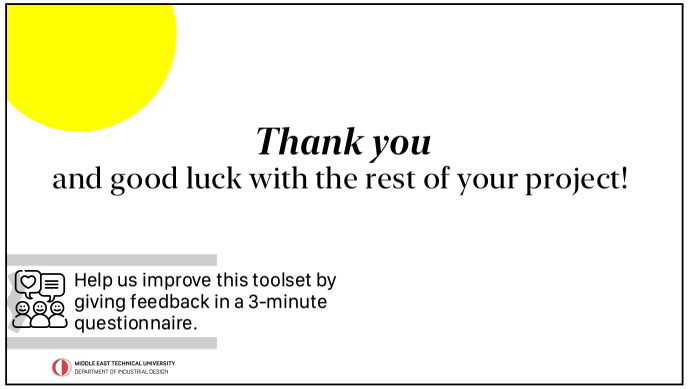
21



22



23



24

Figure J.6: Presentation slides, 6 of 6

Appendix K

WBD WORKSHOP GUIDE FROM WORKSHOP 3

Designing (for) Story Worlds Workshop
for ID 401 "Future of..." Project
November 21st, 2019

Overall schedule for the workshop is below:

Before the workshop day		Research Finding Sheets (1.1) are distributed to the teams. They should bring finished sheets on the workshop day.
		There is a small amount of preparation necessary in the studio before the workshop, detailed in section 1.2.
Workshop day	10:30-10:45	Introduction
	10:45-11:15	Organize research boards
	11:15-11:45	Worldbuilding part 1 (timed)
	11:45-14:30	Worldbuilding part 2 (free)
	14:30-15:15	World overview
	15:15-15:30	Coffee Break
	15:30-15:45	Design brief
	15:45-17:00	Casual presentations and class discussion

Below is a step by step application procedure for the workshop.

1 Before the Workshop Day

1.1 Research Phase
Students will complete two research tasks prior to the workshop, as groups. The first one will be general and the second one will be specific to their assigned activities, such as designing, dining, shopping etc.
Students will be given out the **RESEARCH FINDINGS SHEETS (1.1)** to fill out with their findings. 10 sheets per group seems reasonable, but course instructors can and should modify this number based on their expectations. Students will bring these sheets with them, filled, on the workshop day.

HANDOUT



RESEARCH FINDINGS SHEETS (1.1) → 10 per team

Figure K.1: Workshop guide for the conductor, used in workshop 3, 1 of 12

1.2 Preparing Boards in the Studio
Each team should have a blank space on the walls to use as their research board. The horizontal space can be around 1.5-2 meters, as the generated material will be taped from left to right.

Each space will be labeled by the team's number and their designated future activity, using the **BOARD LABEL SHEET (1.2)**. On the left of each team's space, **RESEARCH AXIS SHEETS (1.3TOP & 1.3BOTTOM)** will be taped by the instructors.

The final space for each team should look like this:
RESEARCH BOARD LAYOUT



2 *Workshop Day*

2.1 Introduction
10:30-10:45
The workshop will be introduced to the students.
SLIDESHOW

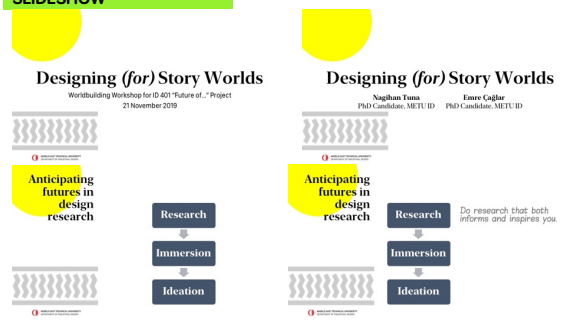
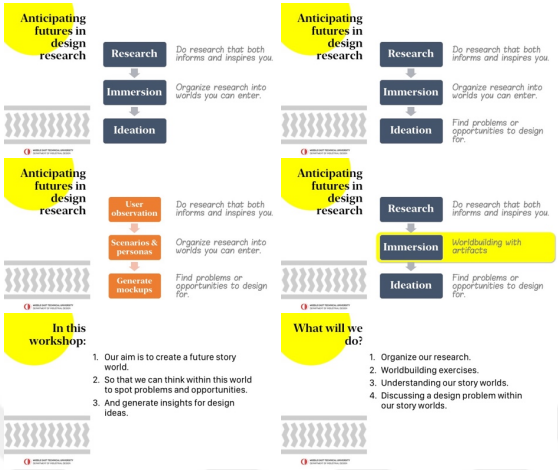


Figure K.2: Workshop guide for the conductor, used in workshop 3, 2 of 12



2.2 Organize Research Boards
10:45-11:15
Students will find their designated research boards in the studio. Then, they will tape their **RESEARCH FINDINGS SHEETS** to the research boards, based on how they evaluate each finding as informational or inspirational. More informational findings go towards the top of the board, while more inspirational findings go towards the bottom.

RESEARCH BOARD LAYOUT



I recommend supplying some sticky notes to the students beforehand and encourage them to take notes on the research board about anything they think is important, notice-worthy or maybe

Figure K.3: Workshop guide for the conductor, used in workshop 3, 3 of 12

unrelated. If they have any remarks within the group about their research findings, they should do their best to write it down on a sticky note and put it up the board.

SLIDESHOW



2.3 Worldbuilding Exercise Part 1
11:15-11:45
The first part of the worldbuilding exercises is timed. There are 4 exercises in this part, and they will be given 5 minutes to complete each (Total work time for this part is 20 minutes).

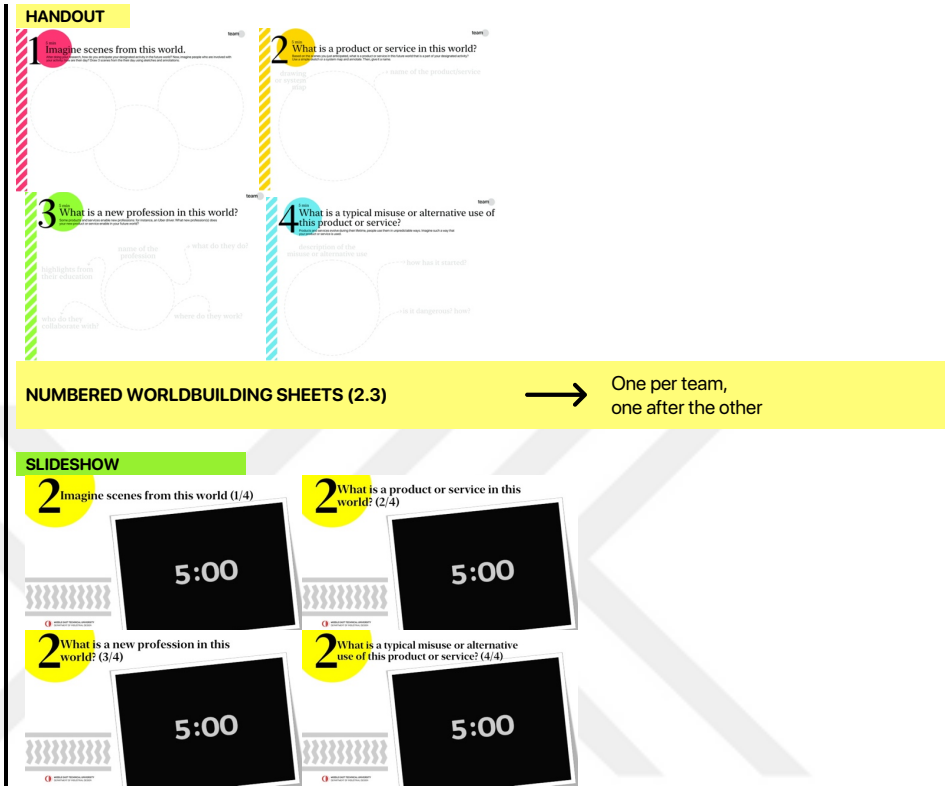
This is a group work; one sheet will be filled by the group at a time. Therefore, it is important to remind students that they are expected to conduct a small discussion before writing or drawing the results on each exercise sheet. Research findings should guide but not heavily constraint these exercises.

