

# Experiencing socio-technical futures:

*Augmenting the anticipatory facet of (e)CTA with  
experiential futures methods*

A Master Thesis

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## **Summary**

Soft impacts are impacts of technologies that are characterized by unsettled moral status, unquantifiability and unclear causes. Ethical-constructive technology assessment (eCTA), as presented by Kiran et al. (2015), aims to anticipate soft impacts by way of imagination and scenarios. Also the constructive technology assessment (CTA) which eCTA is based upon relies roughly on same methods but does not focus on micro-level dynamics like eCTA. Such methods, as this thesis argues, lack in context-awareness. Drawing on user studies literature and applying postphenomenological arguments, it calls for including both potential stakeholders and artefactual representations in soft impact anticipation processes to increase their sensitivity to context. Subsequently, it identifies experiential futures methods (EFMs) as capable of granting these two wishes in a temporal niche suitable for anticipation. The thesis then proceeds to examine and illustrate the epistemic benefits of combining eCTA and EFMs and more specifically, through two hypothetical examples, how combining eCTA methodology with EFMs can help enrich propositions regarding future soft impacts.

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# 1. Introduction

In the context of technology assessment (TA), increasing attention is being paid to *soft impacts* of technologies (Swierstra and te Molder, 2012; Kiran et al. 2015). Soft impacts are impacts of technologies that have not reached a moral stability, are not easily quantifiable and whose causal relations are not easily identifiable (Swierstra and te Molder, 2012). Despite the earlier neglect of soft impacts in risk assessment work, they deserve attention because they change practices and worldviews (Kiran et al. 2015) in relation to issues as diverse and sombre as friendship, conformism and dehumanization. Thus, attending them in design is a way of improving technologies (Swierstra and te Molder, 2012) and improving technologies can be seen a way to improve society.

Anticipatory activities are a staple of current technology assessment (TA) approaches. Basing their work on postphenomenology and mediation theory, Kiran et al. (2015) have proposed a specific methodology to anticipate soft impacts of new and emerging science and technologies (NESTs) within their TA approach, the ethical-constructive technology assessment (eCTA). Methodologically, the anticipatory facet of eCTA as represented in Kiran et al. (2015, 11) is based on imagination supported by mediation theory and potentially scenarios and thus, this thesis will argue, does not operate in full accordance with postphenomenological principles that are its theoretical starting point: a nuanced and *realistic* understanding of human-technology relations with emphasis on empirical analysis. To address this deficiency, this thesis will propose augmenting eCTA with emerging experiential futures methods. In practice, this combination will entail 'bringing (potential) futures into the present' through tangible design elements as opposed to resorting merely to the imagination or scenarios (as proposed by eCTA, Kiran et al. [2015, 11]).

Accordingly, the main research question of the thesis is the following: *How can experiential futures methods epistemically enrich propositions regarding future soft impacts produced by eCTA methodology?* An array of subquestions structure the thesis: The first chapter (2) will answer the question of how soft impacts are currently anticipated within eCTA and related scholarship. Separate sections within it will address what soft impacts are (2.1.) as well as what eCTA is along with its related approaches like CTA, constructive technology assessment, and what are the methods eCTA, along with its related approaches, applies in anticipating soft impacts (2.2.). As these two approaches, eCTA and CTA, significantly overlap, sometimes the combination of them is referred to as “(e)CTA” in this thesis.

The second chapter (3) will seek answers to the question of how methodological

deficiencies of eCTA regarding context-sensitivity can be remedied. The first section (3.1.) will start off by highlighting eCTA's methodological deficiencies with regard to contextual sensitivity and move on to proposing a preliminary way to address it: involving potential stakeholders and avoiding excess methodical reliance on historical information regarding *similar* cases and NESTs of concern as the one at hand during anticipatory processes. The second section (3.2.) will further develop the contextual emphasis relying on postphenomenological understanding on how humans and technologies together make up the meanings of technologies in contexts (Verbeek 2005, 117) by proposing to add into TA processes a representation of the NEST to be interacted with. The final section (3.3.) will answer the question of how the a posteriori work called for in the two previous sections can still be anticipatory.

The final chapter (4) will answer the question of to how experiential futures methods (EFMs) can provide epistemic assistance for (e)CTA in crafting propositions regarding future soft impacts. Section 4.1. will introduce EFMs in their own context. Section 4.2., on the other hand, will seek to answer how they align with both the theoretical aims of (e)CTA and the conditions for more context-sensitive soft impact anticipation outlined in chapter 3. Using two hypothetical case studies, section 4.3. will expose what types of epistemic benefits EFMs can bring when combined with (e)CTA in terms of crafting propositions regarding future soft impacts. The section will also chart appropriate application contexts and deficiencies of such a methodological combination.

The societal relevance of this thesis is straight forward: As technologies and society co-evolve, it is important to understand what type of emerging technologies should be pursued and in what form. In this task, anticipation is a relevant practice since anticipating can facilitate understanding about how different actors relate to NESTs and deliberation on how they can as well as ought to do it. The future thus becomes a “resource to modulate the directions and outcomes of science and technology” (Konrad et al. 2017, 479). In many contexts, for it to be a maximally useful resource, a degree of plausibility for the propositions regarding future dynamics (such as soft impacts) should be established. As philosopher of technology, Nordmann (2013, 126) states, some propositions regarding future dynamics deserve more attention than others. Which ones do, is largely a question of anticipation methodology. This is why this thesis focuses on anticipation methodology.

