When Anticipation and Design Epistemology Converge: Insights from a Futures Literacy Lab

Author:

Alisa Belmas

Supervisor:

Marjukka Parkkinen

Master's thesis

Subject: Futures Studies
Author(s): Alisa Belmas
Title: When Anticipation and Design Epistemology Converge: Insights from a Futures Literacy Lab
Supervisor(s): Marjukka Parkkinen
Number of pages: 97 pages + appendices 4 pages
Date: 13.06.2024

The fields of futures studies and design studies increasingly acknowledge the potential for collaboration in theoretical and practical domains. Designers are recognized as agents, who are privileged to select and prefer one possible future over another, producing it in material form. Therefore, they need tools to facilitate the critical reflection of their assumptions about futures. Such tools can be found in the field of futures studies. In turn, the field of design offers valuable elements beneficial for futures studies. Namely, design epistemology, as a way of knowing, can be integrated into futures research approaches. This integration can foster transformational and affective engagement by giving imagined futures a tangible form.

Driven by this twofold motivation, this study takes an interdisciplinary approach and converges insights from both futures studies and design studies to make a methodological suggestion for a Futures Literacy Lab with Design Epistemology (FLL-DE). It develops the FLL-DE method and evaluates its trial execution with professional designers on a topic of "Futures of cities 2044".

The study offers several key findings. Firstly, it sheds light on the interrelation between anticipation and design epistemology in the proposed FLL-DE method. Essentially, their convergence shapes the process of *artifact-reading anticipation*, which involves producing knowledge about imagined futures through the making of artifacts and subsequent reflection. It allows participants to make tacit anticipatory assumptions explicit, critically assess, accept or challenge them, and build upon them. Secondly, the study suggests that participation in the FLL-DE is likely to develop the anticipatory capabilities of participants and evoke affection, leading to a sense of agency and motivation to act towards the desirable future. Thirdly, the findings indicate the potential for adjustment of designers' "internal compasses" and daily practices as a result of participation in the FLL-DE. Lastly, the images of the future and corresponding anticipatory assumptions that emerged from this study are distinctive and elaborated and connect abstract aspects of futures with human-scale representations. This finding supports the value of applying design epistemology as a way of knowing in futures research.

The principal contribution of this study is in the field of futures studies, adding to the body of research on different modes of knowing in the field. Besides, the results may be of interest in the field of design, as the FLL-DE may be utilized by professional designers to increase awareness of their anticipatory assumptions. This study recommends further investigations to establish the suitability of the proposed FLL-DE method for audiences beyond professional designers and to assess the potential for the full-length FLL-DE to enhance the depth of anticipatory assumptions elicited from *artifact-reading anticipations*.

Key words: Futures Literacy Lab, artifact-reading anticipation, anticipatory assumptions, design epistemology, visual artifacts.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 Introduction

> *"In a very real way, designers create the human environment; they make the things we use, the places we live and work, our modes of communication and mobility. Simply put, design matters."*
>
> – William McDonough, Toward a 21st Century Renaissance, 2003

Design is central to shaping the future (Auger & Hanna 2019, 93). Material characteristics inherent in each piece of design call certain futures into view while eliminating other possibilities. In turn, imagined futures indicate possibilities for modes of living. (Taffel 2018, 163.) The mutual influence of design and futures constitutes a golden thread of this thesis. Futures studies and design studies both deal with the themes of the future and change and there is a mutual recognition between disciplines regarding their potential to exchange ideas and collaborate. Candy and Potter (2019, 1) emphasize that design and futures increasingly engage in a dialogue, due to each field "becom[ing] more fluent in a second language which is the other's native tongue". The essence of their argument is that mutual enrichment through the exchange of concepts, methods, and mindsets helps disciplines come together. For example, designers can systematically explore alternative futures by employing methods such as scenarios, while futurists can utilize visual and material forms to instantiate images of the future. This thesis seeks to add to this cross-disciplinary fluency in second language, by making the language of futures, particularly anticipation, more accessible to designers, and conversely, by presenting futurists to design epistemology as a way of knowing, in the context of Futures Literacy Lab. This interdisciplinary study reveals something about the potential of integration of design and creative practices in the process of conscious anticipation, where *artifact-reading anticipations* – artifact making coupled with the following reflection – allow to give form to tacit assumptions about futures and to connect otherwise abstract images to the materiality of everyday life.

1.1 The role of designers's agency and assumptions about futures

Design can be defined in many ways. One of the definitions posits it as "the competent, aware and creative conception of the material world" (Morello 2000, according to Bello 2010, 30). Another convention of design is "to initiate change in man-made things" (Jones 1970, according to Lawson 2005, 33). Lawson (ibid., 14), establishes an understanding of design above all as an activity: a process of mentally processing various sets of

information, building consistent sets of ideas, and executing some tangible representation of them. Taking as a point of departure the common focus on the tangible and material dimension, I will now shed light on how design and designers' agency towards the future is constructed upon this element.

We increasingly live in a world that we've made, or – predominantly – designed. Designers create the human environment: objects, places, environments, and modes of living. Designers have a unique ability to give form to propositions about how the world could be, acting as agents of change and creators of objects and systems that underpin our social world. It can be argued that designers occupy a space between what is possible and what is real, with their "grasp of the future" being an important determinant of our common reality. (Margolin 2007, 4, 15.) Indeed, designers' beliefs about the future are to some extent embedded in their creations because they produce things intended for future use, guided by their own images of the future (Lawson 2005, 165). Designer and educator Bruce Mau posits that all designers are futurists and refers to design as the capacity to imagine and systematically bring to life a particular future (Smith 2021).

Both Margolin (2007, 4) and Mazé and Wangel (2017, 286) observe that designers, in their professional role, hold extreme power over futures, as they are privileged to select and prefer one possible future over another, producing it in material form. Design can affect market demand, public opinions, and cultural imaginaries. Yet, its major power lies in its deep integration into everyday life practices; through our repeated contact with a multitude of designed objects and constructs, we shape our bodies, habits, environments, and relationships. Hereby, mainstream design artifacts, produced for mass consumption shape the present and future on the human scale. Another source of design power is concept design intended for mass communication in mainstream media, influencing our images of the future. (Mazé & Wangel 2017, 285.) Hence, it is the sum of the dispersed but widespread design decisions is what renders design powerful (Celaschi & Celi 2015, 162, 165).

Hence, there is a consensus that design possesses capacities for more or less conscious modification of reality and privileging one possible future over others. This creates an imperative for designers to take responsibility for their assumptions, agency, and power over futures. Design is embedded with designers' preferences, subjectivities, and normativities, which could and should be made explicit to exercise this power differently.

(Mazé & Wangel 2017, 286.) Additionally, as designers create for the world filled with competing images of the future created or propagated by different groups, they should reflect on their own values, assumptions, and social concerns to orient themselves in this multiplicity of possible futures (Margolin 2007, 10, 12). Ultimately, Mazé and Wangel (ibid., 274) urge designers to become critical practitioners.

The field of futures studies can offer tools to develop the necessary criticality and shed light on designers' assumptions, agency, and power. Specifically, a recently emerging area of research – the discipline of anticipation – addresses activities related to imagining futures and considering this information for decision-making in the present. Anticipation has recently caught attention in the domain of design, notably with the research of Zamenopoulos and Alexiou (2020, 2) who bridge two fields and characterize design as an anticipatory phenomenon. It is important to note, though, that this perspective is still quite novel for the field, and design studies tend to emphasize speculation over anticipation (Light 2021, 2-3).

Futures Literacy Lab (FLL) is a method from the discipline of anticipation to help people imagine futures, uncover their assumptions, and embrace ambiguity and emergence (Bergheim 2022, 3). Although some research has been carried out to explore designers' engagement with anticipation (Ollenburg 2018; Finn & Wylie 2021; Light 2021; Aranda Muñoz, Bozic Yams & Carlgren 2023), to my knowledge, no published research studied the potential of FLL for designers' anticipation. This thesis makes an original contribution to the field by addressing and tailoring FLL to this professional group.

1.2 Co-development of design and futures

The histories of futures studies and design studies – or, more broadly, of futures and design – share several notable similarities and points of co-development. Both disciplines emerged relatively recently. The 1960s and 1970s marked the advent of design methodology and design theory, coinciding with the rise of futures studies, including milestones such as the development of scenario planning, the foundation of the Centre International de Prospective in France, and the publication of numerous foundational works. Already then, prominent thinkers from the fields of futures and design cooperated: for instance, Buckminster Fuller, designer and systems theorist, was a member of the World Future Society alongside futurists Herman Kahn and Alvin Toffler. For both disciplines, that was a period of raising questions and offering alternatives to the status

quo. "The Limits to Growth" is a report we consider seminal in futures studies, which prompted increasing concerns with global visions of the future and the "greening" of futures research. It also addressed ecological demands for design, leading to the birth of the first ecological approaches. However, starting from the 1980s, the integration of design in business expanded, leading to marginalizing its functions beyond the creation of commercially successful products as fantasy. Futures studies similarly experienced the prevalence of neoliberal institutions and worldviews in the 1990s, which somewhat accelerated the development of critical futures studies at the turn of the century. After the sequence of shocks in the 2000-2020s, a revival of a societal request for imagination and thinking about alternatives to the current systems impacted equally design and futures. Both disciplines are currently addressing pressing global challenges, both are transitioning from an exclusively expert-oriented focus to more participatory approaches, and above all both mutually recognize and see potential in joining forces. (Dunne & Raby 2013, 6; Bürdek 2015, 60, 108, 127; Gidley 2017, 6-7, 56 64, 70-71; Godhe & Goode 2018, 152.)

On one hand, mutual appreciation between design and futures results in joint projects, initiatives, and events – to illustrate, a recent exhibition "What if? Alternative Futures" by the Helsinki Design Museum in collaboration with Finnish Innovation Fund Sitra showcased creative professionals' interpretations of weak signals in topics of work, home, nature, city, decision-making, and the metaverse (Designmuseo What if? Alternative futures, n.d.).

On the other hand, the disciplines are coming closer to each other in terms of theory and methods, leading to the creation of hybrid design/futures methodological approaches. Interestingly, the methods often remain more firmly rooted in their originating field and incorporate ideas from the other field more or less loosely, therefore they can be divided into "design-first" and "futures-first" approaches. I will now provide a brief overview of the key methods within each group.

Among the design-first approaches, there are two most common. First is design fiction, a term coined by Bruce Sterling (2005, 30), who later gave it a widely cited definition of "the deliberate use of diegetic prototypes to suspend disbelief about change" (Bosch, 2012). It was developed into a research method and design approach by Julian Bleeker (2009) within his Near Future Laboratory studio. The method includes creating artifacts

that embody a particular imagined future, and often take the form of an ordinary object such as a sign, a magazine, or a product catalog; design fiction can be applied as a corporate foresight tool to create artifacts embodying a company's vision (Examples of Design Fiction, n.d.). The second notable method is speculative or critical design, described comprehensively by Anthony Dunne and Fiona Raby (2013). It can be defined as "[the use of] speculative design proposals to challenge narrow assumptions, preconceptions, and givens about the role products play in everyday life" (ibid., 34). It intends to address wicked problems, suggest critiques of current systems of production, and shed light on the dangers and risks of new technologies (Dunne & Raby 2013, 2; Pinto, Ramírez-Angulo, Pedro & Bonett-Balza 2021, 3). This method entails creating an artifact, oftentimes highly technological and "futuristic", and placing it in a setting such as art galleries or culture inserts in the media, to prompt discussion. Mazé (2019, 27) also considers concept design and persuasive design as design "genres" concerned with futures. The former involves prototypes or artifacts that are created by companies to depict the imagined future of industries in trade shows or corporate media. The latter aims to "nudge" those who interact with a designed piece to change perception or behavior to address challenges such as the climate crisis. All these approaches are similar in their way of utilizing futures primarily as a design context or a medium to support imagination.

Futures-first approaches draw from the rich scholarship of futures studies and employ design to create material representations of alternative futures. Among the early instances of leveraging material or performative dimension in futures research is Jim Dator's Hawaii 2050 Sustainability Project, which included staging four live simulations in four "futures rooms" to immerse the audience into four alternative futures of Hawaii in 2050 and gathering feedback to be used in the following stages of the project. (Dator 2009, 13.) Another hybrid approach is the Ethnographic Experiential Futures (EXF), proposed by Candy and Kornet (2019). EXF entails a cyclical approach to investigating images of the future, creating tangible representations and exhibiting them, and altering the images based on additional data collected (ibid., 11). In developing this approach, Candy and Kornet emphasized representing the images of the future emerging from research data (as opposed to designers' own speculations), gathering feedback, and evaluating the impact of the designed intervention, which is often neglected in design-first approaches. Presently, EXF is utilized for cultural and social research. In the context of foresight, a similar approach has been suggested very recently by Fu and Xia (in press). The method,

called Design Foresight (DF), seeks to perform visual foresight through design. DF combines the exploration of alternative futures and material representation of one – often the desirable – future. (ibid.)

In futures studies, the voices of scholars who criticize the field for its focus on verbal, written, and schematic knowledge are becoming more prominent. Candy and Potter (2019, 1) claim that there is a discrepancy between futures research and its impact on behaviors, attributing this gap to the field's verbal and theoretical focus. Miller (2018c, 29) similarly highlights the uniformity of knowledge creation processes, which leads to treating the past, present, and futures the same and ignoring the open and unpredictable nature of futures. In Ketonen-Oksi and Vigren's (2024, 9) view, the need for novel approaches, tools, and methods is urgent and vital to generate transformative agency. They go on to ask: "How to support the transcendent nature of imagination and the emergence of the previously unimaginable unless we can reform the methodological grounds to do that?" (ibid., 10).

The application of creative, visual, and material practices of the arts, including design, is viewed as promising to facilitate deeper, more visceral, and emotionally resonant ways of engaging with futures. Ketonen-Oksi and Vigren (2024, 5-6) suggest that such approaches raise engagement in affective, transformative, social, and intellectual ways, and even spark empowerment and hope, and therefore, they are key in creating a sense of agency over futures. Methods such as building prototypes can also enable more openness in communication and interpretation of ideas due to their iterative, playful, and work-in-progress nature of exercises (ibid., 7). In a similar vein, Kimbell (2021, 186) advocates for participatory futures approaches that involve making, experiencing, and interpreting creative artifacts to develop anticipatory capabilities and prompt actions. Pouru-Mikkola and Wilenius (2021, 10-11) support this perspective and especially propose merging FLL with improvisation, art, or design fiction. Finally, Godhe and Goode (2018, 155-156), encourage scholars to consider how imagined futures are connected to material practices and take materiality as seriously as abstract concepts. Relative to this is a notable characteristic of hybrid design/futures approaches – their focus on the human scale of futures, including material practices of daily life, that allow for more emotional engagement. In such a manner, they allow us to reconceptualize futures from abstract and far from our everyday life to tangible and immediately associated with our experience.

It is hoped that this thesis will address this call. I expand upon the idea suggested by Pouru-Mikkola and Wilenius (2021, 10-11) and incorporate the making and reflection upon visual artifacts into the methodology of FLL. By doing so, I hope to contribute to widening the range of ways of knowing in futures studies.

1.3   Research questions and aims

Previous subchapters provided an overview of the research background and twofold motivation driving this study. On one hand, designers possess power over futures and thus require tools to become aware of their assumptions, agency, and influence on the future. On the other hand, there is a demand and interest in novel approaches to exploring futures, to transcend the dominance of written, verbal, or schematic forms of knowledge in futures studies. My aim is essentially to promote a more integrated dialogue between futures studies and design studies, and to make a methodological suggestion for an approach that leverages the strength of both fields, thereby applicable in both fields.

With this in mind, I pose the following research questions:

1) *How does design epistemology interrelate with anticipation, particularly within the context of Futures Literacy Lab?* The word "interrelate" in the question suggests a dynamic relationship between design epistemology and anticipation, where each concept influences the other. My goal is to establish the existence of this mutual relationship and to shed light on how it is facilitated by the proposed materials and techniques.

> a) *What role do visual artifacts play in revealing and understanding individuals' anticipatory assumptions?* As opposed to the predominant written and verbal form of knowledge in futures studies, artifacts are more material and visual. My goal is to study how they enable the exploration of tacit knowledge about futures.

2) *What anticipatory assumptions about futures of cities are conveyed through the artifacts created in the Futures Literacy Lab?* Addressing the focal topic of the Futures Literacy Lab – futures of cities 2044 – my goal is to analyze anticipatory assumptions represented in the artifacts and uncovered in participants' reflections.

1.4   The approach and structure of the thesis

The approach I take in this study is naturally interdisciplinary, drawing from both futures studies and design studies. An interdisciplinary approach integrates disciplinary insights from two or more fields into new knowledge, seeking to construct a more comprehensive perspective. Such integration can range from just exploring and comparing the ideas from different disciplines, to mutually integrating concepts, theories, methods, and epistemological principles. (Menken & Keestra 2016, 31.) Although it is hard to pinpoint where interdisciplinary integration exactly happens in research (ibid., 42-23), I will try to do so to orient the reader.

Primarily, my research rests within the discipline of futures studies, maintaining its foundational principles, such as formulated by Masini (1993, 6-10): (1) futures are plural: there are possible, probable, plausible, and preferable futures; (2) the future is the only space in which we can exert influence; (3) in futures studies there is a tension between knowledge, on the one side, and desire and fear, on the other. I adhere to an established disciplinary understanding of the future as plural; open; fuzzy; surprising; not surprising; fast; slow; archetypal; future that could be possible, plausible, probable, and preferable; future that could be inbound and outbound (Bengston 2008, 194-199).

As for a particular research philosophy in this study, I anchor my choice on Minkkinen's (2020, 17-21) categorization of theories in futures studies, which includes five broad categories: theories for rigorous forecasting, theories for effectively representing futures, theories for making sense of anticipatory processes, theories for pursuing desired futures, and radical epistemological critiques. Minkkinen urges futures researchers to adopt reflexivity and purposefully navigate these theoretical fields as necessary for research objectives and consciously position themselves in their studies. Recognizing the unique role of designers in constant making and expanding the future, I adopt in this study a constructivist perspective on futures, that suggests that people create knowledge about futures through their own experiences and reflection on those experiences. Theories for making sense of anticipatory processes and radical epistemological critiques represent the constructivist approach to futures (Minkkinen 2020, 18). Within this study, I take the role of analyst, focusing on observation and interpretation of ways of anticipating futures with design epistemology. While I acknowledge that the participatory nature of this study may have the potential to influence attitudes among participants, this is not the primary

objective. Hence, anticipation and the theoretical concepts developed to make sense of anticipatory processes are the foundation of the present research.

Building on this foundational understanding, I incorporate elements from the discipline of design studies, particularly design epistemology and the unified model of design knowledge as proposed by Thoring, Mueller, Desmet and Badke-Shaub (2022). By doing so, I aim to extend ways in which we can "know" the future (albeit imperfectly and limitedly). I integrate disciplines as I add and connect theory and method: using the insights from design studies I modify Futures Literacy Lab – an established futures studies method – to incorporate design epistemology for knowledge creation. A suggested tool is abbreviated in this thesis as FLL-DE (which stands for Futures Literacy Lab with Design Epistemology). Theory-driven evaluation (Chen 2012) of the trial run of FLL-DE then allows to investigate the application of design epistemology in the context of anticipation. In a nutshell, elements borrowed from design studies make up the object of my research in the domain of futures studies.

Explicitly articulating certain tasks for this study may also help the reader in understanding the approach of this study:

- *Building a theoretical framework*: Theoretical research is used as a starting point for the methodological design of FLL-DE. It includes translating key theoretical concepts (anticipation, futures literacy, anticipatory assumptions, design epistemology, artifacts) and processes suggested by theory into mechanisms to enable participants to engage in anticipatory processes through design-based exercises.

- *Developing FLL-DE:* The established four-phase FLL structure is adopted, at large informed by the UNESCO Futures Literacy Laboratory Playbook (UNESCO & PMU 2023). Design-based exercises are incorporated to leverage design epistemology as a device for creating knowledge and surfacing anticipatory assumptions. In addition, the implementation theory for the trial run is formulated regarding the anticipated outcomes and processes of the FLL-DE.

- *Organizing a trial run and analyzing the results*: A trial run of the FLL-DE was organized with a group of professional designers from a Helsinki-based design

agency Rune&Berg Design. Data was collected in the form of observations, audio recordings, and visual artifacts, and further analyzed in relation to theory.

As a result, this study successfully sheds light on the mutual influence between design epistemology and anticipation, when they converge in the FLL-DE. The findings suggest that utilizing *artifact-reading anticipations* that encompass making artifacts representing a particular future and reflecting on them allows for both building images of the future and developing the anticipatory capabilities of participants. In particular, this approach facilitates representing abstract aspects of imagined futures in a tangible way, on the human scale, which potentially evokes an emotional response and stimulates a sense of agency, as observed in this study. Besides, the findings suggest a potential to adjust designers' "internal compasses" and practices as a result of participation in the FLL-DE.

I conclude this subchapter with the outline of the thesis. It consists of six chapters. Chapter 2 provides the theoretical framework for the study, which consists of the theory of anticipation, futures literacy, and anticipatory assumptions in the discipline of futures studies, and design epistemology and artifacts in the discipline of design studies. Chapter 3 introduces the methodology used in this study, explaining in detail the development of materials and techniques of FLL-DE aimed at facilitating participants' engagement in anticipation. This thesis employs theory-driven evaluation as the analytical framework; therefore, the chapter also outlines the "implementation theory" – expectations regarding outcomes and processes based on the insights from theoretical research. In Chapter 4, the results are presented, addressing the research questions of the thesis. A resulting system map instantiates the interrelations between design epistemology and anticipation as observed in the trial run of the FLL-DE. Anticipatory assumptions underpinning three alternative futures are also presented in this chapter alongside visual artifacts. Chapter 5 provides the discussion part of the thesis, where the theory and results of the research are reflected upon and discussed. Finally, a conclusion in Chapter 6 addresses the implications of this study and the potential for further study.

1.5   Key terms defined

This subchapter aims to briefly examine some key terms used in this thesis and their conventions, to aid the reader's comprehension:

- *Anticipation*: drawing from Rosen's definition (2012, 415, according to Donoghue 2021, 26) the term anticipation in this thesis refers to the process of considering alternative futures to select how to act in the present. Another definition by Brassett (2021, 126) – "[to anticipate is t]o allow the future in, in order to recreate the present" – adds a nuanced understanding of anticipation as a creative act.

- *Anticipatory assumptions*: according to Miller (2018c, 24), these are mental models or beliefs that enable us to envision and articulate particular images of the future; anticipatory assumptions are building blocks of human anticipation.

- *Artifacts*: the term can refer both to designed products (Thoring et al. 2022, 26), as well as the drawings, models, and sketches used to give form to ideas (Comi & Whyte 2018, 1058). In this thesis, I use the term *artifacts* or *visual artifacts* mainly in line with Comi & Whyte, as I study artifacts representing particular futures created during FLL-DE.