SLIDESHOW



Hand out each **NUMBERED WORLDBUILDING SHEET (2.3)** separately (Hand out the second exercise sheets to each group only after the first one is done, etc.). Use the relevant slides in the slideshow during each exercise to show them the time, and make sure to give verbal reminders to the class in the middle ("2.5 minutes left") and towards the end ("1-minute left"). Carry out exercises without breaks in between.

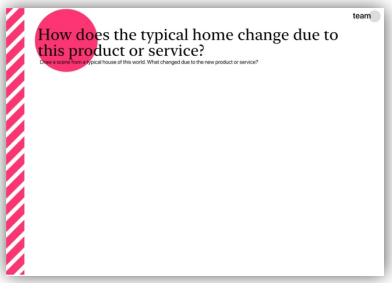
Figure K.4: Workshop guide for the conductor, used in workshop 3, 4 of 12



2.4 Worldbuilding Exercise Part 2
11:45-14:30
In the second part, hand out the remaining 10 **UNNUMBERED WORLDBUILDING SHEETS (2.4)** altogether, to each group. Unlike the first part, students will pick which exercises they wish to do, on their own pace. They should however be asked to complete at least 6 exercises. It is also important to remind them that this is a teamwork. They can delegate the exercises to team members, but they have to discuss and decide the content beforehand, as a team. They can also optionally do custom sheets, without sticking to a given exercise, in addition to completing the minimum number of exercises.

Figure K.5: Workshop guide for the conductor, used in workshop 3, 5 of 12

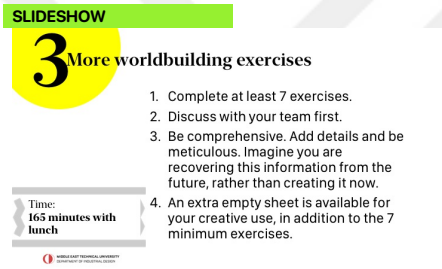
HANDOUT



(example shown above, there are 10 sheets in total)

UNNUMBERED WORLDBUILDING SHEETS (2.4) → 1 per team, handed out, altogether

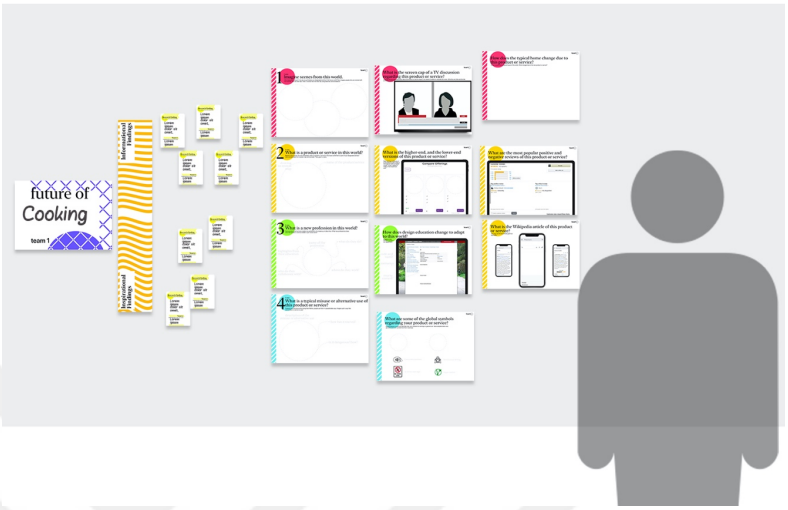
SLIDESHOW



It is important to remind the students that their work should be comprehensive. This means that they should add as much detail as possible to the exercise sheets. The purpose of this phase is to be immersed into a fictional world, and that would be easier if students consider themselves as archeologists, recovering more knowledge about the imaginary artefacts they create during every exercise.
Once the exercises are complete, ask the students to tape the completed sheets on the wall, next to their research finding sheets, so that each team has their own space with all their materials.

Figure K.6: Workshop guide for the conductor, used in workshop 3, 6 of 12

RESEARCH BOARD LAYOUT



2.5 World Overview
14:30-15:15

Hand out one **PEEST STAR (2.6)** to each group.

SLIDESHOW

4 World overview

1. Tape the finished exercises to your boards.
2. Tape the PEEST star to their right.
3. With your group, discuss your world. Think about keywords, insights, questions and descriptions about its **POLITICAL, ENVIRONMENTAL, ECONOMIC, SOCIETAL & TECHNOLOGICAL** aspects.

Time:
45 minutes

Figure K.7: Workshop guide for the conductor, used in workshop 3, 7 of 12

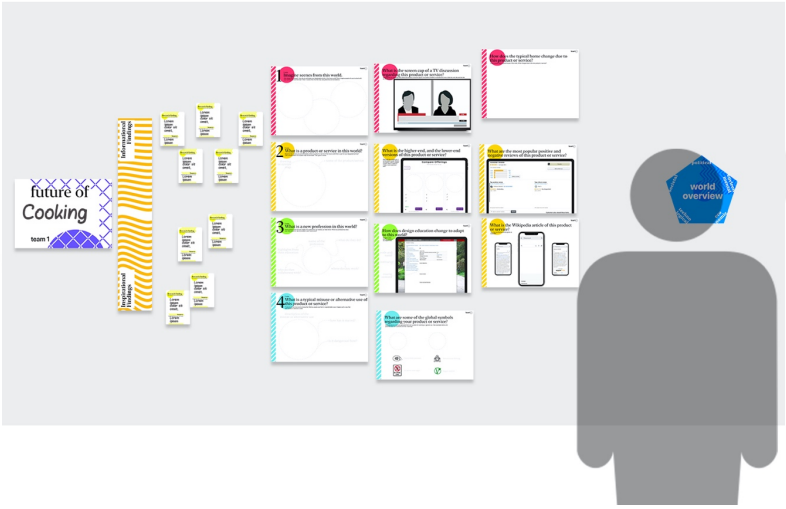
HANDOUT



PEEST STAR (2.6) → 1 per team

Let them tape the **PEEST STAR (2.6)**, to the right of the world building exercises.

RESEARCH BOARD LAYOUT



Now, let them overview their future world as a whole. On the board, they will have research findings and world building exercises. Considering this information, ask them to generate insights for this world, regarding its political, environmental, economic, societal and technological overlook. They will write their insights on sticky notes and paste them around the **PEEST STAR (2.6)**, at their respective locations. They can be keywords or short sentences; whatever they feel comfortable with. It is important that they collaborate and discuss amongst themselves during this phase.