Even if the issues discussed in this thesis can also have clear societal implications regarding citizen participation in futures work and democratization of technological development, an in depth analysis on such issues largely fall outside the scope of this thesis.

Neither will this thesis tackle meta-ethics or ethical methodology per se, despite discussing eCTA. Rather, it focuses on the epistemological (and phenomenological) basis upon which ethical deliberation relies and the epistemic, anticipatory facet of eCTA more specifically. In other words, the thesis does not aim to provide a normative basis for evaluating technologies but to question and enhance existing (ways of providing) epistemological building blocks or methodologies for doing so: The thesis is a critique of the (e)CTA methodology of anticipating soft impacts and a suggestion as to how it could be improved in order to produce more plausible propositions regarding them.

In doing so, this thesis will rely on literature from a host of domains such as philosophy of technology, futures studies, science and technology studies (STS) and design research. First, when identifying deficiencies in (e)CTA, it will refer primarily to literature from user studies and sociology of expectations as well as postphenomenological staples to highlight the importance of context-awareness in anticipation of NESTs. In conjuring possible remedies for the identified deficiencies, it draws from philosophy (and more specifically, ethics) of technology literature concerning anticipation methods as well as formative texts on technology assessment (TA) methodology to provide signposts for its own path in trying to combine EFMs and (e)CTA. EFMs are an emergent practice in the confluence of futures studies and design research. Thus, the path taken by this thesis will be lined with references to those two domains. While proposing the methodological solution of its own, the postphenomenological standpoint of this thesis will be visible in its belief in technologies' power to spark insight and facilitate political and moral discussions as well as in the belief in that philosophy should be done empirically. To complement empirical philosophy methodologically, this thesis espouses tried and tested, hands-on social science and STS methods of empirical inquiry. Accordingly, the methodology proposed in this thesis to anticipate future soft impacts largely relies on them: The idea is to build an arena to facilitate small-scale socio-technical dynamics as enacted by humans and artifacts (or more specifically, potential stakeholders and representations of the NESTs of interest), in order to subsequently analyze them through the methodological lens of STS and social sciences more broadly, while also utilizing postphenomenological frameworks to structure data. The conclusions from such exercises can then be translated into empirically informed propositions regarding future soft impacts. Even though the merits of elaborate empirical inquiry on soft impacts will hopefully become clear through this thesis, time and resource constraints have led this project to focus on theoretical work and building the methodological scaffolding needed to conduct further empirical research.

## 2. Identifying the (e)CTA approach to anticipation of soft impacts

To answer the main research question of this thesis one has to understand what is meant by technologies' soft impacts and the ethical-constructive technology assessment (eCTA) methodology. This chapter will set the context for the thesis by presenting the notion of soft impacts in the section 2.1. and by examining the ethical-constructive technology assessment (eCTA) that aims to anticipate soft impacts along with related approaches in section 2.2.

### 2.1. Understanding soft impacts

It is appropriate to start this thesis by outlining notions of soft impacts expressed in technology assessment and other literature to identify and understand the need for methodological solutions specifically equipped to anticipate them. While soft impacts have been discussed by multiple authors such as van der Burg (2009) in the context of scientific research and Boenink et al. (2010) in the context of anticipation of technomoral dynamics as well as more implicitly by a host of science and technology studies (STS) scholars (see e.g. Turkle, 2010), a particularly comprehensive and formative definitional work from a technology assessment (TA) perspective is carried out by Swierstra and Molder (2012).

In the past, assessment of the desirability of new and emerging science and technologies (henceforth *NESTs*) has tended to focus on potential risks (Swierstra and te Molder, 2012). Unlike philosopher of technology Verbeek (2005, 99-100) who focuses on classical philosophers of technology as the culprits for painting a baselessly pessimistic and risk-oriented picture of technology, Swierstra and te Molder (2012, 1050) trace this bias towards risks back to the increasing awareness of the potential unintended *and* undesirable effects of technologies in the 1950s and the development of risk assessment practices to address them beforehand. However, also Swierstra and te Molder (1051) note how classical philosophers of technology such as Heidegger and Ellul emphasize the effects of technologies to cultural, political and moral life (aspects whose importance also Verbeek recognizes (2005, 100)) and pursue this focus of classical philosophers of technology as a key aspect of what characterizes soft impacts. As opposed to risk-assessment practices with a narrow focus on safety, health and to a smaller extent environmental issues, classical philosophers of technology emphasize such things as “[e]stablished meanings, world and life views[, e]xisting values, norms and



conceptions of the good life [or t]he (global) distribution of power and control” (Swierstra and te Molder 2012, 1051). Similar themes have inspired the concept of soft impacts.