- *Artifact knowledge*: knowledge inherent in artifacts about their functional, behavioral, and structural characteristics (Thoring et al. 2022, 26), as well as the technological, cultural, and other aspects of its environment (Bürdek 2015, 148). In the case of imagined artifacts "from" the future, this knowledge reveals aspects of this future (Zimmerman & Forlizzi 2008, 42).

- *Design epistemology*: design epistemology is understood as a particular way of knowing, that entails the perception of the world, generating and expressing knowledge about it through the design process.

- *Designers:* acknowledging that design has many branches, I loosely focus on product, environment, service, and interface design in this study; therefore, I imply designers whose practice is related to these areas.

- *Futures literacy*: "the capacity to distinguish different kinds of futures and understand the why and how of these imaginaries", as defined by Miller in his interview for the School of International Futures' (SOIF 2023)

- *Making:* in this thesis, I refer to *making* as a process of creating visual artifacts, i.e. tangible representations of ideas. Making can include a variety of art practices

(sculpture, collage, using figurines or Lego blocks, etc.), but in this study making took the form solely of *sketching*.

- *Sketching*: creating rough simplified drawings, graphic representation of ideas, including both graphic and written language for idea notation (Lugt 2005, 102).

2   Theoretical framework

The theoretical framework for this thesis is constructed upon the pillars of futures studies and design studies. Particular aspects of selected concepts are presented in this chapter, based on their relevance and utility in addressing the research questions. To begin with, this chapter introduces the concepts stemming from futures studies. Ranged from the most overarching to the most specific, they are anticipation, futures literacy, and anticipatory assumptions. The concept of anticipation is particularly relevant to this study because it provides a foundation for exploring how designers not only "grasp" but actively make the future. Through the lens of the Futures Literacy Framework (FLF), which accommodates diverse epistemologies to make sense of futures, I can effectively explore the potential application of design epistemology to do so, thereby answering the research questions RQ1 and RQ1a. Anticipatory assumptions serve as main analytical units, as suggested by FLF, and in this study they will be analyzed to address RQ2. Then, attention shifts to the concepts derived from design studies, namely design epistemology and artifacts. Understanding what constitutes design epistemology and how design knowledge is created is key to ensuring that the research questions are comprehensively addressed. The concept of artifacts is particularly relevant to this thesis because they represent the unique knowledge about futures created through design epistemology and may serve as enablers for uncovering one's anticipatory assumptions.   Finally, the chapter concludes by exploring the interrelationship between these two strands, contextualizing design epistemology and artifacts within the domain of anticipation.

2.1   Anticipation

2.1.1   Anticipatory systems

Anticipatory systems theory is a conceptual framework that explores how systems anticipate and adapt to future events. An anticipatory system is characterized by the ability to inform its behavior by the anticipated future state of both itself and its environment, acquired through an internal predictive model. The system can be a living organism, a biological system, or a social system. (Louie 2010, 19; Poli 2010a, 770.) The theory was first conceived by Robert Rosen, a biologist and mathematician, and focused on the influence of future states on present changes of state. The evolution of the concept has broadened the initial assumption, leading to a current understanding of anticipatory

systems as systems that consider past, present, and potential future states collectively. Expanding the future state to a plural possible futures states is another significant advancement, as it acknowledges the uncertain and open-ended nature of futures. In Poli's (2010a, 773) view, such anticipatory capacities make anticipatory systems more robust due to better alignment with the ever-changing environment.

Central to the understanding of the anticipatory system is the concept of the internal predictive model, which can be seen as a system in itself. Let us describe the initial Rosen's framework. The main system (S) and the model system (M) interact through encoding and decoding specific attributes of system S to serve as inputs to the model system M, followed by using system M's outputs as effectors (E) to change the behavior of the S (Figure 1). The predictive model M produces either predictions of the future states of S or the future states of S's environment. The model system M operates faster than the main system S, which forms a feed-forward loop in S and influences its current behavior. Another crucial aspect of M is its inclusion of a goal that drives the change in the current behavior. (Louie 2010, 25-26.)
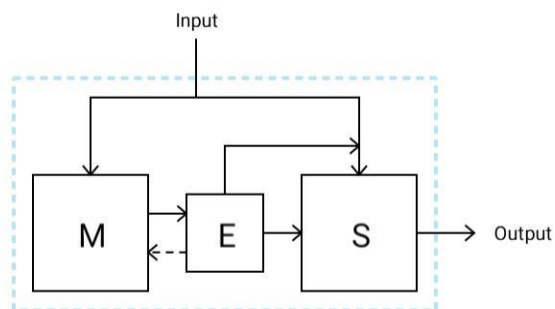
Figure 1. Anticipatory system (based on Louie 2010).

In essence, the information available in M can be used to modify the properties of S through E. It is key to note, that this information is not the definitive knowledge about the future, given that future has not yet happened; it is rather an assertion (Louie 2010, 20). Anticipation can occur on both conscious and subconscious levels, implying that the system itself may either be aware or unaware of its model system. Conscious or explicit anticipation is regarded as strong anticipation, particularly in social or economic systems, given that it can be purposefully utilized. Essentially, if a system perceives its future states positively, it will maintain current behavior, but if it perceives it negatively, it may change behavior to avoid anticipated negative outcomes. (Poli 2010a, 772-773; 2010b, 12.) Three

primary applications of conscious anticipation in social or economic systems are: optimization for a particular future state, contingency or flexible reaction to unknown futures, and novelty or capacity to question the present (Poli 2015, 110). The motivation to render anticipatory processes explicit and purposefully utilized has catalyzed the development of the discipline of anticipation, a topic that will be explored in the next subchapter.

2.1.2 Anticipation as a creative act toward desirable futures

From the conceptual framework of anticipatory systems, a definition of anticipation can be drawn:

> Anticipation […] involves *selective* response to possible futures represented in the present. The very neatly predictable mechanistic world, where 'the future' is imagined as the one and only possible outcome of the past, cannot be preserved if there are systems that anticipate, for anticipation involves symbolizing multiple unrealized possibilities and selecting from those choices. [original emphasis] (Rosen 2012, 415, according to Donoghue 2021, 26.)

The essence of this definition is that anticipation is always expressed in action, which differentiates anticipation from e.g. speculation of, expectation of, or desire for a particular future state (Nadin 2012, 1). Rosen's emphasis on deliberate action toward desirable futures and assertion of anticipated future causing the present are the central tenets of the discipline of anticipation (Brassett 2021, 170).

The discipline of anticipation is a term proposed by Miller, Poli and Rossel (2018, 51-52) to name the budding field of research within futures studies that took off in the 2010s. This area of research aims to systematically study the mechanisms and systems involved in anticipating future states, facilitating a better understanding and utilization of anticipatory processes across different contexts and domains. The authors suggest that a key contribution of the nascent discipline is addressing the question of how to take novelty into account in our perceptions of the present. Publications in the field cover such topics as the theory of anticipatory systems, anticipation and resilience, anticipatory capabilities, anticipatory governance, anticipatory nature of the workings of the brain, anticipation in psychology, anticipatory research in artificial intelligence, and more. (Poli 2010b, 8-11; Miller et al. 2018, 51-53.)

"A Creative Philosophy of Anticipation: Futures in the Gaps of the Present", edited by Brassett and O'Reilly (2021a), is a notable publication that brings together perspectives on the creative processes involved in anticipation. The editors deliberately chose not to make design practice a focal point of the book. Instead, the essays in the collection emphasize broader philosophical and creative aspects. Brassett and O'Reilly (2021b, 2) refer to anticipation as an activity "where the future is not only met but brought into the present as a creative act". In synthesizing various essays from the book, the concept of anticipation can be characterized as expressive and affective, joyous, an activity of "sensing something out", a moment of transitioning from one state to another by learning something new, an iteration of creativity, a "capacity to anticipate beyond the given discourses of needs" (Barron 2021, 85; O'Reilly 2021, 121-122, 124). Creativity is viewed as augmenting the anticipation and introducing unforeseen variables that predictive models may fail to anticipate (Brasset 2021, 157; Donoghue 2021, 49). Brasset (ibid., 126) summarizes the relationship between activities of creation and anticipation when he writes: "[to anticipate is t]o allow the future in, in order to recreate the present". This somewhat poetic definition provides a nuanced perspective on anticipation within the context of my thesis. Designers as creators of objects, systems, and environments that underpin our social world indeed simultaneously anticipate the future and (re)create the present through their practice. However, "the genuinely creative relies on the essential novelty of the world" (Donoghue 2021, 47), which means that designers can fulfill their role only by anticipation.

2.1.3 Anticipatory capabilities as enablers of desirable futures

The capability approach, developed by Sen and Nussbaum (according to Poli 2015, 106-107), understands capabilities as combinations of opportunities for choosing and acting available to agents. Poli (2015, 105, 108-109) observes that all capabilities are inherently futures-oriented in the sense that possessing a capability opens new pathways to the agent's future, and at the same time, the future gives meaning to the possession and application of a capability in the present. He goes on to suggest that the future is the most relevant force that generates value for the agents' choices and actions. Therefore, capabilities enabling agents to engage with futures – anticipatory capabilities – are more important than others, for they enable or fail to enable agents' use of other capabilities in the present. Although Poli does not say so directly, he assumes that those who possess anticipatory capabilities have a different power to those who do not, not only in

attempting personal benefits but also in controlling others through consumable futures narratives. Hence, he urges us to ensure that agents are generating their futures rather than consuming available futures. (ibid., 111.) This also aligns with his argument for conscious, explicit anticipation, deliberately utilized by social and economic systems (Poli 2010a, p. 772-773).

Poli's "consumable futures" closely mirror a concept of the "used future", coined by Inayatullah (2008, 5). It can be argued that the two concepts are essentially synonymous and refer to an image of the future that does not necessarily reflect the genuine worldview and values of the person who holds this image but is acquired from elsewhere, for example, through mainstream media. In the field of design, used futures take the form of conformity and replication of the same visual cues that materialize "the" future, as noted by Lathorp (2023). She maintains that oftentimes mainstream innovations look the same because they are derived from the same social and design systems, which dictate a singular image of the future alongside with singular definition of "good" design (four similar designs of smart speakers illustrate this idea in Figure 2). Inayatullah also discusses the anticipatory capacity, which entails an individual's confidence to break free from the used futures, challenge assumptions about the future, and, ultimately, create desirable futures. Furthermore, this capacity creates conditions for embracing emergence and paradigm shifts. (ibid., 6.)

Figure 2. Used futures manifested in design: "The future literally comes in black and white" (Lathorp 2023)

To date, several anticipatory capabilities have been presented in the literature, including: Futures Literacy (Poli 2015; Miller 2018b), Futures Consciousness (Ahvenharju, Minkkinen & Lalot 2018), Future Time Perspective (Volder & Lens 1982), Future Orientation (Seginer 2008), and Anticipatory Thinking (Klein, Snowden & Lock Pin

2010; Geden et al. 2019). This thesis examines Futures Literacy in particular. The conceptual framework of Futures Literacy, as it will be elaborated in the next subchapter, is built on the recognition that there are multiple epistemological approaches to understanding the future. Therefore, the Futures Literacy context opens possibilities to accommodate design epistemology and explore its interrelation with anticipation. The following subchapter moves on to consider Futures Literacy in detail.

2.2 Futures Literacy

2.2.1 Perspectives and debates around Futures Literacy

Futures Literacy (FL) is a major novelty in the field of futures studies. The term was brought forward mainly by Riel Miller in a series of his publications (e.g. Miller 2007; 2018b; 2023, Preprint) with active lead and support of UNESCO, which aims to establish FL as an educational goal (Miller 2018b, 3).

FL has been defined by several researchers. According to Poli (2015, 110), it is "knowledge of how to use the future; it is familiarity with anticipatory processes". Miller (2018b, 2) defined FL as "the capability to 'use-the-future'" in his seminal work, and, most recently, as "the capacity to distinguish different kinds of futures and understand the why and how of these imaginaries" (SOIF 2023). Balcom Raleigh (2020) emphasized that it is about "diversifying how and why we use futures". Mangnus, Oomen, Vervoort and Hajer (2021, 1) said that FL is "the ability to use an appreciation of projectivity to act upon the future". Despite subtle differences, these definitions share common ground in their emphasis on some kind of action in the present, the "usability" of futures. Balcom Raleigh's definition prioritizes the variety in these actions obtained through being futures literate, while Poli's definition focuses more on acquiring meta-knowledge of how we anticipate. In the definitions of FL, the essence of anticipation as a behavior is, therefore, reflected. The notion of "literacy" is intentionally employed to draw a parallel between the significance of FL and that of, for instance, language literacy. Both are viewed as the acquisition of empowering knowledge. (Poli 2015, 110.)

But what renders FL so empowering? In his recent interview, Miller exhorts:

> Being futures literate contributes to a better understanding of the sources and impact of distinct imaginaries, such as ideologies and the search for certainty, on what people are able to see and do. Without this literacy, individuals are

> susceptible to confusion, anxiety, and fear. They are unable to grasp the power of imaginary futures on both perception and choice. (SOIF 2023.)

Miller's point is that FL empowers individuals to adopt a more critical stance toward their own images of the future and their "consumed futures". Moreover, FL fosters greater agency in present actions: shifting from preoccupation with planning for a "certain" future state to recognizing emergence and taking proactive steps toward realizing a desired future. In comparison to other anticipatory capabilities, FL can be viewed as a meta-cognitive capability, for it entails being critical of own thinking processes, related to futures. (Miller 2018a, 106.)

Futures Literacy Laboratory (abbreviated as FLL in this study) is a tool, specifically developed to research or develop FL (Miller 2018a, 95). A detailed description of FLL is provided in Chapter 4, however, for the purposes of further discussion, a brief description is as follows. At the core of FLL is a collective action learning process aimed at surfacing participants' images of the future of the topic under investigation and assumptions behind them, followed by a task to imagine the future of the topic through a frame that is distinct from existing ones. Once a novel image of the future is created, participants are prompted to reflect and compare the images from different phases. Finally, participants translate their learnings into actionable points for further implementation. (Bergheim 2022, 4.)

Despite the growing interest, significant theoretical challenges exist within the field of FL (Voegele, Pattermann, Bierwisch & Som 2023). It may be caused by two factors. Firstly, the concept is relatively novel and we are witnessing its ongoing evolution; it shows typical traits of a developing field of research such as fragmented scholarship consisting mostly of exploratory research and conceptual contributions. Thus far the field has been shaped by a limited number of scholars, published repeatedly and predominantly as solo authors (ibid.). Secondly, the field is moved forward in large (but not exclusively) by practitioners, many of them involved in UNESCO's FL "global network" (Jennische & Sörbom 2023, 107). This bears a resemblance to the fast but fragmented development of the scenarios method at the turn of the 20th century, which led to methodological chaos and lack of thorough theoretical grounds, despite being one of the most used futures studies methods (see, for example, Spaniol & Rowland 2018).

More recently, literature has emerged that offers a critique of the concept of FL. Facer and Sriprakash (2021) have challenged Miller's narrowing of what a 'right' use of the

future is and insisting on a standard form of futures literacy. They draw our attention to the risks of casting those without 'proper' futures literacy training as futures illiterate, excluding them from the dialogue about the future. The capacity to aspire – the ability to imagine and aim toward a life or society different from one's present – is already unequally distributed in society (Appadurai, 2004, p. 68). Facer and Sriprakash (2021, p. 6) insist that further standardization and promotion of FL from the global centers of epistemic power can only lead to the reproduction of the privilege. According to the authors (ibid.), UNESCO is actualizing this risk through its actions of institutionalizing the particular form of FL and suggesting FLL as the only authorized practice for developing this capability. In a similar vein, Karlsen (2021, 3, 9) questions the idea that FL can be exclusively developed in FLL, suggesting that many other participatory futures methods designed to open up the future and create a preferred future can serve this purpose.

On one hand, the critiques on standardization have some merit. Miller (2018b, 8) calls FL a necessary and ordinary skill; its absence makes actors, whom he calls "futures illiterate", less capable of grasping novelty. On the other hand, Miller explicitly asserts that FL is a reflexive capability, and an individual's ways of using the future could be reinvented and redefined. Even if he insists on FLL as a core practice of building FL, he admits that various futures studies methods can be used to customize FLL to build FL, various epistemologies can be integrated and there is no "procedural or methodological exclusivity" in FLLs. (Miller 2018c, 42-43.) He also is aware of the risk of creating a divergent knowledge space, and he expresses hope for dialogue within the global futures studies community to further develop the concept (ibid.). In later publications, Miller emphasizes the transformative potential of FL in empowering communities to imagine alternative futures, countering future narratives produced by "systems of elite reproduction" that "reproduce past power relationships" (Miller 2023, Preprint, 3), directly confronting the assertions in exclusionary nature of the concept.

Despite Miller's defense, another critique is put forth by Jennische and Sörbom (2023). In their ethnographic study scrutinizing the implementation of FLLs, including those linked with UNESCO, the authors conclude that it carries a potential risk of shifting the locus of responsibility for shaping the future from systems to individuals. Redirecting attention to individual agency, organizers of FLL avoid discussing how FL in practice intersects with the systemic circumstances, even in cases where FL initiatives are

implemented in countries governed by conservative or authoritarian regimes. This standpoint disregards the necessity for systemic reforms and disproportionately emphasizes personal agency, resulting in the utopia of empowerment. (ibid., 114-117.) Scholars, who operate independently from UNESCO, are advocating for a more reflexive approach to FL, that involves reflection on the power dynamics behind different imagined futures (Mangnus et al. 2021, 2) and situating FL within particular systems and historically specific moments (Facer & Sriprakash 2021, 7).

Taken together, the literature presents a range of perspectives on FL. Indeed, power dynamics inherent in the application of the theory may lead to its misuse, and efforts must be made to ensure greater reflexivity and criticality. My assessment of the issue is mixed. I do support the critical perspective regarding the practical application of FL, but I find Miller's argument about the usefulness of FL's conceptual framework and the transformational potential of becoming aware of own ways to use the future to be equally persuasive. Untangling these issues has prompted extensive contemplation regarding my theoretical choice, but, ultimately, I do not deny the theoretical utility of the FL framework for the objectives of my research. Leveraging its pluri-epistemic nature, I believe I can attain a more nuanced interpretation of the role that design epistemology can play in anticipation.

2.2.2 Futures Literacy Framework

The Futures Literacy Framework (FLF) presents a comprehensive and succinct view of the FL as an anticipatory capability. The framework includes: (1) a set of ontological claims about the way we "use the future" drawn from the theory of anticipatory systems, (2) a set of epistemological and methodological claims regarding the development of FL through knowledge creation processes, and (3) the relationship between the two (Miller 2018c, 25; Facer & Sriprakash 2021, 2).

The FLF is based on the theoretical ground of anticipation and anticipatory systems, discussed above. Key ontological claims behind the framework are: (1) the future is yet to be determined but is understood to exist in the present through anticipation, and (2) the universe is creative and generates novelty, therefore our anticipatory – or predictive, in Rosen's terms – models are imperfect and flawed. Understanding the models is important, to make sense of their framings, limitations, and influence on our decisions in the present. (Facer & Sriprakash 2021, 3.) Miller (2018c, 22-23) distinguishes between two types of

conscious anticipation: anticipation for the future, where the goal is to prepare or optimize for potential future states; and anticipation for emergence, where the focus is on the anticipatory process itself, aiming to open up the possibility space and foster genuine creativity and novelty. He also suggests that different types of anticipatory systems correspond to these two types of anticipation (ibid.).

The epistemological part of the FLF describes the knowledge-creation processes: methods and practical ways of generating and describing futures. It rests on the belief that human imagination is pluri-epistemic and cannot be grasped through only one way of knowing. Therefore, a degree of agnosticism and openness to various epistemologies is inherent in the framework, and the selection of a particular knowledge-creation process should be done for the context of each FLL. (Miller 2018c, 28, 30; 2023, 8.) I see the openness of the FLF to different ways of knowing as the point of confluence of this thesis, offering an opportunity to integrate insights from futures studies and design studies. From an interdisciplinary standpoint, the integration of design epistemology in the FLF creates an occasion to imagine and give meaning to possible futures in a manner divergent from the widespread verbal or schematic approaches. This addresses the need identified by the scientific community to diversify ways of knowing futures.

Lastly, the concept of anticipatory assumptions within the FLF is of particular interest for this study. Anticipatory assumptions are the building blocks of our anticipatory models and basic analytical units of the FLF. Anticipatory assumptions are essentially mental models or beliefs that enable us to envision and articulate particular images of the future (Miller 2018c, 24). Connecting the concepts of FL and anticipatory assumptions, Miller (ibid.) concludes that "being futures literate is the capacity to identify, design, target and deploy [anticipatory assumptions]". Hence, when FLL is referred to as a method for developing FL, this means that it allows one to observe and discuss anticipatory assumptions, through a particular knowledge-creation process. Awareness of one's anticipatory assumptions allows one to be critical towards decisions, explore alternatives, and deliberately intervene in the environment of change. Similarly, awareness of the anticipatory assumptions of other actors sheds light on potential conflicts and their solutions. (Bergheim 2023, 3.) Bergheim (ibid., 6) develops the concept of anticipatory assumptions by suggesting a classification based on insights from 11 FLLs. The classification includes four categories: basic assumptions about the issue addressed in the

FLL, dimensions of the issue, assumptions regarding the dis-/enablers of actions, and assumptions about change.

2.2.3 Evaluation and measurement of Futures Literacy

In their recent analysis of the publications on FL, Voegele et al. (2023) report that thus far the field lacks measurement concepts. The fact that FL lacks measurable criteria induces major criticism of viewing FL as a capability (Karlsen 2021). Karlsen points out that we require criteria of assessment from other forms of literacy (e.g. reading), whereas FL does not specify any measurable criteria to be met. Therefore, he questions the use of such notions as 'literacy' or 'capability'. He goes on to deem FL 'a primitive term' rather than a capability. (ibid., 9.)

Indeed, while Miller (2018b, 2) claims FL to be a capability, and FLL to be a practice to develop it, learning outcomes remain speculative, and no measurable criteria for novel literacy are provided. He draws a line between futures literate and futures illiterate agents, but any discussion on how we can distinguish between the two is missing. FLLs, according to Miller (2018a, 108), are effective and efficient ways to develop an ability to discover and invent novelty, making someone who is futures literate able to generate new imagined futures. Yet, again, no measurement of this ability is suggested.

Some attempts have been made by other scholars to provide measurable criteria for FL. Ehresmann, Tuomi, Miller, Béjean and Vanbremeersch (2018, 67) suggest measuring an individual's ability to deal with novelty which can be evaluated by assessing the questions related to imagined futures. They suggest that an individual's ability to ask new questions related to imagined futures can be a proxy measure to FL, with metrics being: binary evaluation of the ability to ask such questions (yes or no), the degree of newness in the questions and the extent to which questions pushes the boundaries of newness. Boer, Wiekens and Damhof (2018, 6-10) suggest that FL can be measured by evaluating six indicators: critical thinking, open-mindedness, creativity, self-efficacy, empathy, and personal need for a structure. While this evaluation model has been applied to evaluate FL development after an intervention in at least one known case (Aranda Muñozet al. 2023), Boer et al. fail to provide compelling arguments as to why these particular components and corresponding assessment scales are recommended and subjective choices dominate the study.