Figure K.8: Workshop guide for the conductor, used in workshop 3, 8 of 12

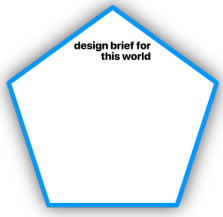
RESEARCH BOARD LAYOUT



2.6 Coffee Break
15:15-15:30

2.7 Design Brief
15:30-15:45
As the final task of the day, ask the students to prepare a short design brief in their world. They should be encouraged to think within the opportunities, insights and problems of their worlds, using the insights they generated around the **PEEST STAR (2.6)**. Hand out a **DESIGN BRIEF (2.7)** to each group.

HANDOUT



DESIGN BRIEF (2.7) → 1 per team

Once filled in after a short discussion, it should be taped on top of the **PEEST STAR (2.6)**.

Figure K.9: Workshop guide for the conductor, used in workshop 3, 9 of 12

SLIDESHOW

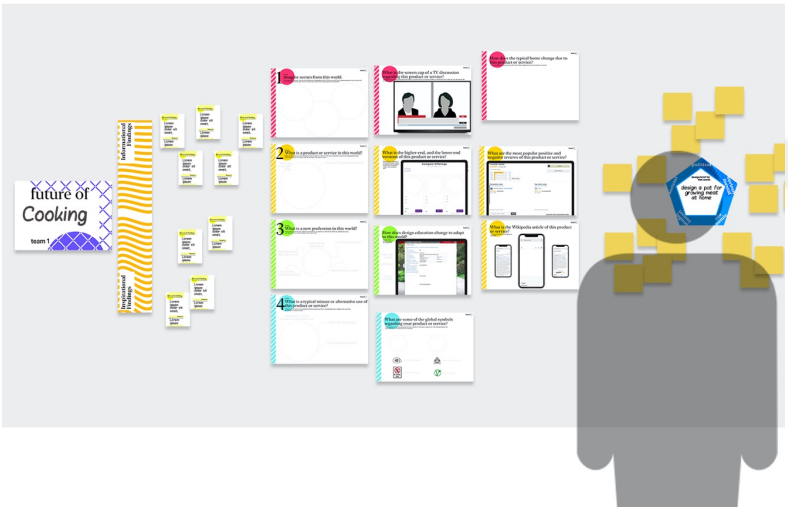
5 Design brief

1. Based on your world overview, come up with a design brief.
2. It can be based on a problem or an opportunity.
3. Phrase it in a way so that it can be solved by a designerly approach.

Time:
15 minutes

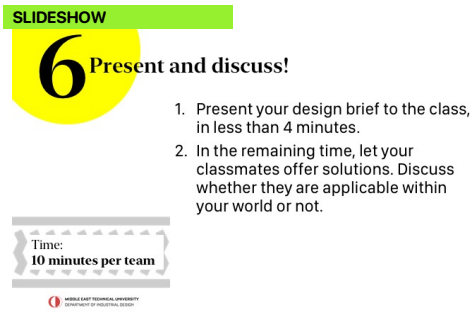
MIDDLE EAST TECHNICAL UNIVERSITY
DEPARTMENT OF INDUSTRIAL DESIGN

RESEARCH BOARD LAYOUT



2.8 Casual Presentations & Discussions
(15:45-17:00)
Each team will have 4 minutes to present their design brief to the rest of the class. The presentations can be done casually, in front of their research boards. Students should be told not to start presenting their entire workshop output, but only reference to any particular exercises or research findings as they talk about their design brief, when necessary. It would be good to keep a strict timing on these presentations.

Figure K.10: Workshop guide for the conductor, used in workshop 3, 10 of 12



During the next 6 minutes, the class can offer ideas about the brief to the presenting team. In an interactive format, the goal is to have a discussion between the presenting team and the rest of the class, as to how the team's design brief can be approached. The presenting team should provide ideas about whether these approaches would work in their world or not.

These briefs, together with the discussions and the PEEST stars will form a basis for the upcoming idea generation phase. Use the last three slides to give them final reflections to think about.



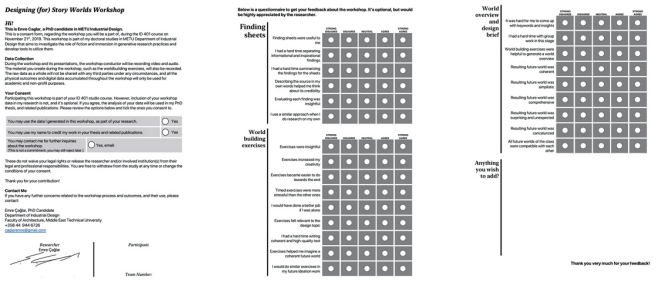
- Are the problems or opportunities we defined about our story world, readily applicable to the real world? If not, why? Are they too exaggerated, vague, cartoonish or unsolvable? If so, can we rephrase these problems to be more approachable, or come up with different problems altogether?
- How were the solutions we received to our design brief from classmates after our presentation? Were they compatible with our story world? If not, what did they misunderstand? Is it an aspect we can further elaborate about?
- How do you think story worlds created by the other teams compare to yours? Would all the story worlds come together as a singular vision of the future? If not, what are the conflicting components? And then, what was the common ground that most teams seem to agree with about the future world?

Figure K.11: Workshop guide for the conductor, used in workshop 3, 11 of 12

Students should be able to proceed to idea generation phase, based on their future world overviews and design briefs.

Hand out the consent forms with the questionnaires at the end.

HANDOUT



CONSENT FORM & QUESTIONNARIE ⟶ 1 per person

You are amazing, thanks!