Swierstra and te Molder (2012) do not only characterize TA practices as having had unwarranted bias towards the “adverse effects” of technologies and the risks they entail but also claim that specific kinds of impacts that they describe as *hard impacts* have garnered disproportionate attention. They characterize this hardness as being associated with objectivity, rationality and factuality (1050) and have constructed a three-dimensional framework to demonstrate how soft impacts differ from hard impacts. They label the dimensions *valuation*, *quantifiability* and *causality* (1058-1061). The first dimension, *valuation*, refers to how impacts are evaluated morally. Whereas hard impacts concern widely agreed upon notions of harmfulness, soft impacts concern effects whose desirability is more disputed (1059). The case of a nuclear disaster can exemplify hard impacts since only few would dispute that a nuclear disaster is a 'bad thing' (1059). In contrast, Swierstra and te Molder (1059), refer to Turkle's (2010) question of whether the internet affects friendships positively or negatively, to exemplify the kinds of unsettled questions that soft impacts concern. Insofar as no (physical) harm can be demonstrated, technologies' impacts cannot enter the debate agendas in liberal democracies easily (1059). As its name implies, the second dimension, *quantifiability*, concerns the degree to which different impacts can be quantified. Hard impacts are characterized by how they easily lend themselves to quantification, making them more regarded within assessment practices. Again, Swierstra and te Molder (1060) use the example of a nuclear disaster to show how both its probability and human casualties are easily quantifiable. Soft impacts are far less prone to precise quantifying. For instance, it would be difficult to calculate the probability or the extent of someone's dehumanization by way of a particular technology. Swierstra and te Molder suspect a general tendency within technology policy discussions: Qualitative sciences are considered as 'soft' and suffer from a more marginalized position in comparison to natural sciences as quantifiability often is equated with objectivity (1060). *Causality* is Swierstra and te Molder's (2012) third and final dimension separating hard and soft impacts. A demonstrable causal link between a technology and an impact implies hardness of the impact (1061). The effects of technologies are however ambiguous and vague. For example, the discourse of technologies *facilitating* particular actions or *inviting* someone to do something (see e.g. Verbeek 2005) is milder than if one would claim that they *cause* something (2012, 1061). Swierstra and te Molder point to legal practice as an example how accountability is still framed in humanistic and individualistic terms: Responsibility is often assigned to a user of technology and not to a hybrid of the two, for example (1061). Accordingly, accountability or causality is often attributed either to

individuals or to no one, effectively muting the discussion around the technologies in question (1061).

Kiran et al. (2015, 7) make a distinction between direct and indirect impacts: The former concerns relations and identities whereas the latter regards norms and values. In terms of their temporal characteristics, soft impacts are presented as either short-term or long-term impacts. The short-term aspect relates to how NESTs (or their uses) “contribute to a re-structuring of norms and relations within a practice or a given context” (7). This contribution often happens due to a need to re-organize different practices so that the functional aspects of a technology could be utilized (7). The long-term impacts, in contrast, concern the changes in moral landscapes which comprise of moral principles and routines that direct people who are immersed in them, albeit often tacitly since they are considered self-evident until breached (8).

Since the delimitations to the concept of soft impacts outlined above still include a plethora of different kinds of impacts, the concept has come to represent a wide range of phenomena that often overlap with the objects of interest in STS and other research. Kiran et al. (2015, 7-8) view that anticipating soft impacts requires a specific methodology but that no established methodology to do so exists. In the article *Beyond checklists: toward an ethical-constructive technology assessment* (2015), presenting their approach to fill this methodological gap, the ethical-constructive technology assessment (eCTA) which will be elaborated further in the next section, they introduce and refer to a set of frameworks intended to operationalize soft impacts. Thus, a more elaborate understanding of soft impacts for the purposes of this thesis, based on Kiran et al.'s (2015) operationalization of them, will be presented in the section 2.2.2., after section 2.2.1. has introduced the theoretical traditions of postphenomenology and mediation theory that inform the operationalization in eCTA.

## **2.2. Anticipating soft impacts by way of eCTA**

This section will first introduce technology assessment (TA) as a context in which anticipation of technologies' soft impacts has developed. After that, it will identify anticipatory practices, ambitions and theoretical backgrounds of the main approach of interest within this thesis, namely, the ethical-constructive technology assessment, or eCTA which is the only TA approach<sup>1</sup> that explicitly attempts to anticipate soft impacts. To understand eCTA better, the more widespread and related constructive technology assessment or CTA will also be given a brief examination. Kiran et al.'s (2015) formative article for eCTA, *Beyond checklists: toward*

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<sup>1</sup> Boenink et al.'s (2010) technomoral scenarios approach also attempts the same.

*an ethical-constructive technology assessment*, will serve as the main source.

### **2.2.1. The theoretical background of eCTA**

Technology assessment (TA) covers a variety of objectives, methodologies and target-groups but typically it involves questions of (the status of) technology development, relevant social actors as well as potential social impacts and solutions to address policy issues arising from the development (van Est and Brom 2012). Importantly, TA often has a clear anticipatory orientation (Fisher et al. 2006, 487; Maathuis 2014, 131). It is especially this anticipatory aspect of TA approaches that also this thesis will focus on. Anticipation-focused STS-scholar Alvia-Palavicino (2016, 137-138) views anticipation as governing future events such as NEST development in coordination with expectations and imaginaries about them, as predicting them is impossible. Overall, some factors can decrease the utility of foresight or anticipation. For instance, specifically volatile situations may not lend themselves to very fruitful anticipation (Konrad, 2005).

As an attempt to address the neglect of soft impacts that Swierstra and te Molder (2012) highlight, Kiran et al. (2015) suggest a technology assessment approach called ethical-constructive technology assessment or eCTA, inspired by postphenomenology and mediation theory and drawing from user studies. eCTA's application fields (or as the authors themselves put it, "levels") are trifold: Mediation theory is used to *anticipate* soft impacts, help *evaluate* the desirability of artifacts overall and to *help designers to better design mediations while technologies are still in development* (2015, 11). In accordance with its main research question, this thesis will focus on the anticipatory element. Before analyzing this anticipatory aspect of eCTA, its position in relation to other forms of TA will be discussed.