However, a lack of measurable criteria is not necessarily an insurmountable obstacle to providing evaluation and assessment of FLLs. Even in the absence of quantifiable measures, qualitative evaluation methods can be employed. For instance, evaluators can focus on assessing the process and perceived value of FLL to participants and stakeholders. Bergheim (2022) has attempted to provide insights into how evaluation of FLLs is done in practice, which he derives from interviewing ten experienced developers and facilitators of FLLs. He reports at least four methods and tools for evaluating FLLs: (1) surveys and questionnaires, (2) use of self-reflections by participants, (3) observations of participants' reactions and engagement during FLL, and (4) retrospectives among facilitators and stakeholders. The fifth method – semi-structured interviews with participants – is mentioned as a promising, but not yet utilized tool. In terms of the "what" of evaluation, only a few examples are reported, including, among others, participants' engagement, the occurrence of collective learning, or participants' understanding of the limitations of their future perspectives. Bergheim observes, that these answers mirror the answers given on the intentions to run FLLs. (ibid., 10.) Bergheim's observations underscore the theory-driven nature of the evaluation process. This approach means that evaluation efforts are grounded in the theoretical underpinnings of the intervention (Chen 2012, 17). In the case of FLLs, the evaluation methods and criteria identified by Bergheim reflect an effort to examine how FLLs fulfill their intended objectives and align with the theoretical foundations of FL.

2.3   Design epistemology

2.3.1 Understanding design knowledge: generation, transition, types, qualities

Design epistemology is commonly referred to as the study of "designerly ways of knowing" (Cross 2006, 101). This notion suggests that designers have a unique way of sensing the world and understanding it, seeing problems and opportunities that others do not see. Therefore, they also think in a particular way. (Thoring et al. 2022, 28.) This particular way of perceiving, however, is not exclusive to professional designers but is rather a universal human ability cultivated in all individuals who partake in the act of designing to change their environment (Simon 1969, according to Bello 2010, 32; Kim & Tan 2022, 5).

Yet, reducing design epistemology only to the ways of knowing neglects some of the other key questions of epistemology, such as: What can be classified as knowledge? What mechanisms facilitate its acquisition of knowledge? What underpins people's justified beliefs? Hence, a more comprehensive approach is needed, one that takes into account not only the perception of the world (and its futures) but also the pathways through which such knowledge is constructed. For the purposes of this thesis, it is important to understand what constitutes design knowledge, and how it can be generated and expressed. These insights will later be integrated into the FLF to develop specific methods and materials of FLL-DE to facilitate anticipation through design epistemology.

In their recent article, Thoring et al. (2022) reviewed the literature on design knowledge, identified 30 most influential works, and proposed a pioneering comprehensive model of design knowledge. Their model facilitates further research on design epistemology in a more unified way, also opening up opportunities for bridging theories of design knowledge with research in other fields. Thoring et al.'s (2022, 30) unified model of design knowledge is illustrated in Figure 3.
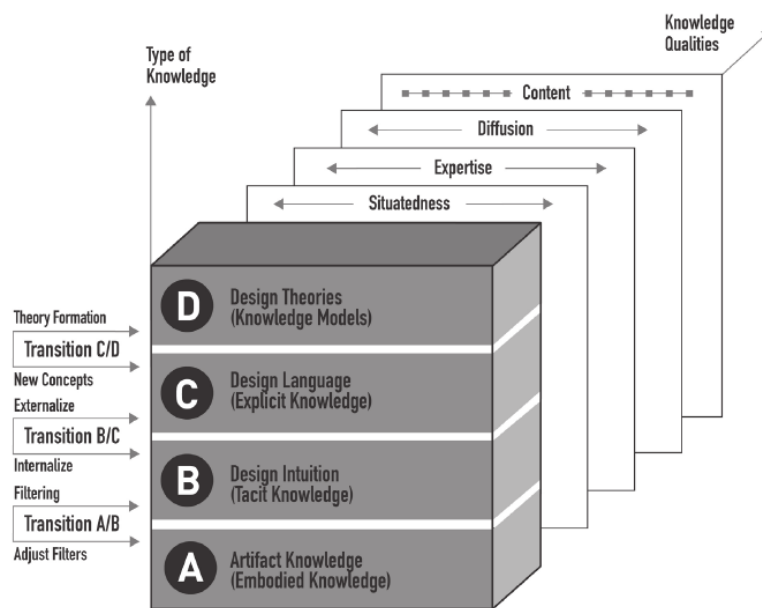
Figure 3. Unified model of design knowledge (Thoring et al. 2022, 30)

It includes the following components: design knowledge types (representation of knowledge), design knowledge qualities (aspects of design knowledge), and transformation of knowledge embedded in transitions between knowledge types. Here follows a short description of these components.

Knowledge types refer to types of representation of design knowledge. We can distinct between four different forms or formats in which design knowledge is represented or expressed, each conveying different aspects of knowledge and serving different purposes in the design process (Thoring et al. 2022, 26-27, 29):

- Artifact Knowledge (Level A). Objects created by designers contain in themselves knowledge about functional, behavioral, and structural characteristics. They also inform about its use (Isley & Rider 2018, 366), e.g. the solution of how to open a bottle is embedded in the form of the bottle opener itself.

- Design Intuition (Level B). Tacit knowledge about design gained through experience or, sometimes, observation, which results in the ability to intuitively assess design and understand knowledge embedded in objects.

- Design Language (Level C). A symbolic level of knowledge, codified in texts, figures, visual languages, terminology, or the use of specific computer programs.

- Design Theories (Level D). Compressed and abstracted form of design knowledge, transferable across projects, and aimed at how an artifact should be conceived and developed.

Knowledge qualities refer to specific characteristics of design knowledge and provide additional dimensions for design knowledge beyond just its categorization into types. Regardless of the type of design knowledge, these four qualities contribute to its nature and characteristics and can be found in each type. Four qualities are as follows (Thoring et al. 2022, 29):

- Situatedness. The extent of knowledge specificity vs applicability across various contexts or domains.

- Level of Expertise. Evaluation of a designer's experience and skills, e.g. novice vs expert.

- Knowledge Diffusion. Availability of design knowledge to a broader audience, ranging from low to high.

- Knowledge Content. Topic or domain, which the knowledge concerns.

Three knowledge transitions emerge between the four knowledge types, indicating the pathways through which knowledge is transformed or moved from one level to the next (Thoring et al. 2022, 28):

- A⇄B. Gathering signals from observing or interacting with designed artifacts builds the designer's tacit knowledge, adjusting how he or she sees the world, and vice versa, tacit knowledge is given a form through artifact making.

- B⇄C. Externalizing the tacit knowledge through agreeing on terminology, learning specific skills, and, most importantly, through reflection, verbalization, and discussion of tacit experiences; in turn, explicit knowledge can become tacit through frequent application.

- C⇄D. Building practical models or frameworks to address specific design problems, such as "journey maps" or "personas", with the use of design language, and agreeing on design language for particular theories.

Having established what counts as knowledge, it is important now to address the question of how the knowledge is generated. Central to design epistemology is the fact that knowledge is created through the very process of design – through making and consecutive reflection. More specifically, it is generated through the designer and the relationship between the designer and the artifact, thus, the two cannot be separated. In other words, designer, process, and artifact in their inseparability serve as sources of knowledge. (Isley & Rider 2018, 364-365; Kim & Tan 2022, 5.) Light (2021, 12) observes that it is the "hybrid process + object" [emphasis original] that provides learning opportunities in the design process.

Among other processes of making artifacts, sketching is frequently reported by artists and designers to play a central role in creative discovery (Verstijnen, Leeuwen, Goldschmidt, Hammel & Hennessey 1998, 2). Lugt (2005, 102-108) summarizes three key functions of sketches in the context of collaborative idea-generation derived from his literature review: (1) the thinking sketch, being incomplete and ambiguous, enables designer to re-interpret it and re-iterate with newly acquired insights; (2) the talking sketch is a means of sharing own ideas for re-interpretation of other participants; (3) the storing sketch provides accessibility of the earlier ideas to use them in the idea-generation process. This

classification sheds light on how the dynamics between designers, artifacts, and the design process may unfold in a collaborative setting.

2.3.2 Artifacts as anticipatory epistemic objects

This subchapter discusses artifacts and their epistemic significance in greater detail. Stanford Encyclopedia of Philosophy (Preston n.d.) defines artifacts as "objects made intentionally, in order to accomplish some purpose". This definition traces back to the Aristotelian distinction between man-made and naturally occurring objects, extending beyond tangible objects and including abstract entities, such as musical performances, software, actions, or belief systems (ibid.). The term "artifact" is employed across a variety of disciplines, ranging from archeology and museum studies to education. Design studies employ the term as well, where it can refer to designed products (Thoring et al. 2022, 26), as well as the drawings, models, and sketches used to give form to conceptions (Comi & Whyte 2018, 1058).

Epistemic objects are objects that serve as a focal point for knowledge construction, open-ended projections oriented to something that does not yet exist (Miettinen & Virkkunen 2005, 438). Artifacts are epistemic objects. I have introduced the term "artifact knowledge" already in the previous subchapter, as one of the types of design knowledge (Thoring et al. 2022). Bürdek (2015, 137, 139-141) traces the development of the notion of artifacts bearing knowledge in design studies from the 1970s, arguing that design objects are not only functional but also informational, serving as signifiers and means of language and understanding of the social environment. Bürdek (ibid., 148) further writes, that

> […] today design is a phenomenon that can only be understood under technological, social, economic, ecological, and most of all cultural aspects.
> […] Design has become a "living socio-technical formation"[1]

In short, Bürdek's observation is that design artifacts exist in a socio-technical milieu, therefore, artifact knowledge reflects the technological, cultural, and other aspects of its environment. In a similar vein, Miettinen and Virkkunen (2005, 443) suggest that "the human form of sociality is objectified in the use of shared artefacts [sic]". One implication of this assertion is that denoting artifact knowledge through analysis can provide insights

---

[1] Bürdek cites here Faßler, M. (2014). Design – Statuskunst? In: Design identifizieren, ed. by Deutscher Designer Club. e.V. Frankfurt am Main

into the world to which it belongs, including its cultural, social, technological, economic, ecological, and political aspects.

This thesis is firmly rooted in futures studies. Yet, I find it intriguing to take a moment to explore how the disciplines studying the past – art history, cultural history, and archaeology – harness the power of artifact study. Fleming (1974) proposes a model for artifact study in the field of cultural history. According to him, artifact study involves, among other procedures, analyzing tangible and intangible dimensions of the artifact, reasons for its creation, and intended and unintended uses. Through such analysis, researchers can derive broader generalizations about the society that produced and/or used the artifact. Artifacts can be regarded as documents containing evidence about their culture, that can be read to establish historical facts such as the technological level of the culture, social structures, trade relations, and more. (ibid., 157-160.)

Returning to the subject of futures, the question is, can artifacts – and now I am talking about imagined artifacts "from" the future – shed light on the future in a similar manner that they reveal something about the past? One of the central premises of futures studies is that "there are no past possibilities and there are no future facts" (Brumbaugh 1966, according to Bell & Mau 1971, 9), meaning that there is no certain future about which we can make any factual claims. Thus, the answer is "no" if we are asking about the future, in singular. But we can use artifacts to study images of the future and underlying anticipatory assumptions about futures, in plural, varying across individuals and groups.

For one, we can employ research methods that involve design and artifact-idea generation, such as those explored in Chapter 1 (for example, design fiction or EXF), and others, such as "The Thing from the Future" game developed by Candy (2018). In this participatory method, participants are tasked to articulate imaginary things that could exist in a specific future. Candy (ibid., 239) calls this process "reverse archaeology": whereas archaeologists study artifacts to make generalizations about their cultures, participants of the game particularize a skeletal description of the world in the form of artifacts. In other words, they are imagining evidence about alternative futures, that can be further studied to uncover underlying assumptions.

Furthermore, we can observe real designed artifacts – both products and prototypes (i.e. visual artifacts). As Lawson (2005, 165) asserts, any piece of design contains a judgment about the future. In my view, it is undoubtedly true for prototypes, but it is also true for

products as well, for they are created to exist in the "later than now". One can argue that they are, in a sense, artifacts "from" the future, while also functioning as artifacts within the present milieu. If the context of use belongs to a possible future, artifacts can reveal something about it (Zimmerman & Forlizzi 2008, 42), for instance, what behaviors are widespread and what social norms could enable the adoption of this product in that future, who can and who cannot use this product and why, etc.

What follows from this analysis, is that artifacts can serve as anticipatory epistemic objects[1], on par with scenario reports and technology roadmaps. They can be employed as structures that "scaffold" our cognition (Preston n.d.), therefore, enabling the creation of knowledge about futures, design knowledge in particular. It was established earlier that design knowledge creation happens through the relationship between the designer and the artifact, during the process of making and reflecting (Kim & Tan 2022, 5). Knowledge related to imagined futures can be hence generated through (1) making an artifact that renders the designer's imagined futures tangible and (2) reflecting on the artifact and the process. Zimmerman & Forlizzi (2008, 42) call this process "disciplined imagination" that allows one to intentionally construct the future through making.

Numerous scholars consider artifacts to be distinctive and unique as anticipatory epistemic objects. Firstly, the artifact knowledge is not always transferable to numbers or words (Isley & Rider 2018, 364), thus potentially offering distinct futures knowledge when compared to using narrative-based or quantitative methods. Light (2021, 4), for instance, highlights that scenarios require contextual embedding either through reading or presenting, while speculative artifacts do not require as much context, and could be presented on their own, due to the fact that knowledge is embodied in them. In turn, Donoghue (2021, 47-48) discusses how analysis reduces objects to elements already known, while intuition expresses objects as a unique whole with what there is inexpressible in them; although analysis can be applied to understand things that come from intuition, products of analysis cannot be grasped intuitively. Secondly, several scholars agree that the unique role of visual artifacts is to connect material present and immaterial futures. Artifacts simultaneously exist physically in the present while projecting into futures, thereby enabling sensory interaction with imagined futures, facilitating discussion about this image, and making it amendable for further work.

---

[1] Term drawn from Anderson (2007, p. 157)

(Dunne & Raby 2013, 51; Comi & Whyte 2018, 1056, 1078.) Thirdly, an important quality of visual artifacts is their mutability; they can be altered with new information or feedback. This way, knowledge is created through constant recreation or realignment of artifacts based on trial and error, without an aim to construct a final unmutable representation of reality. Visual artifacts, therefore, embody, not avoid, uncertainty. For instance, upon reflecting on the fit of the artifacts to their human, social, and natural contexts of use, a designer can decide to change her mutable artifact to embody another possible future. (Comi & Whyte 2018, 1059, 1066; Isley & Rider 2018, 364.) Lastly, in the collaborative setting, Peukert and Vilsmaier (2021, 6-7) observe that artifacts support openness and co-production of knowledge in three ways: through flexibility and modifiability of material, through adaptability of the process to the context, and through the unfinished nature of artifacts that allows for connective communication of ideas, multi-level interpretation and integration of perspectives.

2.4 Connecting theories of design epistemology and anticipation

As explained earlier in this chapter, the conceptual framework of FL is pluri-epistemic. It is open to various ways of knowing to explore and give meaning to futures. Particular epistemology should be determined by the domain and goals of using the future; subsequently, this choice will influence the sources of knowledge and the process of its generation. (Miller 2018c, 28, 30.)

In this thesis, the role of design epistemology and visual artifacts as anticipatory epistemic objects will further be explored in the context of FLL. The procedure of FLL includes surfacing participants' anticipatory assumptions and reframing them, which is often achieved through working with texts and narratives. By incorporating the creation and analysis of imaginary artifacts into this procedure, I hope to contribute to the understanding of alternative ways of knowing futures.

When introducing design epistemology to the conceptual framework of FL, relations between design knowledge and anticipation emerge as an aspect that merits closer examination. A synthesis emerges regarding the components of design knowledge in the context of anticipation, amalgamating from the array of theoretical concepts examined throughout this chapter (Table 1).

Table 1. Components of design knowledge in the context of anticipation, developed by the author.

Design knowledge types and transitions according to Thoring et al. 2022	In the context of anticipation
Artifact Knowledge (Level A) Knowledge that is embedded in the artifacts	Artifacts contain designers' judgments about futures and embody their anticipatory assumptions. Designed objects represent their real or anticipated socio-technical milieu, context of use, user, and more.
Design Intuition (Level B) Tacit knowledge of a designer gained through experience or observation	Conscious or subconscious anticipation can be seen as a part of Design Intuition. In other words, tacit images of the future and anticipatory assumptions form the designer's internal compass to make and access design decisions. Also, the futures literacy of a particular designer.
Design Language (Level C) Explicit, codified knowledge of a designer	Explicit anticipatory assumptions or images of the future that are reflected and discussed; understanding of anticipatory processes and reflexivity about one's use of the future.
Design Theories (Level D) Abstracted forms of design knowledge aimed at the design process	Design approaches, theories, frameworks, or tools, that deal with anticipation, including both methods to explore futures such as design fiction or EXF, and methods to facilitate anticipation in the design process.
Transition A⇄B Using artifacts to represent tacit knowledge, and gaining tacit knowledge from encountering artifacts	A→B. In turn, through "reading" the knowledge from designed objects, designers form their own conceptions of what the future might be like. It is worth noting here, that this can be a way to acquire "used futures", that may lead to conformity and avoiding exploring other possibilities. A←B. In the process of articulating artifacts, form is given to the tacit assumptions about imagined futures, and therefore, these ideas can be further analyzed and reflected upon.
Transition B⇄C The transition between tacit and explicit knowledge	B→C. Reflection, verbalization, and discussion of the tacit experiences (e.g. learning experience during an FLL) help build explicit awareness about one's use of the future. B←C. Developing anticipatory capabilities as a part of design intuition through frequent engagement with conscious anticipation.
Transition C⇄D Building practical models and agreeing on design language for particular theories	C→D. Developing new frameworks to specifically address the link between design and anticipation of future contexts of the product's existence; integration of existing futures studies methods into the design process. C←D. Disseminating these frameworks, providing training of anticipatory capabilities.

This chapter presented a unique blend of theoretical perspectives and concepts that underpin this study. Now, the transition to the Methodology chapter marks an essential milestone in the research process, where theoretical insights will be operationalized into action.

3 Methodology

The central focus of this thesis is to explore the interrelations between design epistemology and anticipation. This can be achieved by modifying an established method of building futures literacy – namely the Futures Literacy Lab – to incorporate the concepts of design epistemology discussed in the previous chapter. The focal role of visual artifacts in the lab gives an opportunity to address their significance as enablers of uncovering one's anticipatory assumptions. Of particular importance is the need to include professional designers as participants in the FLL, given their openness and proficiency in employing design methods.

This chapter describes the methodological approaches used in the present study. The first subchapter establishes the research setting. The second subchapter introduces the reader to the specific operationalizations of the conducted FLL, including the structure of the session, the exercises conducted, and the materials used. Lastly, the third section describes the data collection and analysis procedures, employed to answer the research questions.

3.1 Research setting

This study organized an FLL for a group of designers, creating a space to apply design epistemology to anticipate futures. I reached out to several Finnish design agencies and sent a proposal as "cold emails". Rune & Berg Design (abbreviated R&BD in this study), a Helsinki-based design studio, expressed interest in participating. R&BD's services include designing work, service, and real estate environments and are based on principles of experience-focused design.

Some might object to the methodological choice of inviting only professional designers as participants on the grounds that the findings of the study may have limited generalizability. While it is true that professional designers may not accurately represent the general population and their ability to engage with the proposed exercises may be higher due to training and experience, I believe that for the purpose of this study, the intrinsic motivation of the participants outweighs this drawback. As reported by Pelzer and Versteeg (2019, 24) highly imaginative or design-based ways of exploring futures proved less successful in connecting with audiences such as policymakers, even when they participate in workshops or mediations. In contrast, for professional designers, these

methods can be considered "natural", and they are willing to apply them. By focusing on this group, therefore, I can expect to gain a deeper understanding of the relationships between design epistemology and anticipation. Additionally, this choice enables me to propose a tool applicable to professional designers in their practice, responding to the demand for such tools highlighted in the introduction.

The Futures Literacy Lab with Design Epistemology (abbreviated FFL-DE in this study) took place in March of 2024. A total of six participants, representing various teams of the studio, took part in the session. FFL-DE included a content and a process component. A content component comprised a topic of the FLL, agreed with R&BD, namely "Futures of cities 2044". The motivation behind choosing this topic was twofold. On the one hand, there was a practical interest of R&BD in exploring the futures of cities, for the key areas agency's projects are work, retail, and real estate environments are all situated within urban settings, therefore and using the futures of cities 2044 as a 'container' topic for FLL-DE activities provided insights into it. On the other hand, selecting a topic that is familiar to participants is a prerequisite to an effective FLL (Miller 2018a, 99). A process component included the activities of FLL-DE in which participants engaged. A comprehensive depiction of the session's structure is provided in the following subchapter.

3.2 Methodological design of the FLL-DE: Futures of cities 2044

3.2.1 FLL methodology

FLL is a relatively novel participatory futures research method, focused on exploring anticipatory assumptions of participants. It was mainly developed by Miller (2018a) and practiced around the world by UNESCO (UNESCO & PMU 2023). In brief, FLL is a structured activity that leads participants through a multi-phase process (Miller 2018a, 102-107):

- Reveal: during this phase, participants explore their images of the future (usually both probable and desirable), and the underlying assumptions that guide those images; as a result, participants surface and acknowledge their own implicit anticipatory assumptions.

- Reframe: participants are introduced to a scenario that depicts a future that is not probable, nor desirable, and experiment with a different set of anticipatory assumptions while exploring it; as a result, participants get the experience of thinking beyond their initial assumptions and exploring new possibilities for the future, and confront the limits of relying solely on using the future to prepare and plan.

- Rethink: participants reflect on the futures they explored in Phases 1 and 2 and identify new questions they have about the future; as a result, participants gain insights into their perspectives of the future.

- Next steps (optional): participants identify actions to apply their new insights to their work and lives.

Although the phases of FLL provide quite a rigid structure, the final realization of each FLL is not expected to be the same. Miller (2018b, 7) calls for flexibility in e.g. terminology, heuristics, or reframing devices, adapting these elements to specific contexts and groups of participants. Yet, the primary goal of finding a way to surface participants' anticipatory assumptions and make them sensible should be kept in mind while designing FLL (Miller 2018a, 95, 101). FLLs organized in affiliation with UNESCO have traditionally relied upon 'layered analysis' heuristics, which is adapted from the Causal Layered Analysis method by Inayatullah (1998). The benefit of this approach is the deeper and richer descriptions of futures, that participants co-create, and a better understanding of underlying anticipatory assumptions that frame the imagined futures. (Aceron 2018, 208-209; UNESCO & PMU 2023, 42.)