Figure K.12: Workshop guide for the conductor, used in workshop 3, 12 of 12

Appendix L

PROGRESSION MAPS FROM WORKSHOP 3

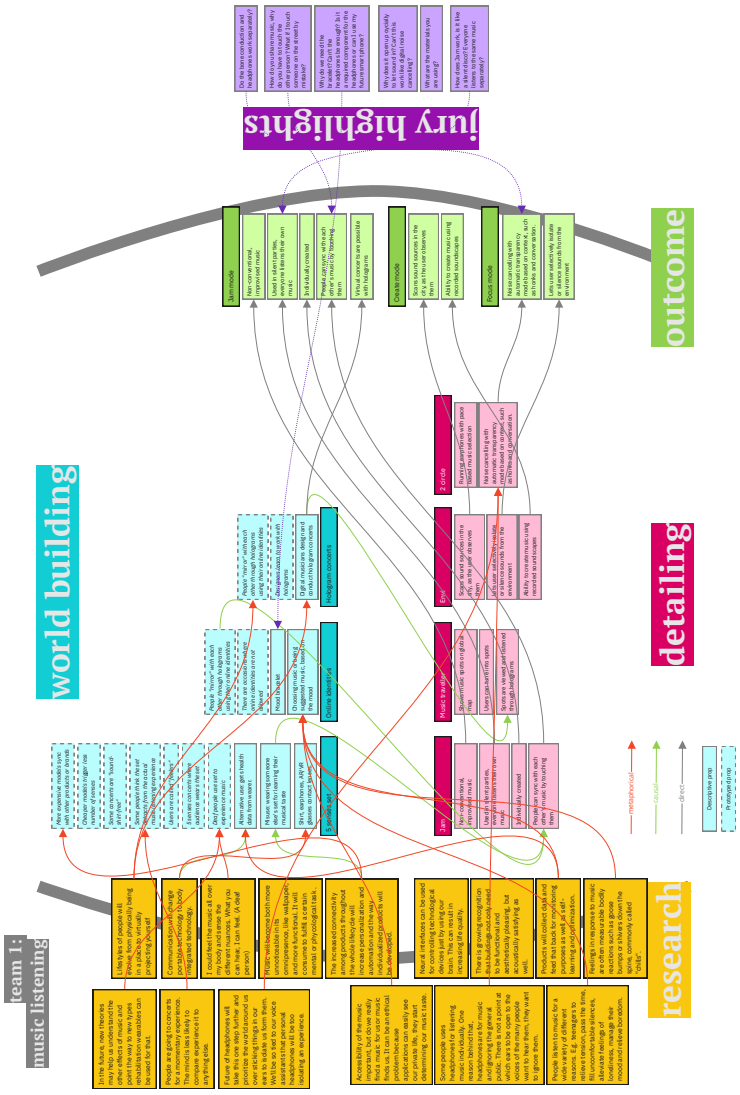


Figure L.1: Progression map for Team 1, Workshop 3

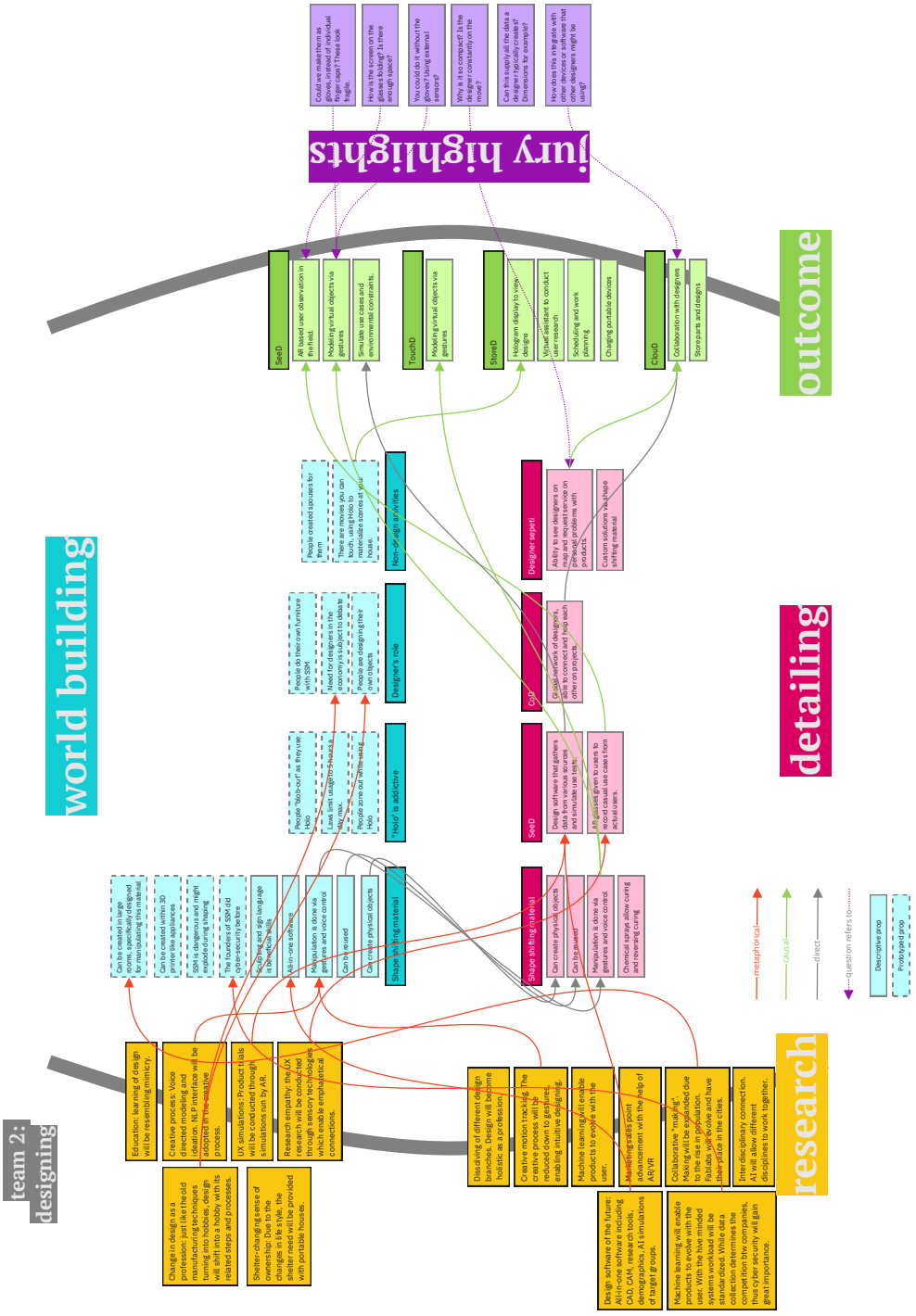


Figure L.2: Progression map for Team 2, Workshop 3