### **Constructive approaches: reflectively feeding anticipation back into the development process**

While other constructive approaches such as design interventions (see e.g. Andersen et al. [2011]) and living labs (see Hyysalo and Botero 2013) exist beyond TA, there is only one constructive approach that Kiran et al. (2015) explicitly refer to: As can be understood from its name, eCTA is a reaction to or a further development of an approach called *constructive technology assessment* or *CTA*. To understand what it means to be constructive within the domain of TA, a look into the core factors that differentiate CTA from other TA approaches will follow below.

The methodical roots of CTA can be traced back to the early 1960's TA approaches which were meant to help governments to obtain control over the potential negative effects of

emerging technologies through *policy interventions* which later in the 1980's morphed into *design interventions* meant to facilitate “anticipating potential impacts and feeding these insights back into decision-making, and into actors' strategies” (Maathuis 2014, 131). STS perspectives have also shaped the approach to a great extent (Rip and Robinson 2013, 38). In fact, it was STS scholars' criticism towards the linear and unidirectional understanding of technological development that was seen exogenous to the society that led to the bridging of the formerly separated technology and society methodologically (van Est and Brom 2012, 19-21).

TA has generally been a tool of the institutional 'control faction' in technology development processes. CTA, in contrast, is meant to operate at the nexus of the earlier institutionally separated attempts to promote and control emerging technologies, (Rip and Robinson 2013, 39-40). It aims to achieve “better technology in a better society” (Rip and te Kulve 2008, 50) by bridging the consideration of social aspects that have given rise to the 'control side' of the division of labor regarding the societal acceptance of NESTs and the 'promotion side' (Rip and Robinson 2013, 40). In fact, CTA scholars Rip and Robinson (40) define the 'constructiveness' in certain TA approaches as referring to how the process of TA has been adopted into constructing technologies and embedding them in societies. Specifically, the broadening of technological development should be done in a manner conscious and attentive of the “dynamics of technology development and its embedding in society”, reflecting the notion of co-evolution of society and technology (2013, 38). This ambition within CTA to understand meso- and macro-level phenomena diverges from eCTA's micro-level focus (Kiran et al. 2015, 11).

In practice, CTA is supposed “to broaden technological development by including more aspects and more actors” (Rip and te Kulve 2008, 50). To achieve this diversification of participants in development efforts, CTA processes include workshops as *bridging events* which bring together stakeholders, beyond the professionally involved groups such as engineers and designers, with different backgrounds and differing views on the technological development at the center of attention to engage them in a process of collective deliberation (Maathuis 2014, 26). Kiran et al. (2015), however, do not explicate how different stakeholders should be involved in eCTA. This omission can either be taken to mean that it does not differ from CTA in this regard or that it does not focus on stakeholders as much as CTA.

Similarly as CTA, also eCTA favors a constructive take on technology development which is why Kiran et al. (2015, 10-11) call technology *accompaniment* or an active involvement in the development process 'from within' over a conventional technology *assessment* conducted from a supposed external point-of-view. In practical terms, the

accompaniment entails a consideration of the moral aspects of a NEST while it is still under development to understand how it could be developed into a morally (more) acceptable state, not merely whether or not the technology already can be considered as morally permissible as such (10-11).

### **Postphenomenology and mediation theory**

eCTA builds on two closely related theoretical frameworks both associated with Verbeek's work. The older and more overarching one of the two is *postphenomenology*, pioneered by Ihde (see e.g. 1990). Postphenomenology is interested in the relations of humans and technological artifacts on the micro-level while acknowledging the mediative capacities of the latter (Verbeek, 2005). Whereas the classical phenomenology tried to bridge what it viewed as distinct subject and object through the notion of *intentionality* referring to the fact that consciousness is always consciousness *about something* or directed towards an other, a more ardent position of postphenomenology is that the subject and the object in fact constitute each other (2005, 112-113). This dynamic of co-constitution leads postphenomenological thinking to reject claims of context-independency (2005, 113) and manifests in Verbeek's claim that "technologies are what they are" only within concrete use contexts (117).

Like with classical phenomenology, a core element of postphenomenology is a focus on experience (Verbeek 2005). With regard to methodology, the major difference between the two is that the latter does not assume a 'pristine', unmediated or 'authentic' point-of-view to experience but has incorporated the emphasis on contextuality and locality of the linguistic turn and post-modernism (2005, 104). This re-orientation of emphasis lets postphenomenological research focus empirically on specific technologies in specific contexts (2005). Even though Kiran et al. (2015) do not expressly mention postphenomenology beyond having a constitutive influence in the development of mediation theory (9), its core principles are visible in the eCTA approach in that it rejects ethical principles as constants unaffected by technologies and is open to a more empirically anchored inquiry of specific technologies by intervening in their development 'from within' (Kiran et al. 2015, 10).

The other significant theoretical strand meant to inform eCTA practices is mediation theory (Kiran et al. 2015, 11). Its main drive is to recognize technologies' and artifacts' mediating influence in humans' relations to their environments. This is likewise an aspect of the artifactual that can already be seen implied in the notion of soft impacts. More theoretically, the aim of mediation theory is to challenge the stark dichotomy between the subject and the object established in modern philosophical discourse (Verbeek 2005). To elucidate the role of technologies for human perception and action in mediation theory, Kiran

et al. (2015, 9) provide the reader with two examples respectively: Firstly, ultrasound imaging entails a specific perception of an unborn, and secondly, features of road design impact the speed of cars. These examples exhibit how the artefactual can, formulated in Verbeek's postphenomenological terms, *amplify* or *reduce* certain interpretations of phenomena and *invite* or *inhibit* certain actions or more generally, co-shape human experience and existence (Verbeek 2005, 195-197). The influence of mediation theory is best visible in the mediation theory -based frameworks that structure anticipation in eCTA, elaborated on in the next section.