The focus on finding ways to surface anticipatory assumptions was maintained while developing the FLL-DE. In addition, the following design principles of an FLL were taken into account (Bergheim 2022, 4-5):

- FLLs are designed to be action-learning processes: participants of FLLs are encouraged to engage in learning-by-doing activities and reflections.

- Learning occurring in FLLs is a social process. FLLs are most effective when participants work together to inspire each other, share ideas, and build on each other's insights leading to the construction of a shared meaning.

- FLLs are 'laboratories' in the sense that they are designed to be safe spaces where participants can experiment with their assumptions about the future and imagine without fear of judgment.

Resulting from these principles was the decision to use both individual and group activities, with a focus on learning through hands-on making and reflective exercises.

3.2.2 The Thing from the Future

As an artifact-idea generation method for the Reveal phase of FLL-DE, The Thing from the Future, developed by Candy (2018), was adopted. In this participatory method, participants are tasked to articulate imaginary things that could exist in a specific future, which suits well for the purpose of this study.

The Thing from the Future is a gamified futures research method, developed by Candy (2018), that aligns with the principles of FL and provides a structure of participation for helping participants navigate change. The Thing from the Future takes the form of a deck of cards, which presents creative prompts and encourages participants to describe, prototype, and narrate artifacts, that could exist in alternative futures. The gamified nature of the tool and the cultural norm associated with card games offer the advantage of triggering an exploratory mindset and helping participants embrace randomness. (Candy 2018, 234-235, 239.)

The gameplay of The Thing from the Future is as follows: in a group of three to five participants, a prompt is collaboratively generated by drawing several cards; once a prompt is formed, each participant articulates an artifact from a potential future through making or describing it verbally; the last step can involve a discussion and a selection of the "best" response (in competitive mode). In the first design of the game, each prompt was formed by drawing 4 different cards, but in the following version, released in 2017, a simplified structure of 3 cards was introduced. (Candy 2018, 236-237.) The creators of the tool do not prescribe a specific duration for each round of the game. To exemplify, drawing from the author's participation in the game within a collaborative learning context, artifact creation was observed to be limited to 2-3 minutes, with a longer duration allocated for subsequent group discussion. Candy (2018, 239) suggests a versatile application of the tool spanning from icebreaker to primary ideation method, therefore implying that the gameplay and specific scheduling may differ significantly across

practical applications. An illustration of The Thing from the Future's application in the context of FLL can be found in Aceron and Cruz (2018, 224-226), where the tool was employed in the Reveal phase, and the gameplay was modified to a competition between teams.

3.2.3 Resulting structure of the FLL-DE: Futures of cities 2044

FLL-DE: Futures of cities 2044 design combined and amalgamated two ideas: first, it adopted the established four-phase FLL structure; second, it incorporated exercises and activities leveraging design epistemology as a device of creating knowledge and surfacing anticipatory assumptions, namely, those described in the previous subchapters. The methodological design was at large informed by the UNESCO Futures Literacy Laboratory Playbook, which summarizes the organization's experience acquired through running over 115 FLLs worldwide and proves as a comprehensive guide to developing and facilitating FLLs (UNESCO and PMU 2023). The resulting structure of the FLL-DE for R&BD on the futures of cities in 2044 is summarized in Table 2.

Table 2. Phases and steps of FLL-DE: Futures of Cities 2044

Phase 1 - Reveal	Phase 2 - Reframe	Phases 3 and 4 - Rethink and Next Steps
1.1 Welcoming participants, sharing agenda, rules, and other practical information. 1.2. Probable futures exploration through making. 1.3. Revealing anticipatory assumptions behind probable futures. 1.4. Desirable futures exploration through making. 1.5. Revealing anticipatory assumptions behind desirable futures.	2.1. Introducing the Reframed futures scenario. 2.2. Group discussion of initial impressions. 2.3. Invention of novel anticipatory assumptions in groups. 2.4. Making for the Reframed futures and presentation on the plenary.	3.1. Reflection on Phases 1 and 2, comparing different futures and anticipatory assumptions. 3.2. Reflection on the role of making and visual artifacts 3.3. Sharing key learnings and call-to-actions

Phase 1 - Reveal

The Reveal phase lasted for 90 minutes and began with welcoming participants and informing them of the agenda and topic of FLL-DE. Then, participants did an icebreaker exercise in pairs, answering the following questions: "How can you describe cities in 2004? Is there anything that seems very old-school and amusing when you look back?".

The goal of the icebreaker was to highlight the ongoing change and to promote more open thinking about the possible change in the future.

The first exercise was dedicated to exploring participants' probable futures of cities in the year 2044 through the making of visual artifacts (i.e. sketching). Adapted from the second version of The Thing from the Future game, the exercise asked participants to create visual artifacts in response to individual creative prompts. Prompts were built through a drawing of two cards: (1) the Thing card informed the basic form of an artifact; (2) the Theme cards described contexts, places, and topic areas of the object. The Thing and Theme cards were randomly distributed between participants. When put in the order of (1) Thing and (2) Theme, the cards were connected with a 'phrasal template' to enhance participants' understanding (Candy 2018, 237), which was reading the following: "In this future there's a […] related to […]. What is it?" (Figure 4). Each participant created one visual artifact, that consisted of drawings and notations and/or texts (as suggested in Comi and Whyte 2018, 1059). Then, participants discussed all the artifacts and reflected on what the artifact knowledge revealed about the possible future, and what anticipatory assumptions informed particular design decisions.
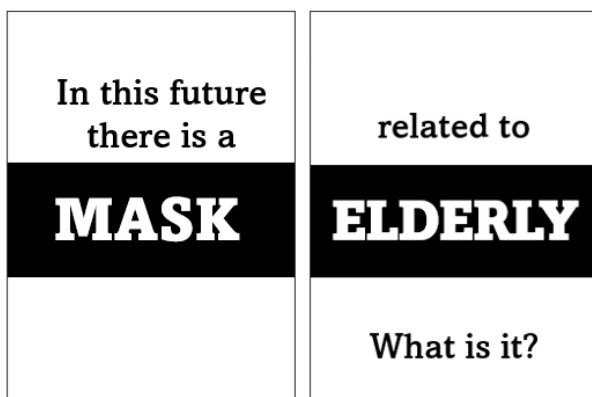
Figure 4. Example of the prompt generated through a random drawing of Thing and Theme cards

In the second exercise, participants were asked to now create artifacts that represented a desirable future. Participants were given two options: (1) to use the same creative prompt and adjust the previous artifact or (2) to draw a new creative prompt, in the same way as explained above. The option to opt for alteration was included to leverage the inherent mutability of visual artifacts and emphasize the idea of exploring open futures without aiming to construct an ultimate representation of reality (Comi & Whyte 2018, 1059;

1066; Isley & Rider 2018, 364). Again, artifacts included drawings, notations, and/or texts. The following discussion revolved around the desirable future revealed by artifact knowledge, and corresponding anticipatory assumptions.

Phase 2 - Reframe

After a break, the Reframe phase began with dividing participants into 2 groups of 3 participants for further work. Then, "letters from the future" – envelopes, containing a reframed scenario on the futures of cities 2044 were distributed between teams. The process of opening a "letter from the future" was included to create an occasion and mark a point of stepping away from Phase 1 assumptions to an uncertain territory of Phase 2 (Light 2021, 7). The scenario was developed by extrapolating and amplifying the trend for solo-living, described by Tervo (2021, 8-11), and written as follows:

> Welcome to the Reframed Future of Cities in 2044! In this reframed future, solo-living – or living alone – has become the most common living arrangement in urban areas, making up to 85% of households. This includes people from all demographics, regardless of age, gender, or ethnicity. It's important to say, that not all individuals living alone do so by choice, but due to circumstances beyond their control, while others fully embrace this way of living. Some people may live alone only part-time, while others prefer it full-time. The concept of "living apart together" has gained popularity as a type of romantic relationship, where couples prefer to live separately even in long-term relationships. Even families with children have more flexible arrangements, giving family members time alone. This change inevitably affects the housing market, urban design, businesses, and city policies. But how? Do city planners and business owners adopt or try to counteract this new way of living? Do some people live alone more often than others? How might our views about solo-living change over time? How could this affect our relationships?

After briefly discussing the initial impressions, groups were tasked to make assumptions about the reframed future and write them down.

With established shared meaning of the scenario and corresponding anticipatory assumptions, the groups proceeded to design an object, system, or service that embodied the reframed futures and novel anticipatory assumptions. These artifacts were then presented to all participants and discussed on a plenary, with a particular emphasis on contemplating how underlying assumptions influenced distinct design choices. Phase 2 lasted 60 minutes in total.

Phases 3 and 4 – Rethink and Next Steps

During the Rethink phase, participants had an opportunity to reflect on their journey through Phases 1 – Reveal and 2 – Rethink, and compare different sets of anticipatory assumptions and how artifacts embodied them. Then, a discussion of the perceived role of making and visual artifacts in the FLL-DE followed. In light of these reflections, in the subsequent Next Steps phase, participants formulated future actions for both themselves and R&BD to integrate the acquired learnings. This activity closed the FLL-DE, creating a sense of a completed learning journey by establishing a connection with the R&DB practice.

Materials

Materials were created to be used during the workshop to support the participatory process. These included:

- General: Facilitation guide (Appendix 1); consent form; PowerPoint presentation with slides presenting the agenda and descriptions of particular exercises;

- Phase 1 – cards to be drawn to generate creative prompts (Appendix 2);

- Phase 2 – "letters from the future" and a reframing scenario.

3.3 Data collection and analysis

3.3.1 Types of collected data

The data gathered for this study encompassed three types. Firstly, I collected data through the observation of participants throughout the FLL-DE, over the whole duration of three hours. My role as an observer was known to the participants which allowed me to openly collect data at the time the FLL-DE was observed. Primary observations were collected during the FLL-DE, as I noted what happened or what was said at the time. Those were brief and limited, as I took the role of the facilitator at the same time. Immediately after the FLL-DE, on the same day, secondary observations were collected, as I wrote down more detailed statements on what happened and what was said throughout the FLL-DE. This necessarily involved my initial interpretations. About two weeks after the FLL-DE,

the secondary observations were expanded after listening to the audio recording of the workshop. The full amount of written down observations was 1700 words.

Secondly, audio-recorded materials from the FLL-DE were collected. The FLL-DE was not recorded in its entirety, only the parts required for analysis: collective "reading: of the artifacts in Phase 1 – Reveal, presentation of artifacts made in groups in Phase 2- Reframe, and the whole discussion in Phase 3 – Rethink. I refer to this data as "participants' discussions" and "participants' reflections" in this study, with the latter primarily referring to the data collected in the Phase 3 – Rethink. The FLL-DE generated 104 minutes of recorded audio, that was transcribed using the Microsoft Word transcribe feature and later reviewed for accuracy to ensure the final text represents the spoken content. The full transcript consisted of 14 200 words.

The third type of data encompassed the drawings, referred to as visual artifacts or artifacts in this study, that participants created during workshops individually and in teams. The total number of artifacts was 18, including 12 artifacts created by individual participants and collectively discussed in Phase 1 – Reveal, 2 artifacts created by participants in teams and presented in Phase 2- Reframe, and 4 artifacts created to support thinking or teamwork that were briefly addressed in Phase 3 – Rethink. One of these four visual artifacts was not available after the FLL-DE, as it was collected or discarded by the participants who had created it. Artifacts were scanned and used in a digital form.

The observations, participants' discussions, and reflections were treated as texts and are referred to as textual or verbal data in this study. The artifacts are treated as images and are referred to as visual data (albeit they included also written notations made by participants).

3.3.2 Evaluation of the process component of FLL-DE

In order to answer RQ1 and RQ1(a), the process component of the FLL-DE was analyzed. Two approaches, namely, theory-driven evaluation and systems thinking were combined to discover the role of design epistemology in the FLL-DE and the mechanisms of how it enables conscious anticipation.

The core tenet of theory-driven evaluation is the utilization of explicit and comprehensive theoretical frameworks as hypotheses for research or evaluation. Its primary objective is to uncover relationships between mechanisms and outcomes of interventions. (Chen

2012, 16-17.) In other words, theory-driven evaluation involves comparing the initial assumptions regarding what is expected to happen, with the observed results in practice. Combined, those assumptions constitute the program theory, which can be defined as "a set of explicit or implicit assumptions by stakeholders about what action is required to solve a social, educational, or health problem and why the problem will respond to this action" (ibid., 17). A further distinction can be made between program theory, which primarily focuses on outcomes, and implementation theory, which deals with steps and processes that occur within the "black box" of the program (Weiss 2000, 36). This distinction is useful for this study. Given the absence of quantifiable measures to assess changes in FL capability among FLL-DE participants (Voegele et al. 2023), the evaluation pivoted towards examining processes and participants' experiences, mirroring the approach commonly adopted by FLL organizers in practice (Bergheim 2022, 10).

To generate hypotheses feeding into a theory-driven evaluation, a systems thinking approach was adopted. In other words, FLL-DE was approached as a complex system. Systems thinking is a holistic and interdisciplinary way of understanding complex systems. It seeks to elucidate the emergent properties resulting from interactions among the system's components. According to Derbyshire (2016, 52), such properties typically manifest as feedback loops, where events influence their own causes, and emergence, where system properties transcend those of its individual components, resulting from system dynamics. One valuable tool to comprehend complex systems is system mapping – a process of creating a visual aid to illustrate and communicate the assumptions of system dynamics. Leveraging system mapping to generate hypotheses for theory-based evaluation is seen as promising for facilitating a deeper understanding of the mechanisms at play (Renmans, Holvoet & Criel 2017, 2).

Implementation theory

- To begin with, diverse theoretical underpinnings of the FLL-DE were distilled to a list of expectations regarding the anticipated outcomes and processes within the FLL-DE:

- Participation in the FLL develops participants' understanding of anticipatory processes and anticipatory capabilities (FL in particular) (Miller 2018c, 108).

- Imagined artifacts embody knowledge that reflects designers' tacit anticipatory assumptions (Aceron & Cruz 2018, 226; Lawson 2005, 165).

- By "reading" artifact knowledge participants can uncover assumptions about e.g. socio-technical aspects of the imagined future and make them explicit (Zimmerman & Forlizzi 2008, 42).

- Eliciting anticipatory assumptions from artifacts facilitates discussion about a particular imagined future and makes it amendable for further work, for example, to reframe assumptions. (Comi & Whyte 2018, 1056, 1078; Peukert & Vilsmaier 2021, 7).

- Introduction of a novel scenario gives the opportunity to purposefully experiment with a reframed set of anticipatory assumptions and translate them back to artifacts (Miller 2018c, 104: Light 2021, 10)

- In collaborative settings, sketches serve functions of thinking sketches to support re-interpreting visual artifacts and changing them, talking sketches that allow to re-interpret each other's ideas, and storing sketches enable the use of earlier ideas (Lugt 2005, 108).

- Artifacts allow for connective communication of ideas, multi-level interpretation, and integration of perspectives to build a shared vision (Peukert & Vilsmaier 2021, 6-7).

- Process, designer, and artifact inseparably serve as sources of knowledge (Isley & Rider 2018, 364-365; Light 2021, 12; Kim & Tan 2022, 5).

Furthermore, a system map was developed to illustrate the expected interactions, loops, and emergent properties. Thoring et al's (2022) unified model of design knowledge provided the foundational structure for conceptualizing how different types of design knowledge were expected to enter the equation during the FLL-DE session (only knowledge types and transitions were examined, while knowledge qualities were omitted). Figure 5 presents the resulting map.
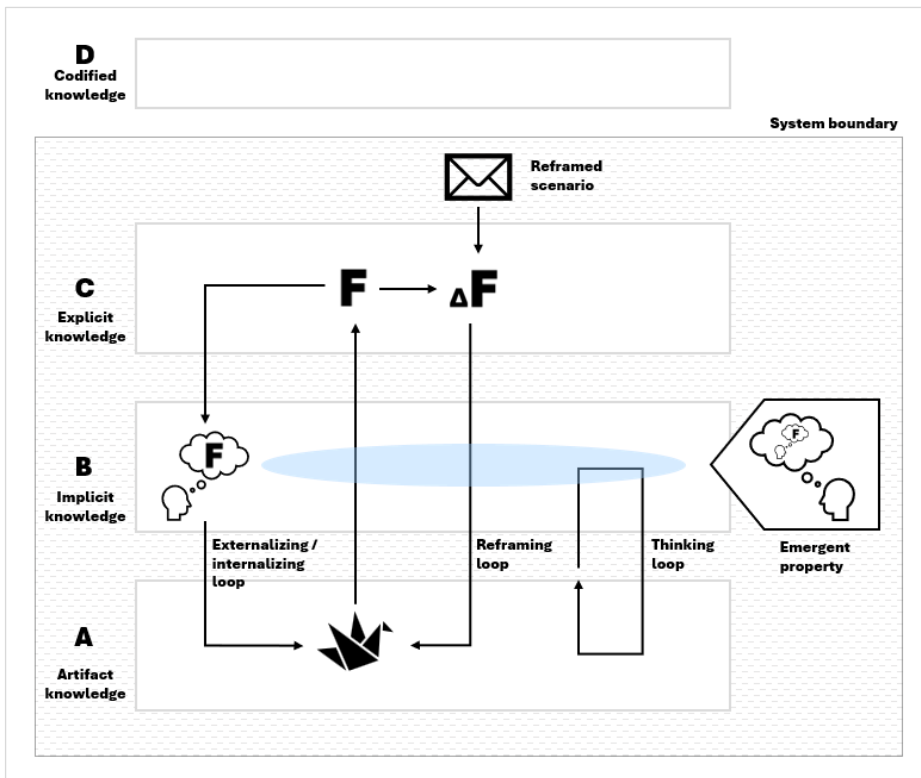
Figure 5. System map of FLL-DE as suggested by implementation theory

The map focused on the creation of knowledge about futures during FLL-DE. Level D of design knowledge – conceptual frameworks and codified knowledge – was perceived as lying outside of the system's boundary, beyond what could happen during FLL-DE. Three other levels of knowledge were defined as follows:

- Level A referred to artifact knowledge, embodied by visual artifacts to be created in the session's activities;

- Level B contained tacit knowledge, including both participants' implicit anticipatory assumptions and their expertise in both producing and analyzing artifacts (marked in blue);

- Level C referred to explicit knowledge in the form of explicit anticipatory assumptions.

I hypothesized that the system contained three loops:

- The Thinking loop between Levels A and B reflected the role of thinking sketching, when designers would give form to their ideas (B→A), re-interpreted

the resulting sketch (A→B), and had a chance to modify it with newly acquired insight.

- The Externalizing/internalizing loop served the purpose of surfacing participants' anticipatory assumptions. Implicit anticipatory assumptions about a particular future F were materialized through making artifacts (B→A). Serving as the stimulus for collective discussion and personal reflection, artifacts facilitated verbalizing and eliciting anticipatory assumptions (A→B→C). In turn, explicit assumptions could feed back to participants' tacit knowledge, with hopes that participants "cannot unsee" what they became aware of (C→B).

- The Reframing loop served the purpose of reframing participants' anticipatory assumptions and deliberately using them to inform design decisions when making artifacts. Once anticipatory assumptions about a particular future F were made explicit (A→B→C), they could be reframed to create a new set of assumptions ΔF (C→C). These reframed assumptions could be translated back into an adjusted visual artifact (C→B→A). A reframed set of assumptions was also supposed to be developed in response to a reframed scenario given to participants.

Finally, it was expected that as a result of participating in the FLL-DE, their anticipatory capabilities, namely futures literacy, will develop, feeding back to participants' tacit knowledge (Level B), and altering also their "internal compass" for making and evaluating design decisions.

Procedure

Observations and workshop discussions served as key sources of data, with some of the artifacts used to illustrate findings. The Phase 3 and 4 – Rethink and Next Steps phases of the FLL-DE were selected for analysis, as they presented participants' reflections on the experience and use of design epistemology for anticipation. Interpretations were mainly drawn from observations, with participants' reflections supporting emerging findings. Both sources were treated as texts. Deductive coding with a semantic-level focus was applied, where codes were drawn from the implementation theory, formulated above.

3.3.3 Analysis of the content component of FLL-DE

In order to address RQ2, additional analysis of the content component of the FLL-DE was performed. Here, particular attention was directed toward the meaning-making of participants through collective "reading" of artifacts embodying different futures. The integration of visual data and verbal data was particularly useful in the context of this study question. Chapman, Wu and Zhu (2017, 12) advocate for joint interpretation of texts and visuals, as well as preserving participants' active role in meaning-making.

Visual artifacts and audio-recorded materials served as sources of data. The Phase 1 – Reveal and Phase 2 – Reframe of the FLL-DE were selected for analysis. Both sources were analyzed in sets corresponding to different workshop phases and exercises (either probable, desirable, or reframed future),

Procedure

For this exploratory part of the analysis, inductive coding with a semantic-level focus was applied. To code the transcribed text, In Vivo or verbatim coding technique was chosen, where each code is extracted from the actual language found in the data rather than generated by a researcher. In Vivo coding has several attractive features: it allows to prioritize and honor the the participants' voices, to preserve participants' meaning in the coding, and it is recommended for beginning qualitative researchers (Saldaña 2013, 91, 94). In a constructivist study like this thesis, this method seems to offer an effective way to avoid inferring added meanings and ensure that analysis is rooted in the actual perspectives of participants. I started with an initial read-through, simultaneously listening to the audio recording and highlighting the words or phrases that were emphasized by participants. From there, a second reading followed, where I applied codes, following Saldaña's (2013, 92-93) advice to trust my instinct and use words and phrases that seemed to "call for bolding [or] underlining" as codes. Another iteration of back-and-forth reading allowed for consistent application of codes.

The visual artifacts presented a strong temptation to be analyzed in detail in order to extract their underlying meanings. After the initial attempt to do so, following the procedure detailed by Chapman et al. (2017), this approach clearly led to imbuing my own interpretation and distorting the meaning-making done by participants. Hence, I decided to reject this procedure and to present the artifacts as results in their own right.

Yet the reader may challenge my decision by insisting that methodological rigor demands analyzing all forms of data, including visuals, and that presenting them as results may compromise the analytical depth. On one hand, I agree with that (hence the initial attempt to code the visual artifacts). But on the other hand, doing so would contradict the theory established in this study. In Chapter 2.3.2, I have introduced previous research that suggests the indivisible nature of artifact knowledge, for example, Isley & Rider (2018, 364), Light (2021, 4). Most notably, I have agreed with Donoghue (2021, 47-48), who draws from Henri Bergson's philosophy and maintains that analysis cannot fully grasp the product of intuition without losing its true meaning. Therefore, I left the meaning-making of the artifacts to the participants and focused on analyzing their intuition-led discussions, to avoid misconstruing the images of the future and corresponding anticipatory assumptions.