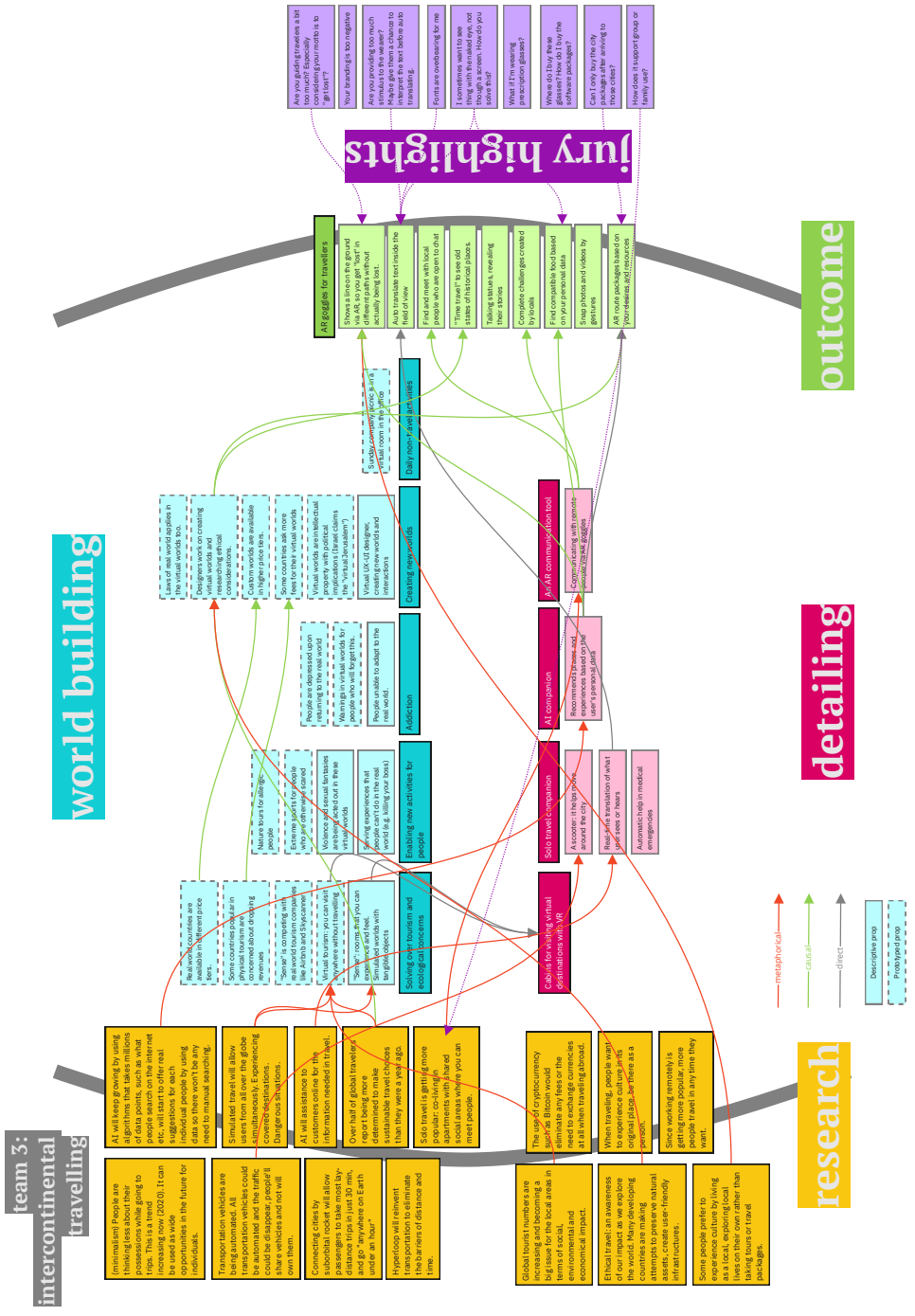


Figure L.3: Progression map for Team 3, Workshop 3

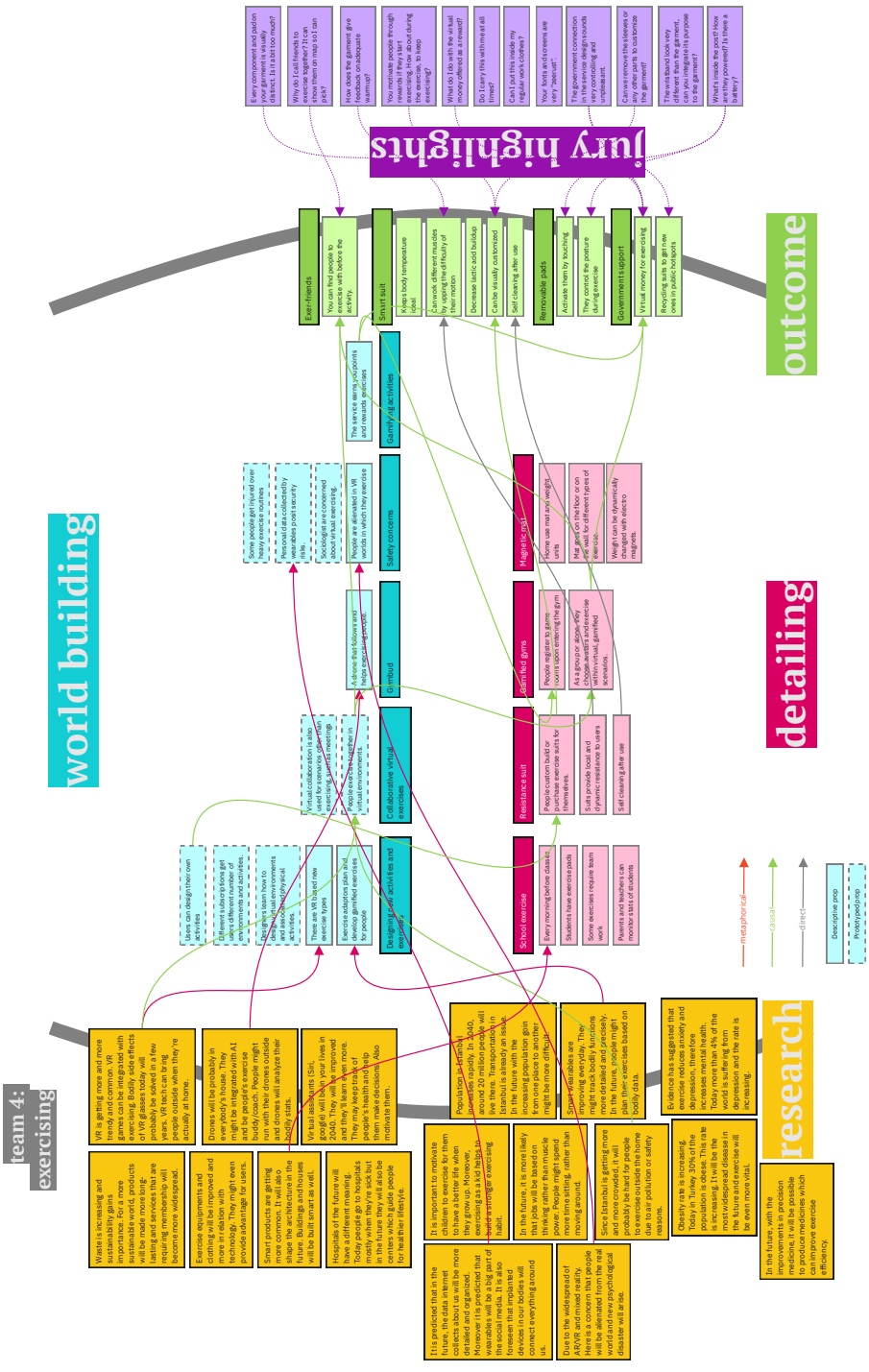


Figure L.4: Progression map for Team 4, Workshop 3

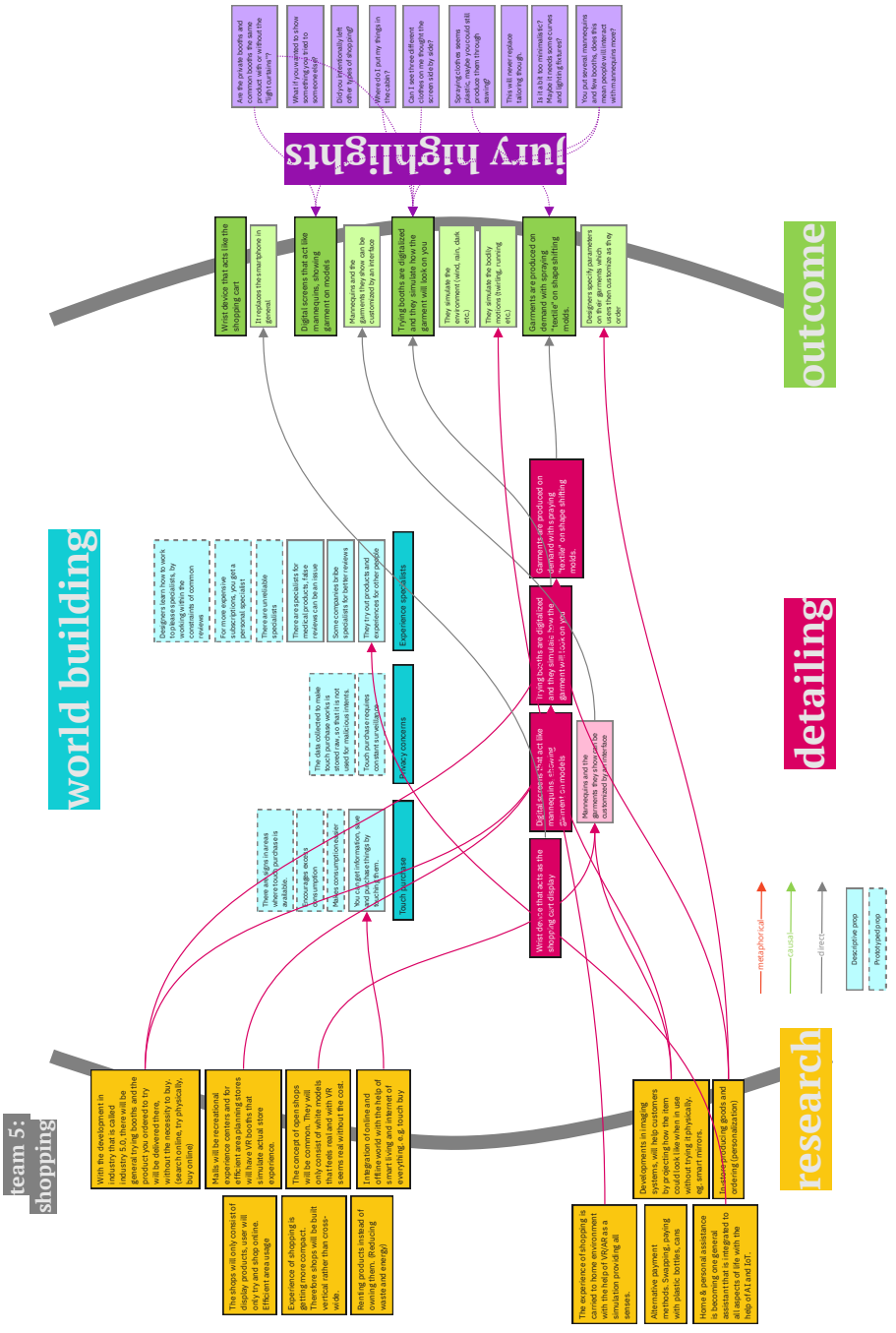


Figure L.5: Progression map for Team 5, Workshop 3