### **2.2.2. Structuring anticipation and operationalizing soft impacts through eCTA-related frameworks**

Kiran et al. (2015) structure their anticipation practices through frameworks inspired by mediation theory that classify different ways in which NESTs can mediate the relations between humans and the(ir) world. The overlap between mediations and soft impacts is visible, for instance, in that also direct soft impacts reshape relations (Kiran et al. 2015, 7). Overall, Kiran et al. (2015) seem to operationalize (a part of) soft impacts as mediations.

The first framework aiming at a structured understanding of technological dynamics is a typification of human-technology relations by Ihde (1990), further developed in the article by Kiran et al. (2015, 9-11) and suggested by them to be used within eCTA when anticipating technological mediations. The below table elaborates different human-technology relations that can arise between technologies and others:

<p><b>Embodiment relation</b> I-technology) → world</p>	<p>In embodiment relations, humans are related to the world via technologies such as eye glasses that themselves become 'transparent', withdrawing from attention and directing it instead toward the world, expanding humans' bodily sensitivity to it (Verbeek 2005, 125-126).</p>
<p><b>Hermeneutic relation</b> I → (technology-world)</p>	<p>In hermeneutic relations, technologies reveal aspects of the world by representing them like a thermometer does when revealing a temperature (126).</p>
<p><b>Alterity relation</b> I → technology (-world)</p>	<p>In alterity relations, humans relate to the technologies such as many types of toys and robots themselves due to their perceived 'autonomy' as if interacting with an other (living being) (126-127).</p>
<p><b>Background relation</b> I (-technology/world)</p>	<p>In background relations, technologies such as central heating systems give rise to experiences without being noticed themselves, fading into the 'background' (127-128).</p>
<p><b>Fusion relation</b></p>	<p>Fusion relations are established when bodies and technologies are fused and their boundaries blur, implying a more intimate relation than an embodiment relation such as in the case of implants (Kiran et al. 2015, 9-10).</p>
<p><b>Immersion relation</b></p>	<p>Immersion relations emerge when technologies in the background 'sense' humans and take action in response (10). For example, smart toilets analyze fecal matter and respond interactively (10).</p>

Table 1: The source for the first four relations and their schematics is *What Things Do* (Verbeek 2005, 125-128) whereas the last two are from Kiran et al. (2015, 9-10).

Kiran et al. (2015) also refer to a more specific three-pronged framework to structure mediations in Verbeek's (2011) *Moralizing Technology*, meant to identify the *locus*, *type* and *domain* of the mediation of a technology. Verbeek (2011) does not explicitly detail the locus, or the "points of application" but it borrows from Dorrestijn's Product Impact Tool (henceforth PIT) (see e.g. Dorrestijn, 2017) which categorizes different ways technologies influence humans, such as the direct *cognitive* and *physical* impacts or indirect environmental impacts. In the PIT, the direct cognitive and physical impacts refer roughly to how artefacts can address the decision making processes 'before-the-eye' or to circumvent them through establishing concrete barriers and paths, mediating gestures and by appealing to senses respectively (Dorrestijn et al. 2014, 286-287). The indirect environmental impacts refer to how technologies can act as a historical societal force, how existing technologies influence the success of NESTs or how technological milieus subtly change behavior (287).

PIT's aim is to come up with a "systematic heuristic tool to anticipate future 'interaction

scenarios' between users and products” to design the latter more effectively and responsibly (285). While PIT focuses on 'products', the same insights can be applied to artifacts more broadly.

The category of *form* or *types of mediation* refers to the behavior changes that artifacts bring about in Tromp et al.'s (2011) fourfold framework whose two dimensions are the *salience* and the *forcefulness* of a technology's impact. Technologies that are both salient and forceful are called *coercive* while hidden and forceful technologies are called *decisive* (2011, 12). It could be claimed that coercive and physical impacts could be seen as overlapping with the *physical* impacts of the *locus* of mediations to an extent. Technologies with a weaker effect are called *seductive* if they are hidden and *persuasive* when apparent (12). The authors seem to determine how impacts relate to each class through psychological categorizations. Tromp et al. (2011, 13-15) state that while strategies such as inflicting pain or eliciting emotions to trigger action tendencies that designers apply to achieve certain behaviors can never guarantee an outcome, they can still affect the likelihood of that outcome and thus grant designers considerable influence over actors through artefacts. In contrast to Swierstra and te Molder's (2012) understanding of soft impacts where the causal relations of the impacts are unclear, Tromp et al. (2011, 12) have made them visible:

	<b>Apparent</b>	<b>Hidden</b>
<b>Strong</b>	Coercive: a speed camera to discourage fast driving	Decisive: a building without elevators meant to ensure physical activity
<b>Weak</b>	Persuasive: a campaign to promote healthy eating	Seductive: a microwave's effect on family dining habits

Table 2: This table positions the four types of impacts typified by Tromp et al. (2011, 12) in relation to the factors of saliency and force and illustrates them through examples given by them.