For further analysis, two methods were used. Firstly, a codeweaving technique, as proposed by Saldaña (2013, 248-249), allowed to integrate the key In Vivo code words and phrases into a narrative form. The codewoven texts are used to summarize the resulting images of probable, desirable, and reframed futures for the reader. Saldaña (ibid) suggests condensing such texts to as few sentences as possible, however, for the purpose of presenting the images of the future, this limitation seems unnecessary. Secondly, a thematic analysis was conducted, allowing to identify the most prominent anticipatory assumptions about the futures of cities and present them in a concise and structured way.

3.4 Ethical considerations

Ethics play an important role in any qualitative study within a constructivist approach, primarily due to the involvement of participants who are viewed as active creators of knowledge and meaning. This study emphasizes understanding participants' subjective perspectives on futures and involves them in creative and intuitive ways of creating knowledge. Thus, the issue of ethics is key to protect participants from any harm arising from participating in this study. Tracy (2010, 847) proposes four kinds of ethical procedures: procedural, situational, relational, and exiting ethics. Applying this ethical framework, I present the ethical considerations of this study as follows:

- Procedural ethics deals with procedures undertaken in the fieldwork. In this study, participants were provided with information about the study and their involvement through a detailed consent form. The form contained information about the study;

the researcher; the voluntary nature of participation and the participants' right to refuse or withdraw at any time without providing reasons; the types of data collected; information about data storage and usage; means of ensuring confidentiality; and the right to decide whether to take part in the study through the signed consent form. Additionally, the aims and procedures were verbally reiterated at the beginning of the FLL-DE.

- Situational ethics refers to respecting the context of research. An essential ethical consideration in this regard concerns the making of artifacts (i.e. sketching) for research purposes. Chapman et al. (2017, 3) draw our attention to the fact that an image[1] may represent deeply personal dimensions of a participant's perspective and reveal more than one consciously intends. They further suggest that a discussion of an image may evoke unexpected emotions in a participant. In this study, participants engaged in collective making and reflecting upon visual artifacts to uncover anticipatory assumptions about futures. Our assumptions about futures are shaped by many factors, including deeply personal experiences, therefore, a risk of harm arises from participating in this study. Participants' right to withdraw from the participation aimed to provide an opportunity to discontinue their involvement if any unintended data or emotional response emerged. Besides, abstaining from imposing additional interpretations of the images beyond those generated during the FLL-DE, with participants as active meaning-makers, allows to maintain participants' autonomy in disclosing data.

- Relational ethics deals with the ethical self-consciousness of a researcher. During data collection, I made an attempt to minimize disruption to the daily activities of the R&BD studio, for instance, by scheduling the FLL-DE in the afternoon, shortening the duration to three hours, and remaining flexible with the number of participants. Additionally, I made an effort to respect the culture of both participants and R&BD. Participants were given the freedom to choose the language for group and pair interactions, and English was only required for the parts recorded for analysis.

---

[1] Chapman et al. (2017, 3) talk about photos specifically; however, their argument seems to be true for any kind of images produced by participants

- Exiting ethics addresses the responsible presentation of the results. Upon leaving, I informed participants about how the issue of confidentiality and anonymity would be handled. Anonymity was ensured with markers after direct quotes to represent participants (e.g. P1…P6 or Team 1…2). Data storage takes place in two locations, safeguarded by passwords: my personal computer, and my personal data cloud, also protected by a password. Transcripts generated with the Microsoft Word transcribe feature did not involve sharing audio or text files with Microsoft, as per the company's official source (Transcribe your recordings, n.d.). Transparent and accurate reporting of findings was prioritized, with an attempt to avoid misinterpretation and bias.

4 Analysis

The following chapter is dedicated to exploring the results gained from the trial run of the FLL-DE on the topic "Futures of cities 2044". I will address RQ2 before RQ1 and RQ1a to improve the reader's comprehension of the results. Three images of the future of cities in 2044 and corresponding anticipatory assumptions are the most immediate outcomes of this study. It is hoped that by becoming acquainted with them first, the reader will gain a solid foundation to grasp the analysis of more general and abstract process component that follows.

4.1 Examining designers' anticipatory assumptions about futures of cities

The following subchapter addresses the content component of the FLL-DE – the topic of futures of cities in 2044, and answers the RQ2: *What anticipatory assumptions about futures of cities are conveyed through the artifacts created in the Futures Literacy Lab?*

After the analysis, it became clear that the artifacts and the following discussion formed integrated *artifact-reading anticipations*; the participants' accounts did not exist without the artifacts, nor did the artifacts alone give deep insight into the participants' constructed anticipations of the probable, desirable, and reframed futures. The content of artifacts, as representations of futures, was constructed through the following collective meaning-making. Others, including myself and the reader, could construct their own meanings, as "the meanings of each image are multiple, created each time it is viewed" (Sturken & Catwright 2001, 25, according to Weber 2008, 42).

Next, I illustrate how the artifacts and their readings together form the anticipations of three alternative futures. To begin with, for each future, a set of artifacts is presented alongside a narrative created through a codeweaving technique, integrating key verbatim code words and phrases. By doing this, I aim to preserve the authenticity of participants' anticipation and represent the constructed images as close to the actual voice of participants as possible. The quotation marks in the codewoven narratives indicate In Vivo codes, but they are not treated s direct quotes and are not attributed to individual participants. After that, themes covering various anticipatory assumptions are presented in more detail, concentrating on similarities in views and most prominent themes, instead of stating every assumption that could be elicited from data.

4.1.1 Anticipatory assumptions about the probable future of cities 2044

Creating visual artifacts depicting the probable future of cities in 2044 was the first exercise of Phase 1 – Reveal. Utilizing creative prompts built through a random drawing of cards, each participant developed one visual artifact (as illustrated in Figure 6). These artifacts were then displayed on the whiteboard, giving the opportunity for participants to view them collectively and "read" the artifact knowledge. Through a semi-structured inquiry involving a series of questions, participants' anticipatory assumptions about the probable future of cities began to surface. A short narrative of the probable future of cities in 2044 is as follows:

> "We're at the limit, a person can only do so much". People seek "efficiency", but "we can't get more efficient ourselves, we need devices". "Devices" that "instantly make life easier", "simplify" our "hectic lifestyle" and enable "efficiently utilizing the time". Thankfully, "our Teslas are getting more clever". "Elon Musk is planting chips on actual people", shaping a future of "blurring boundaries". "Having devices connected to you is really scary" for some of us who have a "fear of losing control" and "depend on machines". Yet "having devices connected to you is really scary" for some of us, revealing the "fear of losing control" and "depending on machines" if "they are compulsory". The "social norm is that everyone shares everything". Amid all of this, we still care about "the planet" and "equal possibilities". We "focus more on mental health", and hope that "younger generations are learning not to carry the burden" of being silent about mental health.

Figure 6. Visual artifacts representing the probable future of cities in 2044, created in FLL-DE. Artifacts were created in response to the following creative prompts: (a) a clothing related to gender; (b) a machine related to work; (c) a bottle related to home; (d) a vehicle related to health; (e) a monument related to mobility; (f) a map related to connectivity

Further analysis revealed several prominent anticipatory assumptions behind this image of the probable future of cities in 2044.

- The assumption of a hectic lifestyle emerged strongly in the context of this probable future, where participants discussed the fast pace of urban life and the ever-growing list of tasks and priorities, that leaves no spare time for oneself and makes having your own moment a luxury. Several participants were quite certain about their assumption that this high-speed living will only intensify in 2044 and require us to surpass the capabilities of the human body.

- Under the group of assumptions about people's needs, several participants highlighted simplification and efficient use of time. Both needs are closely related as both stem from the overarching assumption of the increasing speed of life. Simplification refers to "having things easy", spending less energy and time to complete especially daily tasks, such as grocery shopping. Efficient use of time refers to the need to complete more during a period of time, either by high performance or by doing several tasks simultaneously.

- Another key theme – mental health – was prominent throughout the discussion, not only in the context of future human needs but also in the context of social expectations to take care of one's mental health. For Finland specifically, the theme of mental health was linked to a generational "burden" of unresolved trauma, with one participant stating:

> "We have the past in Finland of the war, and the generations that went to war and they just [had] to build the country from nothing and no complaining. So it's [...] something that we still carry. And I think younger generations are learning not to carry the burden" (P4)

- Participants assume that technology will provide solutions to meet the described needs, and notably that "we need devices" to get more efficient. An assumption was made that "Our Teslas are getting […] smarter", and in 2044 we will be able to rely on technology much more. Technology was assumed to be predictive, ultra-personalized, and screen-free, e.g. based on voice or neural interfaces. One artifact serves as an example of such technology: the "mental health vehicle", a self-driving car in which various mindfulness, relaxation, and sleep programs can be used while commuting (Figure 6, d). One implication of the theme of

technological solutions was referred to as "blurring boundaries", the potential to simultaneously experience real and virtual realities. Another implication is the question of how to use the newly found free time: will one use it to slow down or to speed up and do even more? Participants' perspectives on this implication were varied.

- One prominent group of assumptions concerns the trade-offs of the anticipated change. Participants assumed that the described reliance on technology might have a cost. The theme encompasses dimensions such as dependency on gadgets in a future where each activity, including most basic everyday activities, requires a separate gadget; potential loss of autonomy in deciding whether to utilize a device or not, and the potential for mandatory usage or social pressure to use them and share your data across devices and services; "stupefying" as expressed by one participant (P5), is another trade-off, stemming from constant use of devices.

- Lastly, another anticipatory assumption concerned society as a whole, and the fact that utilizing such technology to own advantage will be available to a few, thus, increasing inequality.

Participants expressed varied emotions towards these assumptions and this image of the future in general. They had positive attitudes toward separate artifacts, however, the future world that enabled these artifacts to exist, as described above, provoked mixed feelings. One participant stated, "having devices connected to you is really scary" (P1). Another participant challenged the prominent anticipatory assumption about the need for devices, and ironically noticed, "Could it be so, that in 20 [more] years we'll look back at this time and laugh like: oh, that was the time of gadgets" (P6). Yet, the overall group feeling was that this probable future is somewhat plausible.

4.1.2 Anticipatory assumptions about the desirable future of cities 2044

Moving on to the exploration of the desirable future of cities in 2044, participants were presented with the option to either have a new creative prompt or reuse the previous prompt and modify the artifact to reflect their hopes for the desirable future. Interestingly, all participants opted to draw new prompts. Again, six artifacts were created (Figure 7) and exhibited on the whiteboard for collective "reading" and meaning-making through a

semi-structured inquiry. A short narrative of the desirable future of cities in 2044 is as follows:

> We "need to feel and enjoy nature" in a balanced blend of "nature and city". It is a world where "biophilic spaces" are "accessible to all", "recycling is effortless" and there is a "shared decision to act" for the "well-being of the world". We "value freedom of choice" and seek "effectiveness" within a "slower rhythm" and more "holistic" lifestyle. Here, "technology is in the background", and "gadgets are sidekicks" used "on our own terms". "You are not the object", "there is enough time" for "leisure" and "just life". You feel free to "block messaging" to "relax in your own bubble", "interact with the community", "seek inspiration", or just "empty your mind" in a "fresh, clean, and calm" environment.
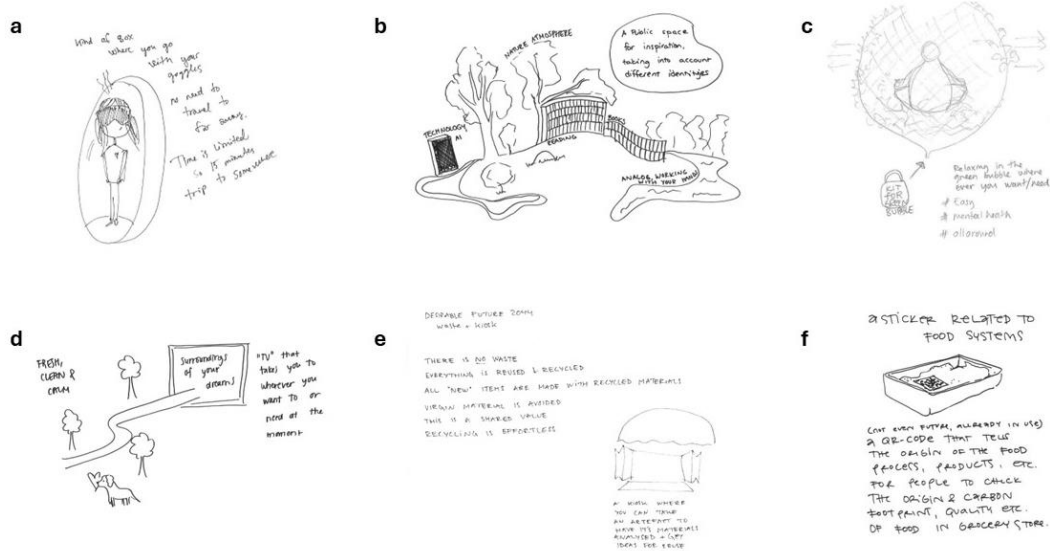

Figure 7. Visual artifacts representing the desirable future of cities in 2044, created in FLL-DE. Artifacts were created in response to the following creative prompts: (a) a box related to travel; (b) a public space related to identity; (c) a kit related to green spaces; (d) a screen related to childhood; (e) a kiosk related to waste; (f) a sticker related to food systems

Seven central anticipatory assumptions behind the image of the desirable future of cities in 2044 emerged from the analysis:

- A prominent desirable future assumption concerned leisure and temporal freedom. It encompassed leisure activities and autonomy over one's schedule. While reflecting on the artifacts, one participant (P4) noticed that "[…] none of this is work-related. This is all leisure". "Or just life?" added another participant (P1). This conversation captures the essence of the desirable future where more attention is given to life outside of work. In discussing temporal freedom,

participants expressed a desire for a slower pace of life and getting rid of expectations to be always available or reachable for others. Participants highlighted that this expectation is relatively new, describing how 20 years ago "people had cell phones that they kept at home" (P1) and "e-mail was when you […] went to the library" (P6). Since it is new, it can be challenged or rejected.

- Anticipatory assumptions about people's needs stemming from the previous assumption include a need for freedom and personal autonomy, as well as a need for individual and collective well-being. As for freedom and personal autonomy, many comments surfaced in relation to technology, which I separately present in the next paragraph. Besides, it involved a need for physical personal space, partly influenced by local culture, as evidenced by quotes like "we are Finnish, [lack of personal space] is a problem" (P6). The discussion of well-being encompassed in particular "the need to feel and enjoy nature" (P5), to be able to slow down and "empty your mind" (P3), and also to recharge, gain inspiration and interact with a community.

- Another prominent anticipatory assumption emerged in relation to the desired role of technology in the future which can be summarized as the "enabler on our own terms" (P2). Several participants echoed this sentiment, expressing the desire that technology plays a secondary role in our lives, and is only used when one deems it suitable. Use of technology in this desirable future is not compulsory, humans have power over technology and use it for their own advantage, as vividly stated by one participant: "you are not an object" (P1). These findings indicate that a change in the role of technology plays a critical role in achieving the desired slow and autonomous lifestyle.

- Natural and urban integration was a desirable future assumption, that is especially visible in the artifacts. Biophilic spaces, green spaces where one can engage in "very analogue things like working with your hands [… and then] stumble upon technology" (P5), portable green bubbles – all these ideas represent the desirable future. Some participants shared that it is important to have both city and nature and make green spaces easy to approach.

- One desirable future assumption related to values encompassed accessibility and inclusivity. It was a recurring notion when presenting artifacts and discussing the

societal aspects of this future. For instance, green spaces in this desirable future are accessible, free, and open to everybody. Information is also available for all, for example, information about a food product's journey that one can get by scanning a QR code (Figure 7, f).

- Another assumption related to values in the desirable future is a value of sustainability and environmental responsibility. It includes not only systemic aspects such as 100% recycling of materials which is effortless for the population, but also a shared "understanding [of] the state of the planet" (P5) and willingness to act collectively. A desire for "nature lobbying" (P2) is a noteworthy part of this anticipatory assumption.

- Finally, a desirable future assumption about actors of change emerged from the discussion of this future. Firstly, it was characterized by a sense of agency shared by some participants, especially in their professional role as designers (this finding is presented in more detail in subchapter 4.2.4). Secondly, industry and businesses were viewed as actors, as several participants shared examples of promising innovations and expressed a feeling of being "inspired by knowing that it's already done to some extent" (P1).

Overall, participants expressed positive emotions towards these assumptions and this image of the future. Several participants expressed concerns that new ways of leisure, exemplified by the created artifacts, would replace some of the current activities like traveling.

4.1.3 Anticipatory assumptions about the reframed future of cities 2044

Phase 2 – Reframe of the FLL-DE involved a team exercise and started with distributing the "letters from the future" with the reframed scenario (introduced earlier in subchapter 3.2.3). A brief discussion followed, where participants expressed their initial impressions revealing a spectrum of attitudes from seeing this future as disruptive to perceiving it as consistent with their current life circumstances. Then, participants in their teams collected a range of anticipatory assumptions to develop a shared understanding of the scenario and proceeded to artifacts making. In this exercise teams had the freedom to decide, whether to design an object, a system, a service, a place, etc., to embody the collected anticipatory assumptions about the reframed future. Unexpectedly, two teams ended up pursuing the

same idea: a concept of a living arrangement where compact individual living units are coupled with communal spaces shared among residents (Figure 8). It seems possible that this decision was influenced by the professional area of design of built environments in which R&BD operates.

Based on the presentations and discussions of artifacts, a short narrative of the reframed future of cities in 2044 is as follows:

> While "opportunities are available unevenly" and "living is more expensive", a "more affordable solo living" is emerging through the "sharing economy" and "architectural changes". "Future community housing" combines "private units and shared spaces", promoting "well-being and mental health", combating "loneliness" and fostering a "community to be a part of". The "city provides different communities" and we "choose a community instead of square meters". It requires us to embrace an "old-fashioned village type of ideology" and proactively seek to "be interested and responsible for others". The shift to "hybrid schools and work" and "fantastic virtual connections" allow us to be mobile and "less dependent on physical proximity". In exploring "what does it mean to own something" the concept of "co-use" becomes crucial, allowing us to "consume what we actually need".
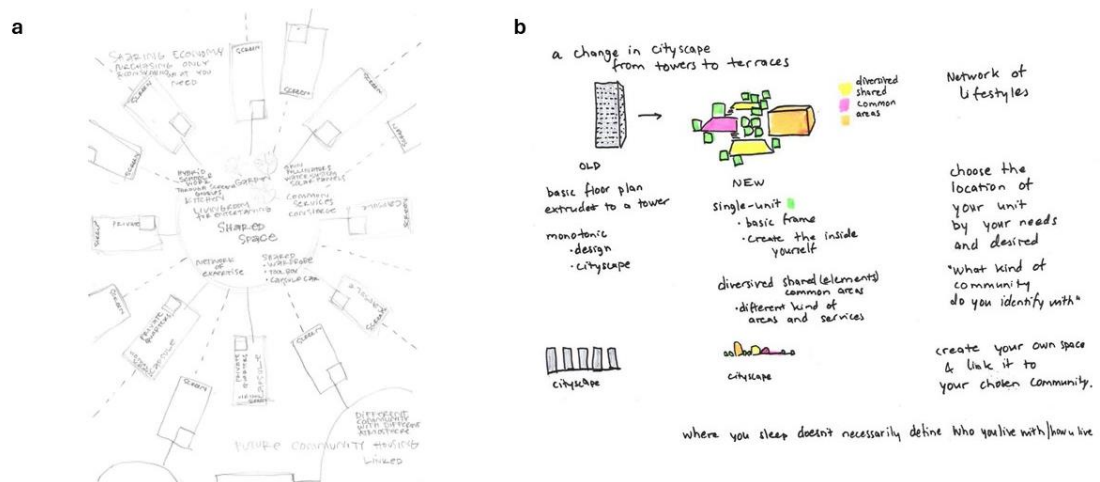
Figure 8. Visual artifacts representing the reframed future of cities in 2044, created in FLL-DE. Artifacts were created to embody the anticipatory assumptions made by teams: (a) Team 1; (b) Team 2

Key anticipatory assumptions, underpinning this image of the future, were revealed in the analysis:

▪ Anticipatory assumptions about the reasons for solo-living were made by the participants to build a more detailed understanding of the reframed future. These

included, on one hand, people's wish to live alone, and on the other, factors such as scarcity of work and educational opportunities in particular areas, that may prompt people to move and even split from their families. Some participants also anticipated the increase in the cost of living.

- Participants from both teams assumed that architectural change and the rise of alternative living arrangements are required to ensure that this future of cities is not a "dystopian [...] nightmare" (Team 2) of identical high-rise buildings consisting of studio apartments. The artifacts of both teams embody the idea of co-living, where individual units are connected with shared spaces, with Team 1 referring to it as the "future communal housing". Assumptions were made that cities would provide these housing to different audiences to rent and purchase.

- One anticipatory assumption concerned the role of technology and connectivity in particular. In the reframed future, virtual connections were viewed as key to upholding social relationships, for example, meeting friends and family in virtual reality. Virtual work and schooling arrangements were assumed to be needed, for example, for kids to have the possibility to stay with either parent.

- Another anticipatory assumption related to the living arrangements was the transformation of an idea of ownership to encompass the co-use of resources in the shared economy. Participants raised questions about what does it mean to own something and what is considered private and hypothesized that the boundary between owning and sharing will blur, as evidenced by quotes like "things become your own even though they are shared" (Team 2) and "shared places feels like part of your home" (Team 1).

- A prominent anticipatory assumption concerned the theme of individual and communal well-being. Loneliness was seen as the main challenge of this reframed future, therefore, teams assumed that combatting loneliness would be a priority. Participants discussed how the proposed living arrangements can facilitate socializing through a traditional village ethos of close network and collective responsibility for the shared space. Despite having more "me-time" due to solo-living was viewed as positively contributing to the well-being, however, both teams noticed that it entails a trade-off, requiring individuals to be proactive and actively choose to connect and take care of others. Another aspect of well-being

was suggested by Team 2, who developed a terraced living environment, as opposed to a "monotonic lifestyle [in] monotonic cityscape" (Figure 8, b).

- Personal choice as a key value was another anticipatory assumption underpinning the reframed future. Both teams recurrently discussed the flexibility and freedom of choice in moving into a community that reflects one's values and lifestyle. Another dimension of this assumption involves the fact that non-monogamous relationships were assumed to become more widespread and acceptable.

- Finally, an anticipatory assumption was made about a sustainable way of living, that encompassed a decrease in consumption due to the transition to shared economy, as well as autonomous energy and water systems in the co-living complexes.