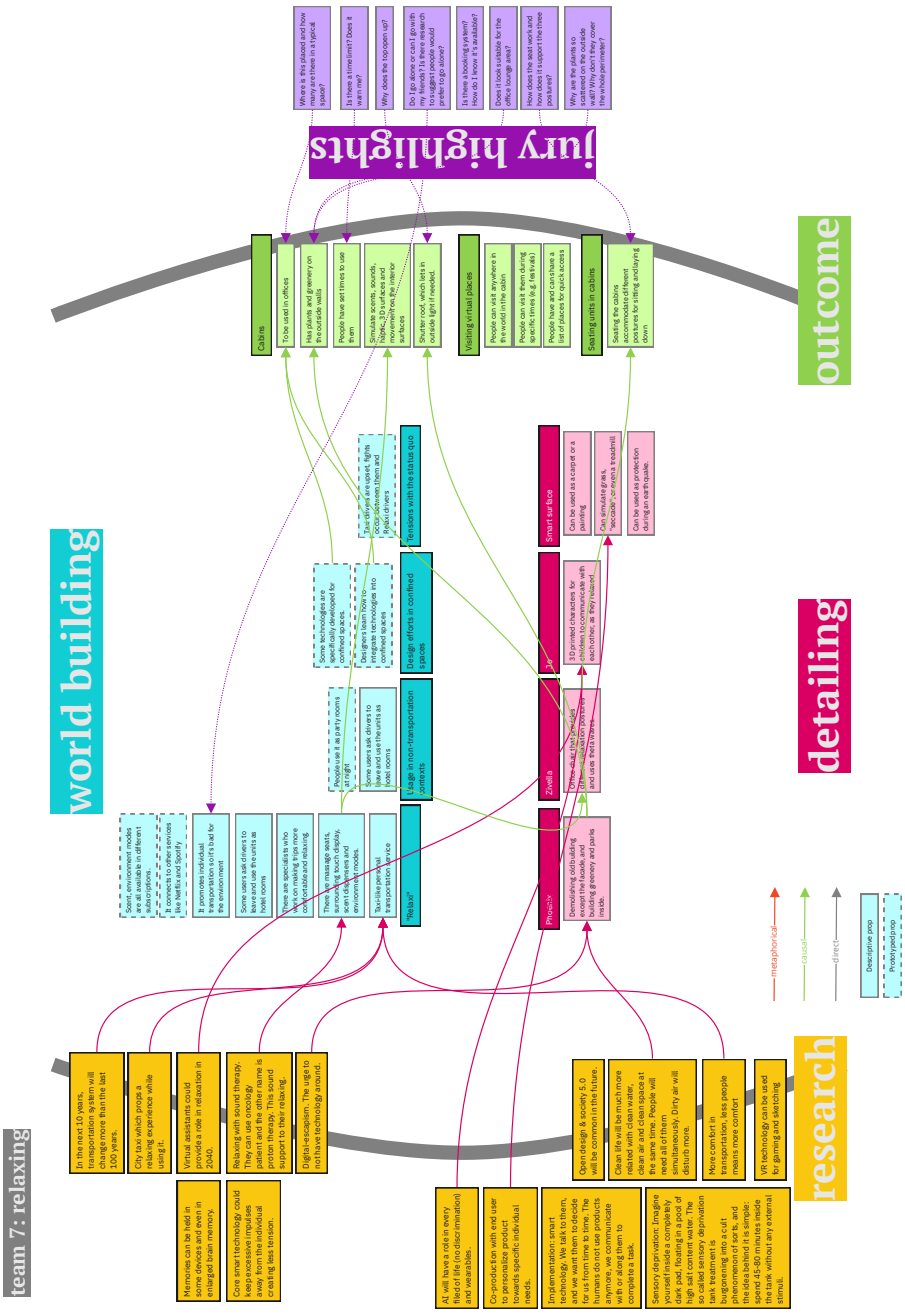


Figure L.6: Progression map for Team 7, Workshop 3

Appendix M

PRINTOUTS FOR THE FINAL TOOLSET

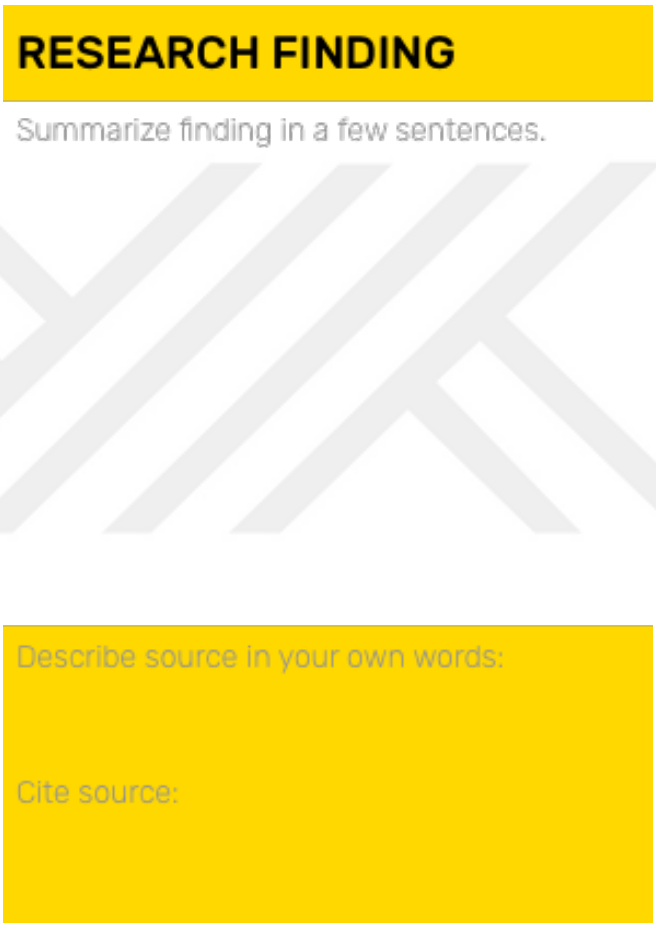


Figure M.1: Research finding sheet for the final toolset

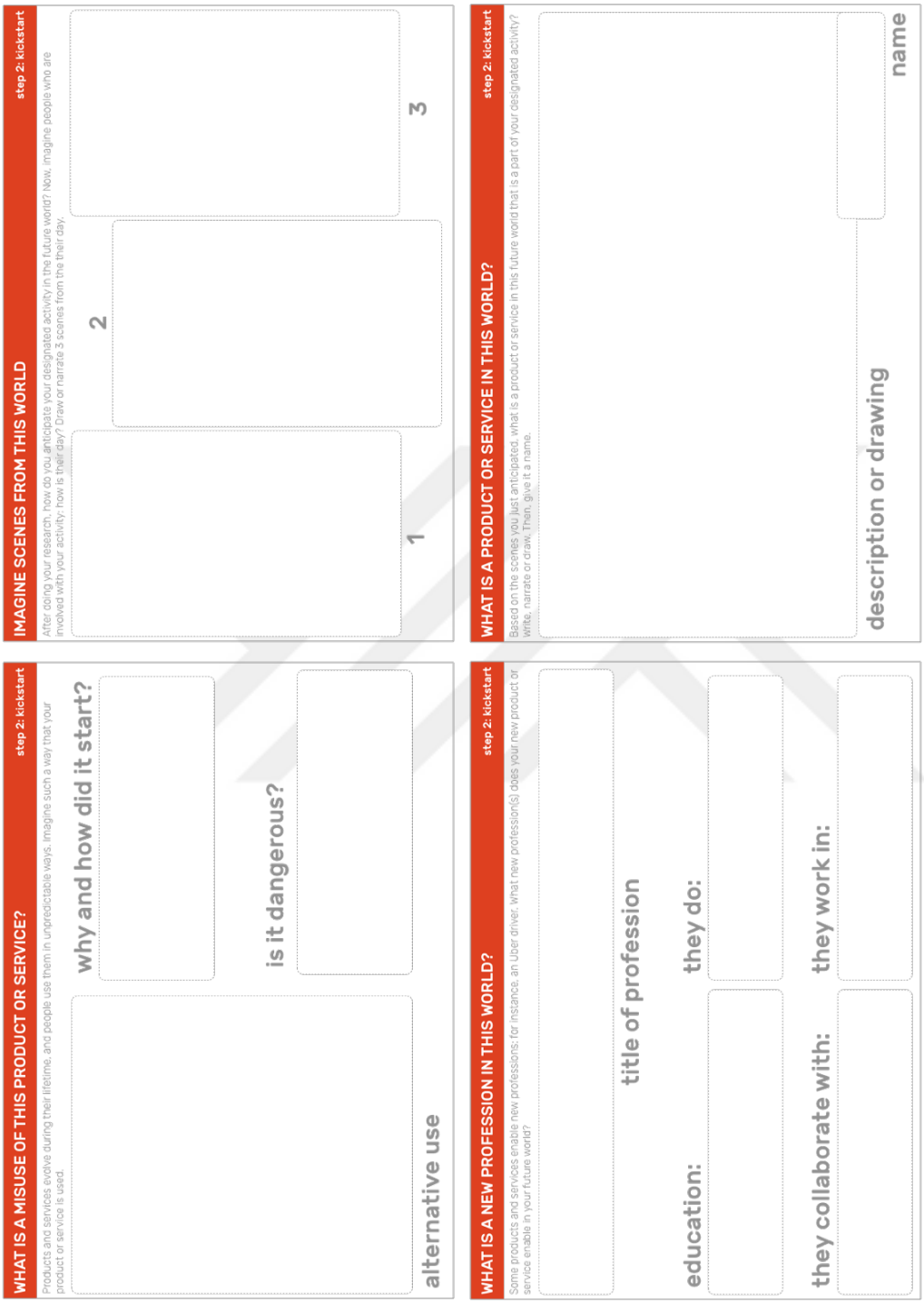