Verbeek has also developed a specifically postphenomenological vocabulary to structure one's understanding of technological impacts. In this vocabulary, technological artefacts are seen as *amplifying* or *reducing* different perceptions and ways of 'encountering reality' in the domain of *hermeneutics* as well as *inviting* and *inhibiting* certain actions in shaping their *existence* (2005, 195-197). This division to the hermeneutic and existential domains has inspired the category of *domains of mediation* within Verbeek's (2011, 87) framework. This part of the framework concerns what could be described as the results of the mediation. On an individual level, the hermeneutic domain can be reflected in experiences whereas the existential one concerns actions (87-88).

However, Verbeek points out how the social level also has to be accounted for and that the



individually focused human-technology relations should thus be complemented with social analysis of mediations (87-88). In practice this boils down to two categories of social mediation: Collectively, the hermeneutics imply frameworks of interpretation while the existential domain concerns social practices (87-88).

Verbeek's (2005, 6, 11) example about how microwave ovens, in certain types of contexts, co-shape the practices of (communal) eating in households can be used to elucidate soft impacts. Introducing a microwave oven into a household might seduce its inhabitants to eat more of 'microwave-friendly' meals according to individual schedules rather than together (6). On a more hermeneutic level, it might co-shape the meaning of dining from a social ritual to fast nourishment. In accordance with Swierstra and te Molder's (2012) conception of soft impacts, the impacts of the microwave to the meaning or practices around eating could well be a source of unsettled dispute, cannot be meaningfully reduced to numbers and also are not caused merely by the microwave but also require a specific socio-material context.

Even though the methodology proposed in this thesis will be exploratory in nature as opposed to one searching for specific impacts, the operationalization of soft impacts by eCTA-related frameworks in this section, along with the above example will help to create a more focused picture of them. Accordingly, the remainder of this thesis will frame soft impacts as changes in mediations, experiences and frameworks of interpretation as well as action and social practices instigated by NESTs.

### **2.2.3. The anticipatory practices advocated within eCTA**

While TA approaches generally anticipate future events (Fisher et al. 2006, 487), eCTA includes dedicated and explicit anticipatory practices. In fact, it consists of three potential "levels" that Kiran et al. (2015, 11) introduce in the following order: anticipation, evaluation and designing of technological mediations. In other words, to close the methodological gap regarding the anticipation of soft impacts identified earlier, they (7) propose an anticipatory approach of their own. According to them (16), different kinds of mediations that technologies potentially bring about should be systematically thought about so that decisions regarding their applications in future contexts would be informed.

Sociologist of time Adam argues that anticipation or "studying the not-yet" (2004, 7) is not easily translated into experiences. This metaphysical dilemma has to be addressed, she argues, by "importing the future into the present" as "images of the future" (8) thereby opening up a range of possibilities in examining future matters. Imaginaries and scenarios are among the most popular techniques that fall under the category of images of the future.

These two are also Kiran et al.'s (2015) techniques of choice in combination with

frameworks informed by postphenomenology and mediation theory. In practice, not elaborating much more on their methodological choices, they suggest that “[i]n order to anticipate mediations, users, designers and policy-makers can use their imagination, guided by the theory of technological mediation, to develop a realistic idea of the potential influences of a technology that is under design, about to be used or about to be implemented” (2015, 11). The authors intend to chart the potential effects of particular NESTs in use to practices that their users are taking part in or are implicated by (11). Also CTA roughly shares the same methodology (Rip and te Kulve 2008).

Kiran et al. (2015, 11) stress that using mediation theory does not help 'predicting the future', but intends to structure the imagination process with the help of mediation theory to analyze technologies' ethical implications systematically. They delineate the function of the anticipatory application of mediation theory by describing it as *heuristic* when elucidating possible upcoming mediations (11).

Not only imagination as such is advocated as the sole source of knowledge regarding potential soft impacts of technologies within eCTA but also “[...] techniques of anticipation like scenario development can play an important role” (2015, 11). Here, Kiran et al. (2015) refer to Dorrestijn et al. (2014) who go through how scenarios can be harnessed to anticipate mediations in a more nuanced way. To structure their anticipatory work, Dorrestijn et al. (2014) evoke the categories of Dorrestijn’s PIT. Their approach alternates between the design method of scenario-based design and the foresight technique of scenario planning, evoking *direct* and *indirect* impacts as understood in Dorrestijn’s PIT as well as evoking micro-level circumstances directly related to use-contexts and macro-level contextual dynamics (e.g. wider socio-political developments) respectively (2014). Even though no such connection is made explicit by the authors, these two scenario-based techniques of scenario-based product design and scenario planning can also be seen to correspond respectively with the notions of direct and indirect soft impacts in eCTA's conceptual framework (Kiran et al. 2015, 7).

The scenarios of scenario-based product design consist of a granular narrative in which a user or another type of a stakeholder has a goal in relation to a product in a *setting* (Dorrestijn et al. 2014, 285). Their notion of setting is rather ambitiously meant to include “[...] all contextual aspects that can potentially influence the user-product interaction, such as the physical environment, and the objects and individuals within that environment” (285). Although the scenario-based product design narratives are often expressed in either written or spoken form, Dorrestijn et al. (285) suggest that they can “alternatively or additionally” be played out through “storyboards, movies, role-playing and (virtual) simulations”. Similar elements will be explored in more depth further in this thesis.