4.1.4 Summarizing findings for RQ2

What emerges from the results reported here are three notably distinctive images of the future, each characterized by its anticipatory assumptions. It is important for the reader to bear in mind that the duration of the FLL-DE was reduced to three hours, while the usual duration is nine to fifteen hours (UNESCO & PMU 2023, 16). This almost certainly limited the opportunity to detail and explain further some of the anticipatory assumptions. The potential approach to further exploration is addressed in the subchapter 5.2 in the Discussion.

In Phase 3 – Rethink, participants were invited to reflect on their journey and to identify questions concerning the futures of cities, based on their participation in the FLL-DE on this topic. Participants identified questions regarding power dynamics, the speed of change in social norms, and the role of technology. Besides, the participants were encouraged to compare the probable, desirable, and reframed futures and the corresponding assumptions. Several insights into the futures of cities were mentioned, which I present below with elaboration based on analysis:

- *The growing need for autonomy and agency.* The theme of control over one's life (understood here as the freedom to choose for oneself, to be autonomous) was prominent in discussions on anticipatory assumptions across the three futures. Here, a question was raised about who decides what kind of lifestyle we have in cities: individuals, employers, governments, or corporations? From the analysis,

the evolution of this theme throughout three futures is evident. In the probable future, there are evident concerns about being socially pressured for certain behaviors such as being always reachable for others, multitasking, or sharing significant amounts of personal data. The desirable future contrasts with this; here temporal freedom is at the core of lifestyle in the cities and autonomy is one of the key values. This emphasis is also prominent in the reframed future, where one of the main anticipatory assumptions is that personal choice is a fundamental value.

- *Changing relationships with nature across the three futures.* In their comparison, the participants emphasized the importance of nature in urban environments and the need for opportunities for human-nature interaction. A comparison of the three final images of the future reveals how anticipatory assumptions about this aspect vary. The theme of nature was almost entirely neglected in the probable future, hinting at overlooking nature in the hectic lifestyle that participants assumed probable. In contrast with that, the theme of nature emerged as central in the desirable future, likely as an antidote to the probable future. Although the relationships with nature are not extensively discussed in the reframed future, the focus on sustainable lifestyle, shared economy, and mentioning community gardens, at least suggests a more responsible attitude towards nature.

- *Challenging the technocentric mindset.* During reflection, participants made critical observations about how we tend to rely on technology to solve future challenges and questioned the desirability of additional technological expansion in human lives. Further analysis shows that participants imagined a different role of technology across the three futures. According to the anticipatory assumptions about the possible future, technology is seen as a required solution to increasing the speed of life; however, it raises concerns about dependency on technology and being socially pressured to adopt it. This contrasts with the desirable futures, where there is an aspiration to control technology usage and assign it a secondary role in daily life. Similarly, in the reframed future, technology is used to one's own advantage to enhance autonomy and enable the designed living arrangements. The reassessed role of technology is notably exemplified by the imagined thing from the future that was imagined first by one participant (P3) to represent the probable future, and then re-imagined and included in the artifacts

representing the desirable and reframed futures. The "Goggles" – the augmented reality headset – are used in the probable future to achieve efficiency and multitask seamlessly; in the desirable future, they facilitate rest, disconnection, and virtual traveling; finally, in the reframed future, they are not visible in the artifact but are mentioned to exist as a means to maintain social relationships.

Finally, what emerged from the results, but was not explicitly mentioned by participants during the reflection on their journey, is the distinct focal point in each image of the future: work and efficiency in the probable future, leisure and life outside of work in the desirable future, and community and belonging in the reframed future. So far, the findings have addressed the RQ2. The following subchapter will discuss the findings concerning the RQ1 and RQ1a.

4.2   Unraveling the interrelations of design epistemology and anticipation

In Chapter 3.3.1, I posited hypotheses about the expected mechanism of the FLL-DE, including the transitions between types of design knowledge conceptualized in a system map. The theory-driven evaluation approach, which entails comparing the initial expectations with the observed results in practice, was employed to answer RQ1 and RQ1a: *How does design epistemology interrelate with anticipation, particularly within the context of Futures Literacy Lab? What role do visual artifacts play in revealing and understanding individuals' anticipatory assumptions?* Naturally, facilitator observations served as the primary source of data for addressing this study question, while recordings of FLL-DE and pictures taken over the event's duration supported emerging interpretations.

After assessing the observed processes and participants' experiences, I concluded that the FLL-DE in general unfolded in accordance with the implementation theory, supporting the hypothesized mechanism of FLL-DE. Yet, certain differences and nuances were observed, that I will now present in detail. To begin with, each feedback loop and emergent property of the system will be presented, comparing the expected mechanisms (illustrated earlier in Figure 5) those emerging from data. Once each element is discussed, I will attempt to theorize my findings in a revisited system map.

4.2.1 The externalizing-internalizing loop

The first feedback loop in the hypothesized system was the *externalizing-internalizing loop*, which represented the expected mechanism of surfacing participants' anticipatory assumptions and making them explicit. The hypothesis was as follows. Externalizing: implicit anticipatory assumptions can be materialized through making artifacts; artifacts, in turn, can be "read" through collective discussion and personal reflection, facilitating verbalizing anticipatory assumptions. Internalizing: in turn, explicit assumptions can feed back to participants' tacit knowledge, altering their "internal compass", due to an expectation that one "cannot unsee" the explicit assumptions.

As expected, the processes of making artifacts and reflecting on them made participants' anticipatory assumptions explicit, thereby serving as a mechanism behind the *externalizing-internalizing loop*. This process primarily unfolded during Phase 1 of the FLL-DE, dedicated to exploring the probable and desirable futures of cities. Let us examine this loop in detail, step by step.

Externalizing started with the generation of visual artifacts in response to creative prompts. This allowed to materialize participants' implicit anticipatory assumptions about the probable or desirable future through making artifacts. Here, participants' openness and trusting the process played a central role, as indicated in one participant's reflection: "It's a good practice [that makes you] trust your intuition" (P6). Here, the participant refers to the practice of making artifacts in response to creative prompts, especially in a limited amount of time that was given (5 minutes). With the limitation of time, prompt, and medium (pen and paper in this case), it becomes imperative to rely on intuition. It was observed that most of the participants enjoyed the act of drawing. Subsequent reflections emphasized how this open-ended activity relieved the pressure of feeling compelled to prove knowledgeable – a pressure sometimes present during discussions about futures. The following participants' reflections illustrate the point.

One of the participants (P6) contrasted sketching to filling a canvas – a widely used heuristic in workshops – and suggested that sketching allowed for a more exploratory approach compared to following a given template or canvas, which was viewed as a more restrictive method (although the latter was not directly articulated). In her point of view, filling in a canvas often involves creating a finished product, or at least, formulating ideas in a finalized manner, while sketching allows for unfinished ideas. Another participant

pointed out how sketching alleviated the pressure of envisioning the probable future of a topic in which she possessed expertise. The participant herself noted:

> My first task involved the word "work" and I work with [the topic of] work, so it became like this huge "I have to know something about it", and then I just decided [to draw] […] and it made it a bit easier. (P1)

In other words, the participant initially felt obliged to possess expertise on the subject and be able to predict its future. However, the design-based heuristics encouraged her to rely on tacit knowledge, easing the sense of burden. Taken together, these two reflections suggest that creating visual artifacts allowed participants to access tacit knowledge and give form to it. This potentially allowed for the expression of subconscious anticipatory assumptions, as opposed to conscious articulation.

The experience of another participant was, however, different. During these exercises, she felt less comfortable and openly expressed her struggle, stating: "I find myself just writing" (P2). Upon reflection, she identified two primary challenges. Firstly, she characterized herself as one who has an analytical mindset and often tries to find optimal solutions, which made it difficult to trust the process. Secondly, she noted that although she works in a design agency, she does not use tools like sketching in her day-to-day work, therefore, it was hard for her to materialize her ideas into visual form. It is important to note, though, that the visual artifact created by this participant for the second exercise (desirable futures) already relied more on visual elements and less on verbal descriptors to convey the idea, in comparison with the artifact depicting the probable future.

Externalizing continued with the collective "reading" of the artifacts and translating the artifact knowledge into verbal descriptors of the future they represented. In subchapter 4.1 above, I have presented these *artifact-reading anticipations* and demonstrated a variety of assumptions elicited from artifacts. Discussions were in part driven by myself as a facilitator, though probing for assumptions about various aspects of the future, such as behaviors or values. One participant (P2) noticed, though, that the facilitator's terminology, e.g. "social norms" or "values", was sometimes overwhelming and unclear. In addition, artifacts themselves served as visual probes, evoking spontaneous comments from participants. In their reflections, participants agreed that visual artifacts facilitated the exploration of ideas about futures, and the discussion overall led to a more holistic view of futures, considering various aspects.

Discussions also involved probes to identify the origins or influences underlying participants' anticipatory assumptions. Many visual artifacts depicting the probable future featured direct references to widely recognized innovations or brands, such as the Google Oculus VR headset or Tesla car, which participants intentionally used as sources of inspiration. On the contrary, the artifacts depicting the desirable future, either lacked specific references or were inspired by less mainstream innovations, such as the Neurosonic relaxation technology developed within the local Finnish market, mentioned by one participant (P3). Generally, participants found it easier to identify influences in the artifacts representing the probable future than those depicting the desirable future, as evidenced by quotes such as "It came to me from Elon Musk" (P1) or "I just thought about what […] the newest trend [is]" (P5).

The final stage of the *externalizing-internalizing loop* indicates the change in participants' tacit knowledge as a result of explicit articulation, discussion, and reflection upon anticipatory assumptions. This is what I refer to as *internalizing*. Given the limited scope of observation in a single iteration of FLL-DE, this part of the system remains beyond the scope of this study.

4.2.2 The reframing loop

The second feedback loop in the hypothesized system was the *reframing loop*. It was hypothesized that throughout FLL-DE, participants would have an opportunity to *reframe,* i.e. alter, their anticipatory assumptions about the futures of cities and use them as input for new visual artifacts.

The *reframing loop* mechanism generally worked as expected. One notable difference was however deduced from the practice. My initial expectation was that *reframing* would primarily be prompted by a linear transition throughout exercises and alternative futures (from probable to desirable, and from desirable to reframed futures). In practice, it was observed that reframing did not happen in a linear manner, nor at specific singular "moments of truth", but it was rather a back-and-forth process of iterative comparison of alternative futures and underlying anticipatory assumptions. Examples of this include the juxtaposition of probable and desirable futures, as well as the collaborative creation of visual artifacts to give form to the reframed future.

As stated earlier in 4.1.1, following the discussion of the probable future, participants were asked about their perceptions of its desirability. Different viewpoints were articulated, with one participant (P1) describing her feeling as "scary", and another (P3) maintaining that for her, the benefits outweigh the possible negative aspects. Overall participants agreed that it was somewhat desirable, but a critical perspective began to emerge. Moving on to the next exercise – creating artifacts depicting the desirable future – no one expressed a desire to modify the artifacts, despite being given a chance to do so. This hints that, at this moment, participants probably did not have the urge to reframe their anticipatory assumptions.

Having created the artifacts depicting the desirable future, participants engaged in the discussion and reflection upon them. It was at this point participants started comparing the two sets of visual artifacts and contrasting the underlying anticipatory assumptions. This led to reassessing their beliefs regarding the probable future and strengthening critiques. For example, one participant commented: "I think nature is more visible in this [set of visual artifacts] than in the previous" (P2), and another participant compared the two futures in the following way: "What made me anxious [about the possible future] was the idea of having to give information without having control of it. And here it's like […] something happened. You're not the object" (P1). It can be concluded that the introduction of the new context – the desirable future – provided the participants with the opportunity to view their anticipatory assumptions in a new light and challenge previously articulated beliefs. As a result, a shared vision of what the group deemed desirable emerged; it was not the complete opposite of the probable, however, the anticipatory assumptions were *reframed* to better capture the shared vision, as expressed by one participant: "effectiveness is still here [...] maybe the ratio [...] is different" (P2). In this process, the artifacts served not only as sources of artifact knowledge, which participants "read" to discern what they perceived as probable and desirable. They also had the role of storing sketches, a function described by Lugt (2005, 107-108), providing accessibility to earlier ideas, and representing alternative futures in a condensed way.

Another opportunity to *reframe* anticipatory assumptions came with the introduction of the reframed future scenario. Presenting the notion of predominant solo-living as a "future fact" led to the collaborative development of a new perspective, that was further utilized as an input to develop a visual artifact. Here's how a participant of one of the teams described the process:

> We began with the expectation that living would be more expensive if everyone lived alone. But I think in the course of the conversation, we sort of wanted or found ourselves going towards something [new, an idea] that it might not necessarily mean that living is more expensive if it's just divided differently. (P6)

Another noteworthy moment indicating reframing is evident in one team's visual artifact for the reframed future. It incorporates both the old and new (i.e. suggested by the team) paradigms of solo-living arrangements. Within the artifact, the reframing is expressed both verbally: "a change in the cityscape from towers to terraces", and visually with the use of color emphasizing the team's preference for the new paradigm over the old (Figure 9). This instance of *reframing* did not necessarily reflect the change in the participants' individual beliefs. Instead, it aimed to challenge the business-as-usual approach, suggesting a novel type of living arrangement based on different anticipatory assumptions. Hence, it illustrates the deliberate use of alternative anticipatory assumptions to inform design decisions.
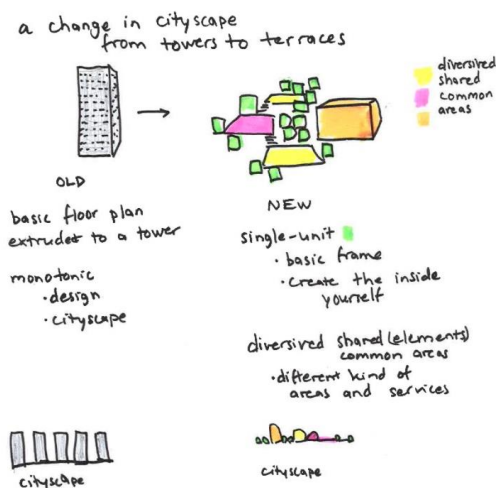

Figure 9. Use of color and words to indicate the reframed anticipatory assumptions. This image has been cropped for clarity

Later at the Rethink stage, a participant (P1) used the metaphor of "opening the lock" to describe her experience of *reframing* the anticipatory assumptions throughout the FLL-DE. In other words, by initially identifying and examining the assumptions about the probable and desirable future, these assumptions became open to challenge, allowing for the exploration of new possibilities.

4.2.3 The thinking-talking loop

The third feedback loop in the hypothesized system was the *thinking loop*. The expectation was that participants would employ thinking sketches and re-draw or modify their artifacts during individual work.

Based on the observed activities within the FLL-DE, I propose that the *thinking-talking loop* is a more accurate notion, that includes both the individual and the collaborative process of visually expressing anticipatory assumptions. The use of both thinking sketches and talking sketches is conceptualized by this feedback loop, as indicated by the following observations.

When engaging in individual exercises (in Phase 1 – Reveal), participants did not make much use of thinking sketches. They tended to go straight to visualizing their initial ideas rather than engaging in trial-and-error and redrawing. Only one participant used this practice when sketching an artifact depicting a desirable future, in response to a creative prompt based on Thing and Theme cards: "In this future there is a kiosk related to waste, what is it?". Here is her contemplation of this moment:

> I started from those words and drew a kiosk. And got stuck on what the kiosk of the future is? And then went back to [the idea of] waste. And so, I [initially] started from the image of […] what is like an iconic kiosk. […] And then the second one, I started from the content. (P1)

In making this comment, the participant describes her interaction with the sketch and the reinterpretation that occurred after giving form to the initial idea. The reinterpretation directly concerns imagining the future and considering the potential appearance and construction of an object, such as a kiosk.

In contrast to individual sketching, in the group work, I observed that one team created several intermediate sketches before finalizing their idea for further presentation (Figure 10). Those sketches did not serve as final artifacts; rather, they facilitated the development of shared understanding and the intentional imagining of the future. In Figure 10, sketches (a) and (b) resemble pictograms or symbols, each conveying a singular idea: terraced housing and individual living units surrounding a shared communal space, respectively. Sketch (c) represents a concept involving a variety of communal spaces (labeled as letters A-D) within different housing units (depicted as circles). During the reflection, the team shared insight into this process, referring also to their day-to-day design practice:

> In our group work or projects, we tend to have different types of people within one project and usually it goes so that maybe I'm explaining something and writing down words, and then maybe [another person] is drawing something more conceptual, so those are good together. They complement each other. (P5)

I conclude that in the thinking-talking loop the sketches serve a dual purpose: firstly, as thinking sketches they facilitate a search for visual forms to represent one's idea, and secondly, as talking sketches they simultaneously allow others to see, interpret, and contribute to this idea.
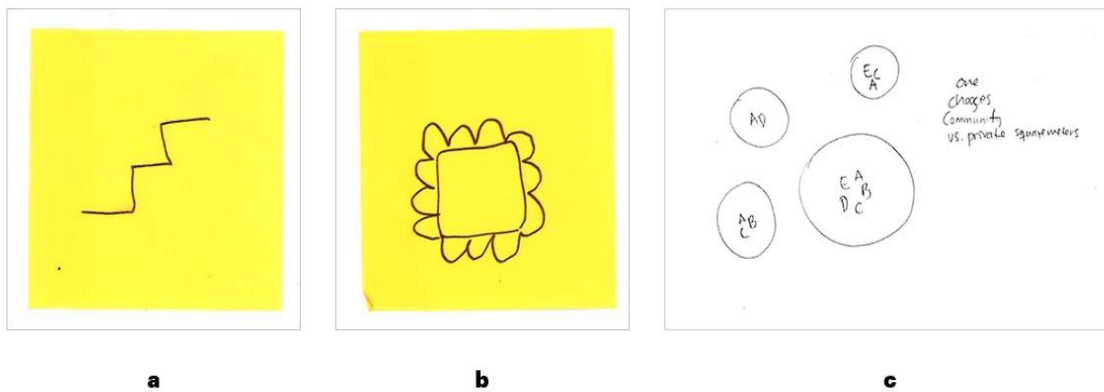

Figure 10. Thinking and talking sketches used in the group work

4.2.4 Emergent properties

In system theory, the emergent properties of the system are behaviors that could arise from the interactions among its components. For the FLL-DE, one such hypothesized emergent property was that participants, through the FLL-DE journey, may become more aware of their anticipatory processes, therefore developing anticipatory capabilities. The analysis of observations and reflections provides grounds to confirm this hypothesis. The findings also suggest another emergent property – the potential development of codified design knowledge, that could be used outside of this particular FLL-DE setting. However, with only a single iteration of FLL-DE, it is important to bear in mind that the emergent properties may not be immediately observable or may change as the system dynamics unfold. Additionally, they may be influenced by external factors or conditions that extend beyond the FLL-DE setting. Considering this, the following describes two emergent properties suggested by the gathered data.

Development of anticipatory capability

As Miller (2018a, p. 106) suggests, participating in the FLL leads to higher futures literacy, which involves the ability to be critical of own thinking about futures and greater agency in present actions. I observed that a couple of times, especially during discussions of desirable and reframed futures, participants expressed motivation to be proactive in shaping the future. A particularly notable moment occurred when one participant enthusiastically suggested, "We should pitch this to our clients!" (P2) in reference to an artifact representing the desirable future. Another participant noted that "[the future] hasn't happened yet, so we have a say" (P1). Furthermore, a following reflection on the team exercise illustrates this proactive perspective:

> […] we did […] make an active decision. We almost […] drowned into […] a dystopia of where you have to live alone and everything's the same. We've made an active decision of not making a nightmare, but rather focusing on a positive thing. (Team 2)

The participants demonstrated a belief in their ability to contribute to futures, which resonates with both Miller's sentiment above and Inayatullah's (2008) notion of anticipatory capacity – confidence to challenge the used futures and actively create desirable futures. In light of anticipatory systems theory, the observed behaviors echo Poli's (2010b, 12) idea that a system that anticipates negative future states would seek to change itself to prevent them from occurring. It is important to note that the quotes reflect the sense of agency and drive to take action specifically in the participants' professional context as designers. Another evidence suggesting the development of participants' futures literacy is the fact that they have identified new questions related to the topic. However, asking such questions proved to be a challenging task for participants, and required additional probing from the facilitator.

Tools to embed anticipation in practice

The codified knowledge level (D) of design knowledge lies beyond the system boundary, however, the findings suggest a potential for using the knowledge created during FLL-DE further in the participants' design practice. To illustrate, one participant noted:

> When we have a workshop with our clients, we often make them […] jump into the positive and the expectations, so we might want to give them a chance […] also to blurt out their fears, because that might give them more space to actually look longer into the future. (P4)

Expanding upon the participant's suggestion, the R&BD team could develop structured exercises or a framework that the team could apply across their projects, integrating anticipation into their practice.

4.2.5 Summarizing findings for RQ1 and RQ1a

At this point, I have presented key mechanisms of FLL-DE, in which design epistemology and anticipation interrelate. I will now theorize the observations made in the trial run of the FLL-DE, to transcend this particular event and make the results amendable for further development. In Figure 11, a revisited system map is proposed to summarize the findings, with the following elements included:

- *Externalizing-internalizing loop*. Participants come to FLL-DE with their anticipatory assumptions being implicit (Level B). A task to make artifacts representing a particular future allows to materialize them in artifacts (knowledge transition B→A). The following "reading" of artifacts represents knowledge transition A→B→C: artifact knowledge is grasped intuitively (hence, the arrow runs through the Level B) and verbalized, making anticipatory assumptions explicit. Upon reflection, participants might internalize some of the assumptions (knowledge transition C→B).

- *Reframing loop*. The same process of "reading" artifacts (transition A→B→C), and reflecting on the surfaced anticipatory assumptions, creates an occasion to challenge or alter them and come up with novel assumptions about futures. This is done consciously, on Level C. Novel anticipatory assumptions then can be used as input for making new artifacts (transition C→B→A).

- *Thinking-talking loop*. This loop describes the process of finding a visual form to represent an anticipatory assumption. A participant may engage in the back-and-forth transition of knowledge between A→B→A… to visualize an idea, reinterpret it intuitively, modify it, and visualize it again. A group of participants may engage in the shared creation of knowledge, A→B→C→B→A…, when they use artifacts to share individual ideas and build upon them together.

- *Emergent property: developed anticipatory capability*. I suggest that this emergent property, indicated as an arrow emerging from the system and pointing toward Level B, influences in particular tacit knowledge of participants, and their

design intuition. There is a potential that the ability to engage in conscious anticipation, and futures literacy, understood as "the capacity to identify, design, target and deploy [anticipatory assumptions]" (Miller 2018c, 24) can become a part of participants' design intuition, and be utilized in their design practice.