Figure M.2: Descriptive world building exercises for the final toolset



Figure M.3: Prototyping world building exercises for the final toolset (1 of 3)

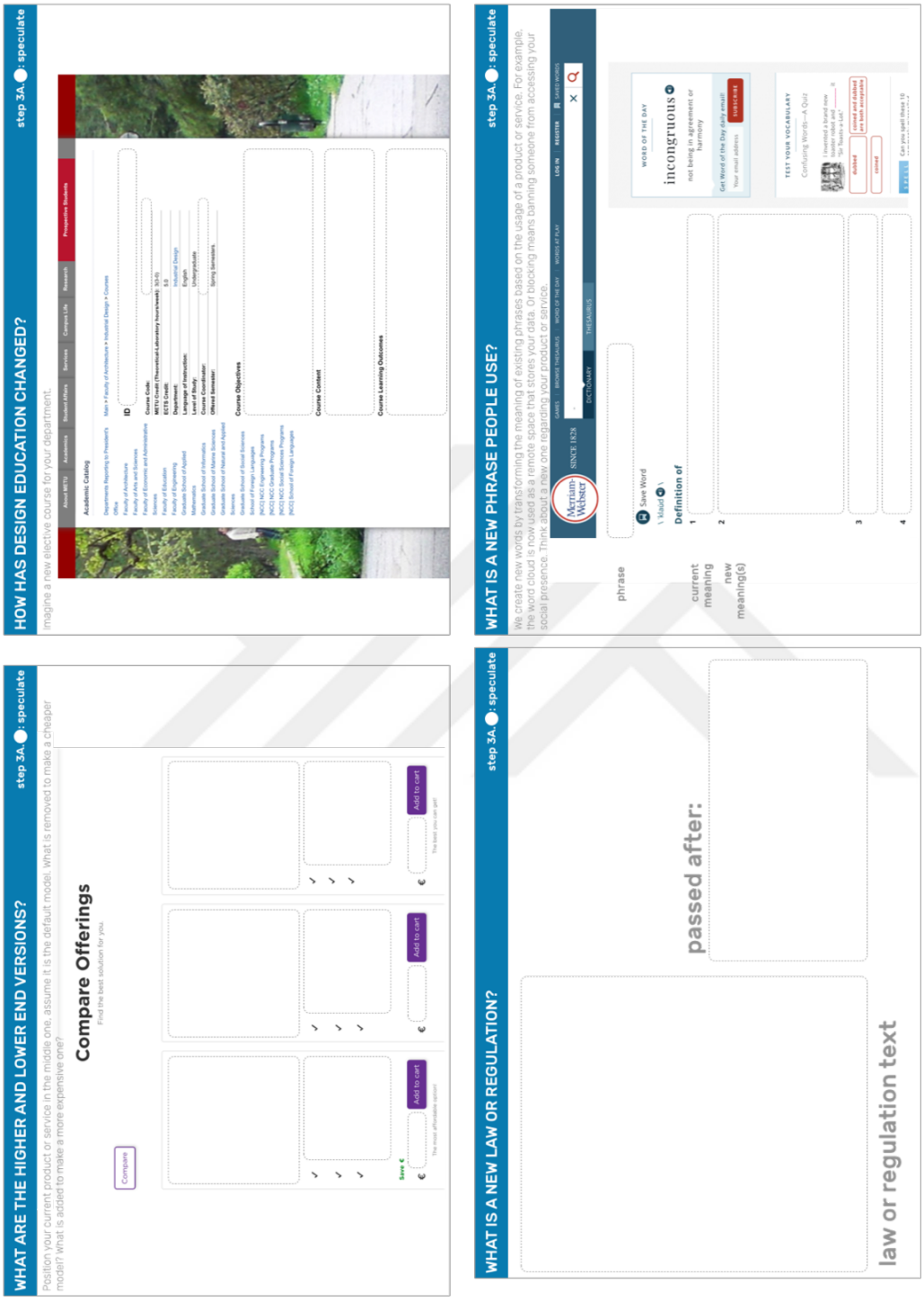


Figure M.4: Prototyping world building exercises for the final toolset (2 of 3)

Figure M.5: Prototyping world building exercises for the final toolset (3 of 3)

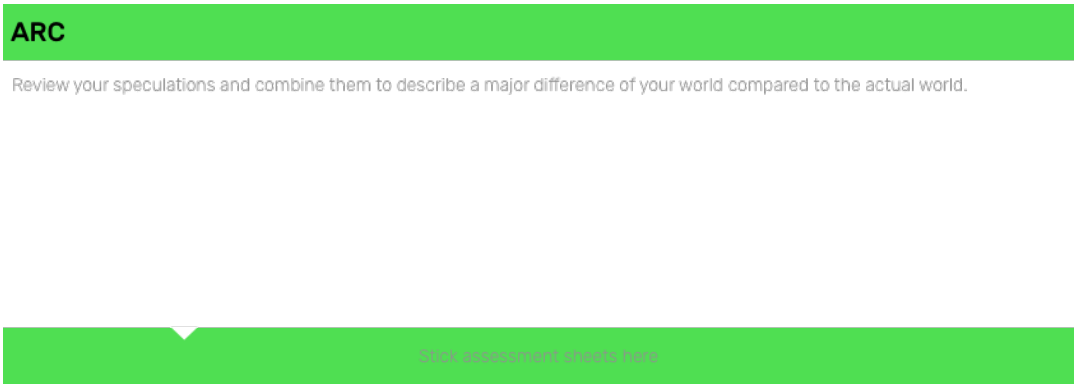


Figure M.6: Arc sheet for the final toolset

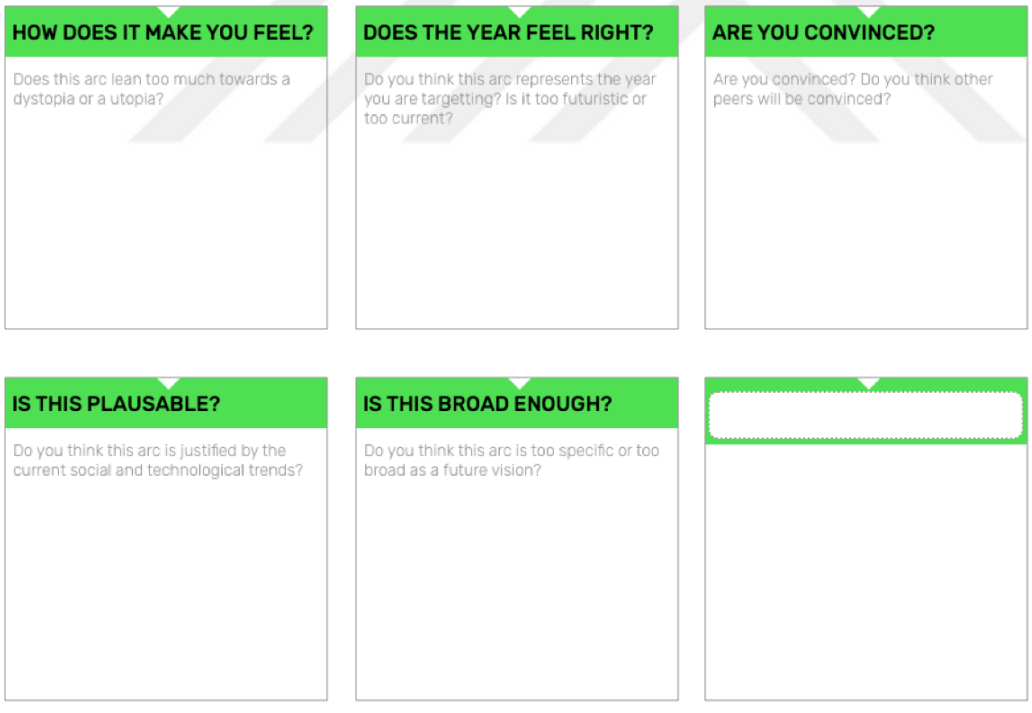


Figure M.7: Assessment sheets for the final toolset

CURRICULUM VITAE

PERSONAL INFORMATION

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EDUCATION

Ph.D., Dept. of Industrial Design, METU, 2021

M.A., Master of Interaction Design Programme, Domus Academy, 2011

B.Sc., Dept. of Industrial Design, METU, 2009

WORK EXPERIENCE

2019–2021	Dept. of Design, Aalto University	Visiting Researcher
2014–2020	Dept. of Industrial Design, METU	Research Assistant
2011–2018	Self-employment	Product Designer
2012–2014	Dept. of Design, Atilim University	Part-time Instructor
2009–2011	Ikoor	Product Designer

PUBLICATIONS

Tuna, N. and **Caglar, E.** (2019). An exploratory study for provocative prototypes: Creating Personas. In *DRS Learn X Design 2019*, Ankara, Turkey, July 2019.

Tuna, N. and **Caglar, E.** (2018). Thematic analysis of online comments for design researchers to contribute to autonomous technologies. In *Proceedings of SIDeR '18, 14th Student Interaction Design Research Conference*, Helsinki, Finland, May 2018.

Caglar, E., Demir, Ö. and Kaygan, P. (2015). One day of the designer: Exploring students' perspectives on the relationship between individual and collaborative work in design process. In *Senses and Sensibility'15: Design as a Trade, Proceedings of the UNIDCOM/IADE 8th International Conference, 5-7 October 2015*, E. Duarte, C. Duarte and F. C. Rodrigues (Eds.), (pp. 353-360), IADE – Creative University, Portugal.

WORKSHOPS

Blatant Fabrications, Co-facilitated with Nagihan Tuna, July 10, 2019, DRS Learn X Design 2019 Fifth International Conference for Design Education Researchers, in METU, Ankara. Participants provided a current design challenge, which we run through a AI text generator (Open GPT-2) and facilitated a future world-building activity based on the results.

Talking Things, Co-facilitated with Nagihan Tuna, November 9, 2019, in METU, Ankara. Participants analyzed sensorial data gathered from household appliances and generated fictional personas for them to be used in potential future of smart products.

Collecting Use Data and Creating Design Insights by Using Design Fiction, Co-facilitated with Nagihan Tuna, September 12, 2018, UTAK 2018 3. National Design Research Conference, in METU, Ankara. A role-playing game was developed to enable design students interview with fictional coffee machines using a conversational interface. We then explored assumptions within user personas they use in their idea generation practices.