- *Emergent property: tools to embed anticipation in practice.* Albeit not observable in the FLL-DE itself, this property refers to the potential to develop and use tools to embed anticipation in design practice. It represents knowledge transition C→D, where particular design theories or practical models are built.
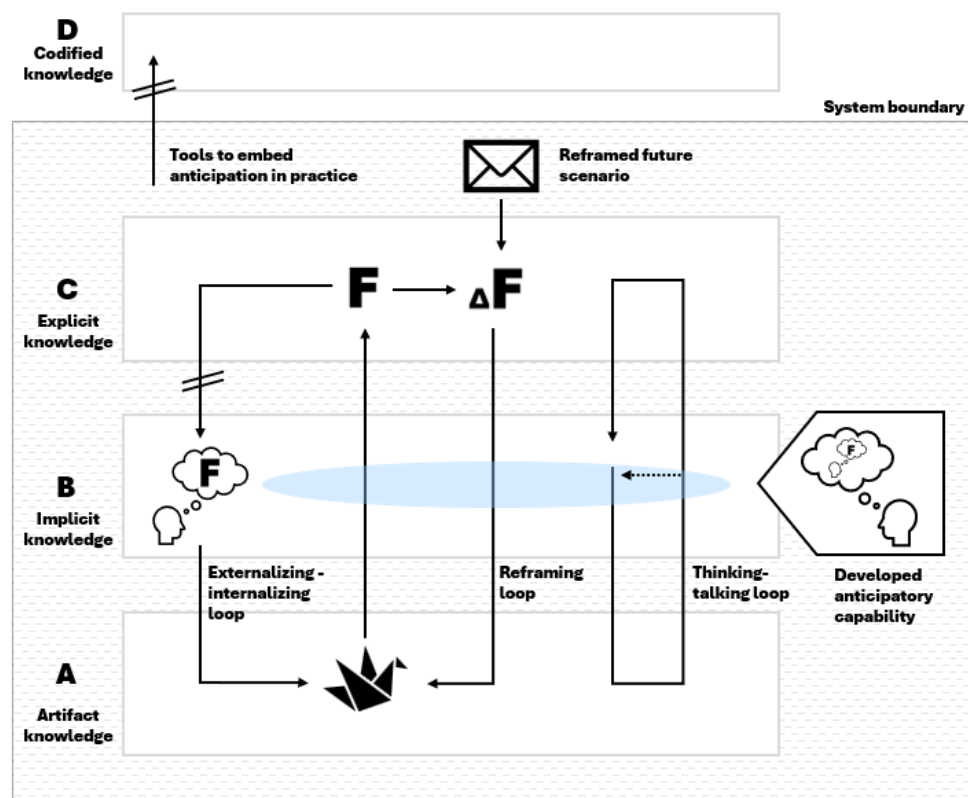

Figure 11. A system map of interrelation between anticipation and design epistemology as observed in the FLL-DE: Futures of cities 2044

Now, answering RQ1 and RQ1a, I conclude that in the context of FLL-DE, there is indeed an interrelation between design epistemology and anticipation.

Integrating design epistemology into the FLL allows to access implicit anticipatory assumptions and externalize them through *making* and *reflection*, which I termed here *artifact-reading anticipation.* These two steps of generating design knowledge serve as a means to intuitively grasp and verbalize various aspects of futures, represented by the artifact. It helps participants to discover what they did not know they "knew" or believed

about futures. *Artifact-reading anticipations* construct the knowledge about futures, which artifacts then store and synthesize in a very condensed and efficient way. They keep the context always present, facilitating further comparison and reframing of anticipatory assumptions. Engaging emotionally, they provoke critical questions and motivate to act, which is the core of anticipation.

In turn, engaging in deliberate anticipation in the context of FLL influences the "designerly way of knowing". Since any piece of design contains a judgment about the future (Lawson 2005, 165), anticipatory capabilities are part of the design intuition of an individual designer, design team, or studio. Participation in FLL is a way to develop anticipatory capabilities. There is also a potential to improve design theory with theoretical concept and practical models of anticipation, helping designers in their professional role to be genuinely creative and open to novelty.

5 Discussion

The aim of this study was to promote a more integrated dialogue between futures studies and design studies by making a methodological suggestion for a futures research method that draws from both fields. This study was undertaken to tailor the FLL methodology to incorporate design epistemology as a way of "knowing" futures, as well as to evaluate the trial run of a new FLL-DE approach with professional designers. Both the process and the content of the FLL-DE have been analyzed. Firstly, the interrelation and mutual influence between anticipation and design epistemology is supported by the current findings. Design epistemology applied for anticipation in the context of FLL-DE seems to enable intuitive perception and articulation of anticipatory assumptions through *artifact-reading anticipations*. There is also some evidence to suggest that the experience of anticipation has the potential to alter the daily design practice of participants. Secondly, the analysis of the *artifact-reading anticipations* revealed a variety of anticipatory assumptions about the futures of cities in 2044, that form the basis for three distinctive images of the future.

The scope of this study was limited by the fact that it only included one trial run of the FLL-DE with a total of six participants. It is impossible to examine the FLL-DE systematically because no group is the same twice (Light 2021, 13). The results should be interpreted with caution, due to a small sample size, as some of the findings might be anecdotal. Moreover, observing only professional designers makes these findings less generalizable to the wider audience. While the findings suggest that FLL-DE can be advisable for professional designers to engage in anticipation, additional studies with participants outside of the professional design field are needed to establish its relevance for a wider audience. Finally, the study lacks follow-up data about the design practice of participants. Gathering data on the experience of the FLL-DE does not provide insight into whether it transformed attitudes or practices. While there is no reason to doubt participants' statements on feeling motivated to act toward a desirable future or considering embedding anticipation in practice, testing whether these intentions led to any changes remains beyond the scope of this study.

In spite of its limitations, the study certainly adds to our understanding of applying design as a way of knowing, in the context of anticipation. In what follows I discuss the findings in light of the theoretical framework and prior research.

5.1 *Artifact-reading anticipation* as a synergistic activity

Prior research has established that design knowledge is generated through the relationship between the designer, the artifact, and the process of its making. Isley and Rider (2018, 365) claim that a designer and an artifact cannot be separated, and the process of inquiry is as important as the final product for the creation of knowledge. They highlight the crucial role of embodied cognition to create design knowledge and the role of a designer in meaning-making (ibid., 364). Similarly, Kim and Tan (2022, 5) note that design knowledge is created through the designer and the process of making, and subsequent reflection.

Consistent with the theoretical underpinnings, this study found that the artifacts and the following discussion formed what I called *artifact-reading anticipations.* Knowledge was created as participants engaged in making artifacts and reflecting upon them. The artifacts allowed for a tangible representation of tacit assumptions about futures, however, artifacts alone did not independently create knowledge about alternative futures. Participants' articulated assumptions, in turn, were elicited only by "reading" this particular set of artifacts. These results match those observed in earlier studies. Light (2021, 12) discusses this idea as a "hybrid *process + object* artifacts" [emphasis original]. Drawing from a series of workshops, she concludes that artifacts become entangled with the processes they support. Several studies have also shown that audiences may struggle to engage with speculative artifacts in their finished form if they were not involved in the making (Pelzer & Versteeg 2019, 25; Hupkes & Hedman 2022, 5).

These findings have implications for further application of design in the context of futures and the development of hybrid futures/design approaches. The synergistic activity of making and "reading" artifacts suggests that any attempt to isolate one from the other might lead to creating insufficient knowledge.

5.2 Artifacts as litany

Exercises based on CLA are widely used in FLL design (UNESCO & PMU 2023, 42-43). Oftentimes, those exercises rely on verbal expression of ideas: either discussing or filling in a pre-made canvas with text. This study sought to provide an alternative and include exercises incorporating design epistemology in the FLL. The findings suggest that *artifact-reading anticipations* that entail both making and reflecting might offer an

open-ended and exploratory way to uncover anticipatory assumptions. This is likely to be related to the creative, intuition-based nature of sketching, as proposed by Weber (2008, 44). In her view, images allow us to "access those elusive, hard-to-put-into-words aspects of knowledge that might otherwise remain hidden", and they may be especially powerful in connecting abstract concepts such as poverty or pollution to our own experience.

It is important to note, that anticipatory assumptions uncovered in *artifact-reading anticipations* were at large situated in human-scaled aspects of futures, such as behaviors, everyday practices, values, and social norms. For certain purposes, producing this kind of knowledge may be sufficient. However, there is a potential to deepen the understanding of anticipatory assumptions with additional exercises. This trial run of FLL-DE was deliberately shortened to last three hours. With the recommended duration for FLL of nine to fifteen hours over the course of several days (UNESCO & PMU 2023, 16), there is an opportunity to extend the "reading" of artifacts.

A reasonable approach to do so could be structuring the *artifact-reading anticipations* according to the CLA layers. I argue that artifacts can be regarded as a litany, a layer in the CLA that deals with visible, easily perceived aspects of futures. In exercises, they often take the form of news headlines, events, or occurrences that are apparent to public attention. However, the findings of this study support the idea that the materiality of daily life in the form of an artifact is another apparent and visible aspect. As anticipatory epistemic objects, artifacts capture tacit "knowledge" about futures. *Artifact-reading anticipations* then can be used to deconstruct the artifacts, in Inayatullah's (1998, 818) terms, and guide participants through deeper layers of analysis – the social causes, worldview, and myth, that enable the artifacts to "exist" in a particular imagined future. Active facilitation is advisable for guiding participants and reinforcing the framing and process of "reading" the artifacts (Finn and Wylie 2021, 8)

Godhe and Goode (2018, 155-156), encourage us to connect imagined futures with material practices. Artifacts as litany allow us to connect the deeper layers of CLA with the materiality of everyday life, potentially leading to more emotional engagement with otherwise abstract concepts. Inayatullah (1998, 821) suggests that by moving up and down layers, we can integrate analysis and synthesis; here, artifacts could be particularly useful to store the synthesized information in a highly efficient way. The suggested use

of artifacts as litany would hopefully leverage the intuitive nature of artifacts combined with the analytical depth of CLA.

5.3 Artifacts as a means of holistic communication

Another finding that stands out from the results reported earlier is the utilization of artifacts to support communication that occurred during the FLL-DE, for instance, to build a shared understanding of a particular future or compare it with other images. In general, artifacts assist participants' communication and collaboration by providing a visual and iterative way to collectively create knowledge. These results are consistent with those of Peukert and Vilsmaier (2021, 6-7) who observe the role of design prototyping in transdisciplinary research as enabling communication and collaborative imagination, allowing for exploration of the unknown and developing shared visions of the future.

5.4 Mediating role of design epistemology

In this study, the making of artifacts was found to alleviate the possible pressure to appear knowledgeable when discussing futures. It is difficult to explain the nature of such pressure, but it might be due to the fact that this study involves professional designers. Their practice encompasses giving professional advice and developing futures-oriented solutions. Professional advisers are often concerned with their reputation for being well-informed and the perceived quality of their advice (Ottaviani & Sørensen 2006, 121). Experts in general experience social pressure to perform, present themselves as confident in their judgments, and be consistent (Trinh 2019, 4). In connection to anticipation, this point is important, as such pressure may result in being unreceptive to novelty and resistant to change (ibid., 6). Alternatively, the pressure that I observed in this study may not necessarily be related to expertise. Research shows that self-presentational concerns may similarly affect non-experts, such as focus-group respondents, with the following factors potentially influencing the level of concerns: group size, within-group homogeneity, familiarity among participants, individual characteristics (self-esteem, public self-consciousness, etc), discussion topic, moderator, and characteristics of physical environment (Wooten & Reed 2000).

Design epistemology involves a simultaneous process of making and generating knowledge, which contradicts the perspective of traditional disciplines, that one must

acquire knowledge before creating some representation of this knowledge (Kim & Tan 2022, 5). Finn and Whylie (2021, 8) argue that creative constraints of making or another creative practice, augmented by time limits, remove the possibility of perfection and completeness of ideas. Hence, a possible explanation of my finding is that engaging in artifact making allowed participants to embrace the not-knowing, even in the face of concerns about reputation and self-presentation.

Another finding of this study is that the task of artifact making was uncomfortable for some participants, particularly those who do not use sketching or other forms of visualization in their day-to-day activities. This finding was also reported by Light (2021, 11) who observed that participants used to creative and critical thinking were more receptive to workshops with a speculation component, compared to more pragmatic ones. Nevertheless, this study shows that repeated engagement in making throughout the FLL-DE gradually leads to a more confident use of visuals.

These two findings, taken together, suggest that design epistemology incorporated in the FLL-DE serves a mediating role between participants, bringing them to a similar position. This result matches that observed in earlier studies (Peukers and Vilsmaier 2021, 6). Similarly, Finn and Wylie (2021, 7) suggest that for the success of similar workshops, participants' openness to unusual processes, creative experiments, and new challenges is more important than their level of expertise and experience with making.

5.5 Identifying and challenging used futures

The second question of this study (RQ2) concerned the anticipatory assumptions about the futures of cities in 2044, possessed by the FLL-DE's participants – six professional designers in the domain of built environment. Three images of the future and underpinning anticipatory assumptions proved to be distinctive.

Perhaps the most striking finding is that the images of the future evidently contain fragments of consumed or used futures – those accepted or borrowed from others (Inayatullah 2008, 5). For example, at least three artifacts representing the probable future of cities are heavily influenced by an image associated with Elon Musk's desirable future, which he is shaping through his companies including Tesla and Neuralink. The desirable future of cities is not noticeably influenced by any particular consumed future; however, several innovations were mentioned as sources of inspiration for the artifacts. Finally, in

the artifact making for the reframed future, it is noteworthy that both teams independently developed the same concept. It may hint that participants might have previously encountered the idea of a similar alternative living arrangement and subconsciously reproduced it during the FLL-DE. For instance, Jackson (2017, 127-129) provides examples of what he calls "intentional communities" in "Prosperity without growth".

I discussed in the introduction how it is important for designers to be critical, and reflect on their own values, assumptions, and social concerns. It is needed to orient oneself in the images of the future created by different holders of power in the polarized world and to avoid their automatic reproduction in their pieces of design (Margolin 2007, 12; Mazé & Wangel 2017, 274, 286). Inayatullah (2008, 6) suggests that developed anticipatory capacity increases an individual's confidence and ability to challenge and break free from used futures.

The findings suggest that *artifact-reading anticipations* can make the fragments of used futures visible and intuitively recognizable. Our images of the future are influenced by many sources and naturally contain some fragments of used futures. Participating in the FLL-DE, I believe, created an occasion for participants to pause, reflect on them, and evaluate their genuine attitude towards them. In this study, the participants demonstrated a motivation to challenge some of the uncovered anticipatory assumptions and contribute to a desirable future by utilizing their power as designers, although these claims should be cautiously interpreted due to their self-reported nature. I interpreted this motivation as a sign of developed anticipatory capability (futures literacy in particular) of participants of this study. This result broadly supports the work of other studies in this area. Finn and Wylie (2021, 9) report clues of the developed imaginative capacity of workshop participants, such as the self-reported discovery of new perspectives on futures regarding their work. Similarly, Light (2021, 6-7) concludes that workshops and experiences that incorporate design knowledge about futures can shed light on the "designed-therefore-designable nature of our world" as a means of developing agency and encouraging creative action.

6 Conclusion

In this study, the aim was to foster a dialogue between the fields of futures and design. It was motivated by two prominent needs within these fields. Firstly, designers, as active creators of our material world, have a need for tools to help them reflect on their beliefs about futures. Secondly, in the field of futures studies, there is a need for new modes of knowing.

This study set out to adapt the method of FLL by incorporating elements from design studies, namely design epistemology, and evaluate a trial execution of the resulting Futures Literacy Lab with Design Epistemology (FLL-DE). It appears to be one of the first attempts to examine the interrelation between design epistemology and anticipation in the context of FLL. The findings provide a deeper understanding of the mutual influence between these two concepts and suggest that there is a potential in utilizing *artifact-reading anticipations* – artifact making coupled with following reflection – for developing anticipatory capabilities, futures literacy in particular, in FLLs. One of the most significant findings to emerge from this study is that the intuitive nature of creating design knowledge potentially allows to access tacit anticipatory assumptions and gives form to them. Doing so allows to critically assess the assumptions, agree or challenge them, and build on them a shared image of the future. Artifact-reading anticipations connect the abstract images of the future with the materiality of everyday life, allowing for emotional engagement that potentially can lead to action, which is at the core of anticipation. The second major finding was that there is a potential for change in design practices and adjustment of designers' "internal compasses" as a result of participation in the FLL-DE. Lastly, the participants of this study have built three distinct images of the future of cities, underpinned by the anticipatory assumptions of designers.

The findings of this study complement those of earlier studies on the integration of art, design, and creative practices in workshops and experiences concerning futures. Although this study rests in the field of futures, the findings may also be of interest in the field of design. The method of FLL-DE used to explore the topic of futures of cities in 2044 may be applied to other subjects of interest to designers.

Avenues for future research include developing and testing a version of the FLL-DE, where CLA layers will provide a structure for the *artifact-reading anticipations* to deepen

the reflection on the anticipatory assumptions. Besides, considerably more work is needed to establish the fitness of the FLL-DE method for various audiences, such as futures professionals, designers from various fields, subject matter experts, and the general public. Questions of the receptiveness of various audiences to the use of design epistemology, as well as the smooth and productive execution of FLL-DE with them remain open.

Disclosure of the use of Artificial Intelligence

In this study, AI-based services and tools were employed as follows: (1) AI-based services Elicit and Litmaps were utilized for searching relevant literature. I do not have information on the integration of AI in the Scopus, Google Scholar, or UTU Volter databases, that were also used for the same purpose. (2) ChatGPT 3.5 was used as a reference source to find synonyms, more accurate terminology, academic vocabulary, and examples of linguistic moves for writing, as well as to improve the readability of some parts of the text. AI-generated suggestions were examined and selectively incorporated into the writing. (3) The AI-based built-in Transcribe function in Microsoft Word was used for transcribing the audio recordings, yet transcripts were then examined and corrected to match the spoken content. (4) Proofreading was done with the built-in Microsoft Word function, as well as the free version of Grammarly, but I do not have information on the integration of AI in these tools.

References

Aceron, A. V. F. (2018). Case 12: Rethinking non-formal education for sustainable futures in Asia-Pacific. In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 205–215. United Kingdom: Routledge.

Aceron, A. V. F. – Cruz, S. (2018). Case 14: Youth leadership and the use of the future. In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 222–229. United Kingdom: Routledge.

Ahvenharju, S. – Minkkinen M. – Lalot, F. (2018) The five dimensions of Futures Consciousness. *Futures : the journal of policy, planning and futures studies*. Vol. 104, 1–13.

Anderson, B. (2007). Hope for nanotechnology: anticipatory knowledge and the governance of affect. *Area (London 1969)*, Vol. 39 (2), 156–165.

Appadurai A. (2004) The Capacity to Aspire: Culture and the Terms of Recognition. In: *Culture and Public Action*, ed. by Walton, M. – Rao, V., 59-84. World Bank Publications, Stanford.

Aranda Muñoz, Á. – Bozic Yams, N. – Carlgren, L. (2023). Co-designing Technological Explorations in Developing Futures Literacy Through Speculative Design and an Artistic Intervention. *Proc. Des. Soc*, Vol. 3, 957–966.

Auger, J. – Hanna, J. (2019). How the Future Happens. *Journal of Futures Studies*. Vol. 23, 93-98.

Balcom Raleigh, N. (2020) 'Demystifying futures literacy, a key skill for climate innovation', FLxDeep, December 31. <https://medium.com/flxdeep/demystifying-futures-literacy-a-key-skill-for-climate-innovation-4cf868a63e93>, retrieved 20.11.2023.

Barron, N.J.P. (2021). Ernst Bloch's ontology of not-yet being. In: *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*, ed. by Brassett, J. – O'Reilly, J., 79-97, Abingdon, Oxon; New York, NY: Routledge.

Bell, W. – Mau, J. A. (1971). *Sociology of the Future Theory, Cases and Annotated Bibliography*. New York: Russell Sage Foundation.

Bello, P. (2010) *Goodscapes : global design processes*. Helsinki: University of Art and Design Helsinki.

Bengston, D. N. (2018). Principles for Thinking about the Future and Foresight Education. *World Futures Review*, Vol. 10 (3), 193-202.

Bergheim, S. (2022). *On the Evaluation of Futures Literacy Laboratories*. <https://zgf-fortschritt.de/media/pages/methodik/zukuenftelabore/1356567106-1666609565/bergheim-2022-evaluationof-flls.pdf>, retrieved 19.01.2024.

Bergheim, S. (2023). *Patterns of Anticipatory Assumptions*. <https://www.researchgate.net/publication/376448424_Patterns_of_Anticipatory_Assumptions>, retrieved 19.01.2024.

Bleeker, J. (2009). *Design Fiction : A short essay on design, science, fact and fiction*. <https://systemsorienteddesign.net/wp-content/uploads/2011/01/DesignFiction_WebEdition.pdf>, retrieved 30.05.2024.

Boer, A. – Wiekens, C. – Damhof, L. (2018). How futures literate are you?: exploratory research on how to operationalize and measure futures literacy. In: *6th International Conference on Future-Oriented Technology*. Brussels, Belgium, June 4-5, 2018.

Bosch, T. (2012). 'Sci-Fi Writer Bruce Sterling Explains the Intriguing New Concept of Design Fiction'. Slate, 2 March. <https://slate.com/technology/2012/03/bruce-sterling-on-design-fictions.html>, retrieved 30.05.2024.

Brassett, J. (2021). For a creative ontology of the future. In: *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*, ed. by Brassett, J. – O'Reilly, J., 152-181, Abingdon, Oxon; New York, NY: Routledge.

Brassett, J. – O'Reilly, J. (eds.) (2021a). *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*. Abingdon, Oxon; New York, NY: Routledge.

Brassett, J. – O'Reilly, J. (2021b) Introduction to a creative philosophy of anticipation. In: *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*, ed. by Brassett, J. – O'Reilly, J., 1-23, Abingdon, Oxon; New York, NY: Routledge.

Bürdek, B. E. (2015). *Design : history, theory and practice of product design (Second revised edition.)*. Basel, Switzerland: Birkhäuser.

Candy, S. (2018). Gaming Futures Literacy: The Thing from the Future. In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 233–246. United Kingdom: Routledge.

Candy, S. – Kornet, K. (2019). Turning Foresight Inside Out: An Introduction to Ethnographic Experiential Futures. *Journal of Futures Studies*, Vol. 23 (3), 3-22.

Candy, S. – Potter, C. (2019). Introduction to the special issue: Design and futures (Vol. I). *Journal of Futures Studies*, Vol. 23,1-2.

Celaschi, F. – Celi, M. (2015) Advanced design as reframing practice: Ethical challenges and anticipation in design issues. *Futures : the journal of policy, planning and futures studies*. Vol. 71, 159–167.

Chapman, M. V. – Wu, S. – Zhu, M. (2017). What is a picture worth? A primer for coding and interpreting photographic data. *Qualitative Social Work : QSW* : Research and Practice, Vol. 16 (6), 810–824.

Chen, H.T. (2012) Theory-driven evaluation: Conceptual framework, application and advancement. In: *Evaluation von Programmen und Projekten für eine Demokratische Kultur*, ed. by Strobl, R. – Lobermeier, O., 17–40. Springer VS Wiesbaden.

Comi, A. – Whyte, J. (2018) Future Making and Visual Artefacts: An Ethnographic Study of a Design Project. *Organization studies*. Vol. 39 (8), 1055–1083.

Cross, N. (2006) *Designerly Ways of Knowing*. London: Springer Verlag London Limited.

Dator, J. (2009). Alternative Futures at the Manoa School. *Journal of Futures Studies*, Vol. 14 (2), 1-18.

Derbyshire, J. (2016). The implications, challenges and benefits of a complexity-orientated Futures Studies. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 77, 45–55.

Designmuseo What if? Alternative futures (n.d.). Designmuseo. <https://www.designmuseum.fi/en/exhibitions/what-if-alternative-futures/>, retrieved 28.05.2024.

Donoghue, M. (2021). Anticipation, creativity and picture perception. In: *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*, ed. by Brassett, J. – O'Reilly, J., 24-53, Abingdon, Oxon; New York, NY: Routledge.

Dunne, A. – Raby, F. (2013) *Speculative everything : design, fiction, and social dreaming*. Cambridge, Mass: MIT P.

Ehresmann, A. – Tuomi, I. – Miller, R. – Béjean, M. – Vanbremeersch, J.-P. (2018). Towards a formal framework for describing collective intelligence knowledge creation processes that 'use-the-future.' In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 66–91. United Kingdom: Routledge.

Examples of Design Fiction (n.d.). Julian Bleeker. <https://julianbleecker.com/designfiction>, retrieved 30.05.2024.

Facer, K. – Sriprakash, A. (2021) Provincialising Futures Literacy: A caution against codification. *Futures : the journal of policy, planning and futures studies*. Vol. 133, 102807-.

Finn, E. – Wylie, R. (2021). Collaborative imagination: A methodological approach. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 132, 102788-.

Fleming, E. M. (1974). Artifact Study: A Proposed Model. *Winterthur Portfolio*, Vol 9, 153–173.

Fu, Z. – Xia, Q. (in press). Design Foresight: A Design Approach that Marries the Futurization and De-Futurization. *Journal of Futures Studies*, <https://jfsdigital.org/design-foresight-a-design-approach-that-marries-the-futurization-and-de-futurization/>, retrieved 30.05.2024.

Geden, M. – Smith, A. – Campbell, J. – Spain, R. – Amos-Binks, A. – Mott, B. – Jing, F. – Lester, J. (2019) Construction and Validation of an Anticipatory Thinking Assessment. *Frontiers in psychology*. Vol. 10, 2749–2749.

Gidley, J. M. (2017). *The future : a very short introduction*. Oxford: Oxford University Press.

Godhe, M. – Goode, L. (2018). Critical future studies - A thematic introduction. *Culture Unbound*, Vol. 10 (2), 151–162.

Hupkes, T. – Hedman, A. (2022). Shifting towards non-anthropocentrism: In dialogue with speculative design futures. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 140, 102950-.

Inayatullah, S. (1998). Causal layered analysis: Poststructuralism as method. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 30 (8), 815–829.

Inayatullah, S. (2008). Six pillars: futures thinking for transforming. *Foresight (Cambridge)*, Vol. 10 (1), 4–21.

Isley, C. – Rider, T. (2018) Research-Through-Design: Exploring a design-based research paradigm through its ontology, epistemology, and methodolog[1]. In: *Design as a catalyst for change - DRS International Conference 2018*, ed. by C. Storni – K. Leahy – M. McMahon – P. Lloyd – E. Bohemia. Limerick, Ireland, June 25-28, 2018.

---

[1] sic

Jackson, T. (2017). *Prosperity without growth : foundations for the economy of tomorrow* (2nd edition.). London: Routledge.

Jennische, U. – Sörbom, A. (2023) Governing anticipation: UNESCO making humankind futures literate. *Journal of organizational ethnography*. Vol. 12 (1), 105–119.

Karlsen, J. E. (2021). Futures literacy in the loop. *European Journal of Futures Research*, Vol. 9 (1), 1–10.

Ketonen-Oksi, S., – Vigren, M. (2024). Methods to imagine transformative futures. An integrative literature review. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 157, 103341-.

Kim, B. – Tan, L. (2022) Design Thinking the Future: Critical Perspectives on Design Studies, Design Knowledge, and Education. In: *Design Praxiology and Phenomenology*, ed. by Tan, L. – Kim, B., 3-15. Springer, Singapore.

Kimbell, L. (2021). Inventive devices and public issues. In: *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*, ed. by Brassett, J. – O'Reilly, J., 182-206, Abingdon, Oxon; New York, NY: Routledge.

Klein G. – Snowden D. – Lock Pin C. (2010) Anticipatory Thinking. In: *Informed by Knowledge : Expert Performance in Complex Situations*, ed. by Mosier, K.L – Fischer, U.M. Taylor & Francis Group, Hove.

Lathorp A. (2023) 'Introducing the Archive of Punk Technologies', September 16. <https://medium.com/@annaharrisonlathrop/introducing-the-archive-of-punk-technologies-5707e166e01d>, retrieved 17.11.2023.

Lawson, B. (2005). *How Designers Think* (4th ed.). Oxford: Routledge.

Light, A. (2021). Collaborative speculation: Anticipation, inclusion and designing counterfactual futures for appropriation. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 134, 102855-.

Louie, A. H. (2010). Robert Rosen's anticipatory systems. *Foresight (Cambridge)*, Vol. 12 (3), 18–29.

Lugt, R. van der (2005). How sketching can affect the idea generation process in design group meetings. *Design Studies*, Vol. 26 (2), 101–122.

Mangnus, A. C. – Oomen, J. – Vervoort, J. M. – Hajer, M. A. (2021) Futures literacy and the diversity of the future. *Futures : the journal of policy, planning and futures studies*. Vol. 132, 102793-.

Margolin, V. (2007). Design, the Future and the Human Spirit. *Design Issues*, Vol. 23 (3), 4–15.

Masini, E. (1993). *Why futures studies?* London: Grey Seal.

Mazé, R. – Wangel, J. (2017). Future (Im)Perfect: Exploring time, becoming and difference in design and futures studies. In: *Feminist Futures of Spatial Practice*, ed. by Schalk, M. – Kristiansson, T. – Mazé, R.,273-286. Baunach, DE: Spurbuchverlag.

Mazé, R. (2019). Politics of Designing Visions of the Future. *Journal of Futures Studies*, Vol. 23 (3), 23-37.

McDonough, W. (2003) *Toward a 21st Century Renaissance*. <https://mcdonough.com/writings/toward-21st-century-renaissance/>, retrieved 06.06.2024.

Menken, S. – Keestra, M. (eds.) (2016). *An Introduction to Interdisciplinary Research: Theory and Practice*. Netherlands: Amsterdam University Press.

Miettinen, R. – Virkkunen, J. (2005). Epistemic Objects, Artefacts and Organizational Change. *Organization (London, England)*, Vol. 12 (3), 437–456.

Miller, R. (2007). Futures literacy: A hybrid strategic scenario method. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol.39 (4), 341–362.

Miller, R. (2018a). Futures Literacy Laboratories (FLL) in practice: An overview of key design and implementation issues. In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 95–109. United Kingdom: Routledge.

Miller, R. (2018b). Introduction: Futures Literacy: transforming the future. In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 1-12. United Kingdom: Routledge.

Miller, R. (2018c). Sensing and making-sense of Futures Literacy: towards a Futures Literacy Framework (FLF). In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 15-50. United Kingdom: Routledge.

Miller, R. (2023, Preprint) Liberating the Human Imagination: Futures Literacy and the Diversification of Anticipation [Preprint]. ResearchGate. <https://www.researchgate.net/publication/375273888_Liberating_the_Human_Imagination_Futures_Literacy_and_the_Diversification_of_Anticipation_Riel_Miller>, retrieved 25.11.2023.

Miller, R. – Poli, R. – Rossel, P. (2018). The Discipline of Anticipation: foundations for Futures Literacy. In: *Transforming the Future: Anticipation in the 21st Century*, ed. by Miller, R., 51-65. United Kingdom: Routledge.

Minkkinen, M. (2020). Theories in Futures Studies: Examining the Theory Base of the Futures Field in Light of Survey Results. *World Futures Review*, Vol. 12 (1), 12–25.

Nadin, M. (2012). What is Anticipation and What is Not? Comment on Nauts, Metzmacher, Verwijmeren, Rommeswinkel, and Karremans (2011). *Archives of Sexual Behavior*, Vol. 41 (4), 753–753.

Ollenburg, S. (2018). Beyond Futures: Designing Futures by Educating Future Designers. *World Futures Review*, Vol. 10 (4), 279–293.

O'Reilly, J. (2021). Becoming other-wise as the practice of anticipation. In: *A Creative Philosophy of Anticipation: Futures in the Gaps of the Present*, ed. by Brassett, J. – O'Reilly, J., 114-151, Abingdon, Oxon; New York, NY: Routledge.

Ottaviani, M. – Sørensen, P. N. (2006). Professional advice. *Journal of Economic Theory*, Vol. 126 (1), 120–142.

Pelzer, P. – Versteeg, W. (2019). Imagination for change: The Post-Fossil City Contest. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 108, 12–26.

Peukert, D. – Vilsmaier, U. (2021). Collaborative design prototyping in transdisciplinary research: An approach to heterogeneity and unknowns. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 132, 102808-.

Pinto, J. P. – Ramírez-Angulo, P. J. – Crissien, T. J. – Bonett-Balza, K. (2021). The creation of dystopias as an alternative for imagining and materializing a university of the future. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 134, 102832-.

Poli, R. (2010a). An introduction to the ontology of anticipation. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 42 (7), 769–776.

Poli, R. (2010b). The many aspects of anticipation. *Foresight (Cambridge)*, Vol. 12 (3), 7–17.

Poli, R. (2015). The implicit future orientation of the capability approach. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 71, 105–113.

Pouru-Mikkola, L. – Wilenius, M. (2021). Building individual futures capacity through transformative futures learning. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 132, 102804-.

Preston, B. (no date), Artifact. In: The Stanford Encyclopedia of Philosophy (Winter 2022 Edition), ed. by Zalta, E.N. – Nodelman, U.

<https://plato.stanford.edu/archives/win2022/entries/artifact/>, retrieved 16.02.2024.

Renmans, D. – Holvoet, N. – Criel, B. (2017). Combining theory-driven evaluation and causal loop diagramming for opening the 'black box' of an intervention in the health sector: A case of performance-based financing in Western Uganda. *International Journal of Environmental Research and Public Health*, Vol. 14 (9), 1007-.

Saldaña, J. (2013) *The Coding Manual for Qualitative Researchers* (2nd ed.). London: Sage.

School Of International Futures (SOIF) (2023) 'Unlocking the Power of Futures: Insights from Riel Miller', 11 July. <https://soifutures.medium.com/unlocking-the-power-of-futures-insights-from-riel-miller-4fc60446969d>, retrieved 19.02.2024.

Seginer, R. (2008) Future orientation in times of threat and challenge: How resilient adolescents construct their future. *International journal of behavioral development*. Vol. 32 (4), 272–282.

Smith, L. (2021). 'All designers are futurists: Why Bruce Mau still believes design can change the world'. Fast Company, 18 March. <https://www.fastcompany.com/90616159/all-designers-are-futurists-why-bruce-mau-still-believes-design-can-change-the-world>, retrieved 28.05.2024.

Spaniol, M. J. – Rowland, N. J. (2018) The scenario planning paradox. *Futures : the journal of policy, planning and futures studies*. Vol. 95, 33–43.

Sterling, B. (2005). *Shaping things*. Cambridge, Mass: MIT Press.

Taffel, S. (2018). Hopeful Extinctions? Tesla, Technological Solutionism and the Anthropocene. *Culture Unbound*, Vol. 10 (2), 163–184.

Tervo, A. (2021). *Domestic space for solo living : changing patterns in the Helsinki metropolitan area, Finland*. Helsinki: Aalto University.

Thoring, K. – Mueller, R. M. – Desmet P. – Badke-Shaub, P. (2022). Toward a Unified Model of Design Knowledge. *Design issues*. Vol.38 (2), 17–32.

Tracy, S. J. (2010). Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry*, Vol. 16 (10), 837–851.

Transcribe your recordings. (No date). Microsoft. <https://support.microsoft.com/en-us/office/transcribe-your-recordings-7fc2efec-245e-45f0-b053-2a97531ecf57#:~:text=Your%20audio%20files%20are%20sent,not%20stored%20by%20our%20service>, retrieved 11.06.2024.

Trinh, M. P. (2019). Overcoming the Shadow of Expertise: How Humility and Learning Goal Orientation Help Knowledge Leaders Become More Flexible. *Frontiers in Psychology*, Vol. 10, 2505–2505.

United Nations Educational, Scientific, and Cultural Organization (UNESCO) – Prince Mohammad Bin Fahd University (PMU) (2023, June). *Futures Literacy Laboratory Playbook*. <https://unesdoc.unesco.org/ark:/48223/pf0000385485>, retrieved 21.01.2024.

Verstijnen, I. – Leeuwen, C. van – Goldschmidt, G. – Hamel, R. – Hennessey, J. (1998). Sketching and creative discovery. *Design Studies*, Vol. 19 (4), 519–546.

Voegele, J. – Pattermann, J. – Bierwisch A. – Som, O. (14 June 2023) 'Tracing the DNA of the Futures Literacy Concept: Bibliometric Insight on its Evolution, Potentials, and Future Research Avenues' [unpublished conference presentation], 23rd Futures Conference, Turku, Finland.

Volder, M. L., de – Lens, W. (1982). Academic achievement and future time perspective as a cognitive-motivational concept. *Journal of Personality and Social Psychology*, Vol. 42 (3), 566–571.

Weber, S. (2008). Chapter 4: Visual Images in Research. In: *Handbook of the Arts in Qualitative Research: Perspectives, Methodologies, Examples, and Issues*, ed. by Knowles, J. G. – Cole, A. L., 41-53. Los Angeles, CA: Sage Publications.

Weiss, C. H. (2000). Which links in which theories shall we evaluate? *New Directions for Evaluation*, Vol. 2000 (87), 35–45.

Wooten, D. B. – Reed, A. (2000). A Conceptual Overview of the Self-Presentational Concerns and Response Tendencies of Focus Group Participants. *Journal of Consumer Psychology*, Vol. 9 (3), 141–153.

Zamenopoulos, T. – Alexiou, K. (2020). Collective design anticipation. *Futures : The Journal of Policy, Planning and Futures Studies*, Vol. 120, 102563-.

Zimmerman, J. – Forlizzi, J. (2008) The Role of Design Artifacts in Design Theory Construction. *Artifact (London, England)*. Vol. 2 (1), 41–45.

Appendices

Appendix 1. Facilitation guide (provided with omissions)

1. Introduction	15 min (15 min)

- Introduction: […]
- Introducing topic and method: […]
- Agenda: […]
- Rules and disclaimers: […]

2. Ice Breaker	5 min (20 min)

- So, let's prepare for our mental time travel! But before we visit the future – year 2044 – let us quickly recall the past of cities. Let's think about cities in year 2004!
    - Please turn to your neighbour(s) and discuss for 2-3 minutes, how was urban life back then? Is there anything that seems very old-school and amusing when you look back?
    - So, what do you think overall? Were cities in 2004 the same as we have them today, or different? *1-2 answers*
- This is a simple, but important observation! Let's keep in mind that a lot can change in 20 years (although some things stay familiar). We might feel like cities have already settled into their future "form", but the change keeps on going. So, let's travel into the future of cities and explore what might come 20 years from now.

3. Reveal: Probable futures	40 min (1 h 00 min)

- Let's start our mental travel to the future. I will ask you to close your eyes and take a few deep breaths at your own pace. With each inhale, take note of the sounds in the room around you. With each exhale, let go of any thoughts or worries you might have from this morning, yesterday, the weekend... when you hear the clap of my hands, we will all open our eyes, and we will have landed in 2044. *Facilitator claps hands*
- Welcome to 2044! We have arrived to **the probable future of cities**! Now, we'll start exploring this probable future together. Thinking about the probable future, means thinking about the most realistic future you can think of, the one that is most likely to happen. But the way things are now, in the future we're in, is still very different from how they were in 2024. Again, I want to remind you that this is our first time in the year 2044, and we're exploring it together. So, there are no right or wrong answers because it's all new to us!

Making (~7 min)
- I will ask you to design and sketch 1 object that belongs to this probable future. Each of you will get 2 cards that will guide your process:
    - o Object card describes the basic form of your artifact.
    - o Theme cards describe contexts, places, and topic areas. It describes where – physically or conceptually – the object is found. *Participants take cards*
- You will have 5 minutes to make your sketch. Include a verbal description or a legend to your drawing.

Reflection (~25 min)
After 5 minutes place the drawings on the wall. Each participant presents their artifact, without explaining why it exists in this future (1 minute/each)

Now let's go deeper in the probable future that we have all thought about. I want us to reflect on what these artifacts tell us about the world in which they exist.
- What are some common themes you see in the artifacts? What do they tell us about this probable future? What makes you say so?
- What actions or behaviors do these objects encourage or stop? Who can use them and who can't?
- What makes it possible for these things to exist? What rules, systems support them?
- What's important in this future? What do people care about?
- Did you incorporate any particular trends or sources of inspiration while you were making these artifacts?
- How do your own experiences and background contribute to what you have imagined? […]

4. Reveal: Desirable futures	30 min (1 h 30 min)

- Here, we dive into another mental time travel. We are still in the year 2044, but now I'm asking you to imagine a desirable future of cities. Your desirable future is the most ideal future. It is incredible, it is awesome in this 2044. It could be desirable for you, for your close community, for society – any level you choose. But focus on the aspect of desirability, on your hopes and dreams. It doesn't have to be realistic.

Making (~5 min)
- This time you can draw a new prompt or use the same prompt and change your artifacts so that they represent a desirable future. Please draw again on a blank page, and again include a legend or commentary. You will have 5 minutes to make it.

Reflection (~25 min)
- Let us again have a look at our artifacts together. *Participants introduce their artifacts with an emphasis on what changed (about 1 minute/each)*.
- Now I want us again to reflect on what these artifacts tell us about the desirable world in which they exist.
  […]

5. Break	20 min (1 h 50 min)

6. Reframe: Introducing the Reframed future	20 min (2 h 10 min)

Immersion to the Reframed future (~10 min)
- Before the break we have explored our Probable and Desirable futures of cities in 2044. Both are informed by our experiences, what we have seen and known, and our reactions to it. We are now traveling to the Reframed future, which is going to be very different. It is a kind of future that maybe we have not really thought about before. It asks us to be creative, open, and to invent new assumptions. It is meant to feel confusing, and you might even get stuck. That is all ok – we'll try to work through it as a group.
- We will work in groups/pairs during this phase, so, now is a time to divide.

  Facilitator distributes the 'letters from the future', give participants a minute to read the scenario, then reads aloud
- Welcome to the Reframed future of cities in 2044! What are your first impressions about this Reframed future? What is something that makes you feel excited about this future? What is something that makes you feel worried about this future?

Harvesting assumptions (~10 min)

- Remember how we were discussing our hidden assumptions or beliefs about the probable and desirable futures when we were analyzing our artifacts? Now we'll do the same, but in reverse order. Before we can create something for the Reframed future, we should build a more detailed image of it. I'm asking you to make as many assumptions about this future, as you can. Please discuss and write down on post-its your assumptions in groups.
  - *Facilitator shows a slide with guiding questions or groups of possible assumptions*
  - *If any participant remains resistant or skeptical, ask the person to lean into or play the role of the resistance forces in this future: what are they fighting against (actors, norms, behaviors etc)?*
- Each group – please share one or two most important assumptions that you have written?

7. Reframe: designing for a reframed future	50 min (3 h 00 min)

Making (~20 min)
- Now in your groups you will have 20 min to design something related to cities in this future, based on your assumptions about it. This time you can create one object, a group of objects, a system, a service, or touchpoints in the customer journey – it is up to you. I will ask you to include images and legends/written commentary, as we did previously. When you are done, you'll share your ideas with others and tell us how you used your assumption in your design. Also, you can change assumptions if you feel like it.

Presentations (~20 min)
Groups present results of their work to others, facilitator probe on assumptions and how they influenced the artifacts, other groups can ask additional questions and comment. Allow around 5 min per team, time allocation to making/presentation can vary depending on the number of groups.

8. Reflect + Next Steps	30 min (3 h 30 min)

New questions (~10 min)
- We are now back in 2024. We have explored different futures in this lab, and now let's take a moment to reflect on our journey together.
- Let's compare our Probable Futures and Reframed futures:
  - What is the same and different between the two futures? How the artifacts show these futures?
  - Did our session raise more questions about the future of cities for you?
  - Are there elements you thought would stay the same in the future, but now you're not so sure about?
  - […]

Role of making (~10 min)
- Now I'm asking you to reflect on the making/drawing process itself:
  - In your opinion, what role it played in our lab today?
  - Did you discover anything interesting or unexpected while making artifacts? Or when you looked at what others made?
  - Were there any challenges or things that didn't work well?
  - If you were to explain to someone outside the design field what happened today, what would you say?

Next steps (~5 min)
- What are the most important things you learned today ? How can you, your team and organization use these learnings?

Wrapping up (~5 min)
[…]

Appendix 2. Cards used for generating creative prompts in the FLL-DE: Futures of cities 2044

The cards were adapted from Candy (2018) to suit the topic of the FLL-DE.

Thing cards:

In this future there is an	In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a
APP	BOTTLE	BOX	BUILDING	KIT	KIOSK	MACHINE	MAP

In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a	In this future there is a
CLOTHING	DEVICE	DOCUMENT	FURNITURE	MASK	MONUMENT	STICKER	TOOL or TOOLKIT

In this future there is a	In this future there is a	In this future there is a	In this future there is a
VEHICLE	PUBLIC SPACE	SENSOR	SIGN

Theme cards:

related to	related to	related to	related to	related to	related to	related to	related to
CHILDHOOD	123	CONNECTIVITY	CARE	GENDER	GREEN SPACES	HEALTH	HOME
What is it?	What is it?	What is it?	What is it?	What is it?	What is it?	What is it?	What is it?

related to	related to	related to	related to	related to	related to	related to	related to
ECONOMY	EMOTIONS	ELDERLY	FOOD SYSTEMS	IDENTITY	LEISURE	MEMORY	MOBILITY
What is it?	What is it?	What is it?	What is it?	What is it?	What is it?	What is it?	What is it?

related to	related to	related to	related to	related to	related to
PRIVACY	SHOPPING	TRAVEL	WATER	WORK	WASTE
What is it?	What is it?	What is it?	What is it?	What is it?	What is it?