Despite methodologically supporting the postphenomenologically and empirically inspired Kiran et al. (2015) in their anticipation work, when planning scenarios meant to highlight macro-level dynamics during their own approach, Dorrestijn et al. (2014, 289) allow for including in them utopic and dystopic visions to stimulate thinking about beneficial and problematic effects of NESTs and conflicts they might foster. They even themselves evoke criticism towards how the reliance on utopic and dystopic visions has driven the philosophical discussion too far from empirically anchored accounts (289). This (contextually limited) acceptance of the utopic and dystopic visions as images of the future still points either to a lack of commitment to the tenets of postphenomenological thinking in the domain of anticipation methodology or a lack of methodological focus.

### **Chapter conclusion**

This chapter has first identified soft impacts through formative literature on it in section 2.1. with special focus on Swierstra and te Molder's (2012) definitional work. Kiran et al.'s (2015) article *Beyond checklists: toward an ethical-constructive technology assessment* has been identified as the formative article of ethical-constructive technology assessment (eCTA) which is an approach that aims to anticipate soft impacts. Section 2.2. has begun by giving a brief overview on technology assessment in general. eCTA's influences, the constructive technology assessment (CTA) as well as the theoretical strands of postphenomenology and the related mediation theory have been showcased in section 2.2.1. As section 2.2.2 shows, eCTA utilizes frameworks like human-technology relations and Verbeek's three-pronged framework introduced in *Moralizing Technology* (2011) to structure its anticipation of soft impacts, thus also operationalizing them. This thesis will rely on both the definitional work presented in section 2.1. and the operationalizing frameworks showcased in section 2.2.2. in its treatment of soft impacts. Finally, section 2.2.3. has presented and detailed the methods on which eCTA's anticipatory facet relies, namely, imagination and scenarios, which can also be termed *images of the future*, following Adam (2004). eCTA and its related practices can be deemed capable of structuring futures through their frameworks but their epistemological reliance on imagining and scenarios is, however, problematic. The upcoming chapter will discuss these problematic aspects in more depth and attempts to remedy them.

### 3. Towards more context-sensitive soft impact anticipation

By engaging with current TA and other anticipatory approaches, this chapter will investigate how a higher degree of plausibility for propositions regarding future dynamics can be attained through grounding the anticipatory visions. Grounding entails anchoring the imagination into empirical instances (Boenink 2013, 149).

The first section will critique eCTA for producing generic knowledge about (non-)use(rs) and go over how stakeholders can be brought into anticipation processes to generate *non-generic* stakeholder knowledge. The second section will propose further development for the grounding process in a way specifically suitable for anticipating NESTs' soft impacts by introducing an artifactual element into it, reflecting a slight modification of the concept of soft impacts to better correspond with the postphenomenological anticipatory context. The third section aims to locate a suitable temporal niche for anticipation of NESTs' soft impacts that will be guided by the parameters given in the previous sections on how to ground anticipation.

#### 3.1. Generating non-generic knowledge through a grounded and distributed epistemology through participation in the present

While eCTA provides useful heuristic frameworks to structure anticipation, the reliance on imagination and scenarios gives eCTA and related approaches an abstract, indirect and empirically detached character, risking excessive speculation. Diverging from their theoretical roots of postphenomenology, the frameworks within eCTA displayed in section 2.2.2. do not highlight (the importance of) social dynamics or context-dependency. The social elements would warrant a bigger role in the anticipation than eCTA gives it. For instance, the multitude of social activity could be recognized as something that in fact frames mediations and thus points to how they cannot be seen as attached to different artifacts but are co-enacted in contexts. As Burri (2009) and Felt et al. (2015) point out, regional and cultural differences that emanate from past experiences with technologies can frame perceptions regarding them. Ihde calls this phenomenon of cultural framing *macroperception* (Verbeek 2005, 123), a concept which along with the concept of co-constitution of technology and society highlights the importance of empirical research into technologies. Similarly, *microperception* is inseparable from *macroperception* and consists of the frameworks that turn sensory stimuli into something meaningful (122). According to Ihde (1990), (micro- and macro-) perception give access to *lifeworlds*.

Lifeworld is a phenomenological concept that highlights the subjectivity of everyday life and “[...] includes individual, social, perceptual and practical experience” (Encyclopaedia Britannica, 2016). Constrained by their experience, it is difficult for both designers of technologies and TA professionals designing *scenarios* alike to transcend one's lifeworld and assume others' positions or to 'enter' into a (non-)user-stakeholder-perspective: The design of scenarios is constrained by their designers' lifeworlds and a risk of excessive speculation looms large when designing them.

Evaluating the eCTA approach to anticipation in terms of the use(r) knowledge it generates can illustrate its epistemological limitations. Since the anticipation in eCTA is supposed to occur while the technology is still in development and nevertheless concerns (non-)users and (non-)use, one can claim that the imagination proposed by Kiran et al. (2015, 11) is a form of use(r) representation. Having analyzed different strands of user studies literature, Peine and Herrmann (2012, 1503) have compiled a six-tiered classification of sources of use knowledge ranging from non-representation of users (meaning that designers' imagination does not venture into users' interaction with the artifact being designed to begin with) to the most precise *domestication* or learning by using:

<p><b>1. Non-representation</b></p>	<p>“Users are neither involved nor represented; designers refer to their own practices and imaginations or stories circulating within their professional networks to obtain use knowledge.” (Peine and Herrmann 2012, 1503)</p>
<p><b>2. Implicit representation</b></p>	<p>“There is no conscious representation of users or use, but traces of earlier explicit attempts to represent users inform the construction of users and use. Technical traditions can be a vital source for handing down certain images of prospective use” (1503)</p>
<p><b>3. Indirect representation</b></p>	<p>“Experts may represent users based on their expertise about users and use. This is the case, for instance, when usability experts enrich a design process with basic principles of ergonomics. In such cases, generalized expertise about users and use is a source of use knowledge. Also intermediary groups, such as consumer lobby groups, may speak in the name of real users and thus contribute to creation and articulation of use knowledge.” (1503)</p>
<p><b>4. Direct representation</b></p>	<p>“Experts can also mediate directly between producers and real users. In this case, their representation of use is based on an empirical investigation of users and use in the context of a specific innovation project. Different forms of marketing research usually fall into this category.” (1503)</p>
<p><b>5. Co-creation</b></p>	<p>“Users can participate directly with designers to co-design an innovation. This is a very interesting source of use knowledge that borders on user innovations in the sense that users are deliberately made co-designers. While some experience exists with co-realization in the development of IT systems, true co-creation of innovation is still found to be a rare instance.” (1503)</p>
<p><b>6. Domestication or learning by using</b></p>	<p>“When users put a new design into use and thus domesticate it, they create knowledge about its meaning and functions. In particular the domestication literature suggests that this is the most elaborate source of use knowledge. However, it is also the source of use knowledge most detached from actual design modifications.” (1503)</p>

Table 3: Peine and Herrmann's (2012, 1503) hierarchy of the precision of user knowledge acquisition can be used to show how eCTA does not capture the most nuanced user knowledge. The explanations are quotes from Peine and Herrmann.

Within this table, the imagination of potential influences of a technology structured by mediation theory most resembles the tier 3 “indirect representation” of users where “generalized expertise about users and use is a source of use knowledge” (2012, 1503). A situated anticipatory understanding of potential soft impacts can hardly be built on generalized expertise.

Kiran et al. (2015, 14-15) recognize in theory the multitude of users and non-users by highlighting different cases of subject constitution through technologies ranging from users that go beyond the intentions of designers by adapting or modifying technologies into their liking and people unable to use technologies to begin with. Still, their choice of images of the future does not fully embed this recognition into their anticipation methodology.

Konrad (2008, 3) points out that technology “designers make assumptions about user groups, their preferences and competencies, their ways of using and the context of use”. The imagination or scenario element within eCTA can be claimed to contain similar assumptions and thus, the anticipatory propositions regarding future matters are distilled through them. Such assumptions, as they are often based on already established technologies, are prone to be erroneous (4). Accordingly, they risk excessive speculation and eCTA risks to reproduce the perspectival epistemological bias regarding the visioning of future soft impacts based on a few key actors, merely pushing epistemic responsibilities from a limited set of designers and engineers to a limited set of TA professionals. One can, however, ask, to what extent it makes a difference if instead of engineers and designers, TA professionals become the primary visionary actors regarding the NESTs of concern.

Peine and Herrmann's (2012) and Konrad's (2008) remarks elucidate the degree of speculation and uncertainties inherent to scenario-based work. If (the meanings of) technologies are seen as co-enacted in contexts by stakeholders (see Verbeek 2005, 117), it may well be the social dynamic of contexts and stakeholders that is more often the more elusive side of anticipation than the technological one. Like in the case of scenarios (and in many cases of design), including only a narrow set of lifeworlds and thus perspectives can entail overlooking dynamics like non-intended use, antiprogrammes or appropriation. In fact, also Verbeek (2011, 88-89) emphasizes that many mediations are unintentional and surprising to the supposed designers of them. This unintentionality implies that not everything can be (easily) factored into scenarios. While charting factors that undermine the accuracy of images of the future, Geels and Smit (2000) have found that social complexity is often underrepresented on the micro-level. They point to the neglect of NESTs non-functional aspects and abilities to generate new activities as well as framing them as mere substitutes for existing technologies in the images of the future (2000, 143-145). Again, an even more postphenomenological emphasis on empirical philosophy than eCTA currently exhibits could shed more light on such contextual dynamics.

As implied above, a more direct representation of stakeholders may help in bursting perspectival bubbles of the designers of scenarios to generate non-generic knowledge. One way of do so is to ground the images of the future, systematically relying on a posteriori knowledge which could be seen as a vehicle to enrich the lifeworld of the designers of scenarios with more awareness of future possibilities and even – based on the similarity of past and future dynamics – plausibilities.

While a debate on the multiple requirements and conditions for establishing plausibility is on-going (see Selin and Pereira 2013), this thesis follows the footsteps of Nordmann (2013) in using the term plausibility to distinguish, in light of abductive reasoning, “seriously possible” and worth considering propositions regarding future dynamics like soft impacts from merely (logically, physically or technically) *possible* ones. Furthermore, Nordmann (2013, 125) ties plausibility to a posteriori knowledge stating that “[i]f something has happened before, one might plausibly assume that it can, might or will happen again”. Ethicist of technology Boenink's (2013) theoretical take on the matter examines the plausibility of scenarios more rigorously than Nordmann while also highlighting the importance of a posteriori backing of them. This thesis echoes Nordmann's (2013) and Boenink's (2013) implications that the plausibility of specific futures increases when anchored empirically. Plausibility can specifically, Boenink (2013, 149) claims, be increased through “grounding imagination of the future in sociological and historical insights in technological innovation processes”. A historical grounding is carried out by Boenink et al. (2010) and Guston and Sarewitz (2002) in their real-time TA approach, for instance. In practice, Boenink et al.'s (2010) technomoral scenarios are constructed through a three-step process: 1) Charting the existing moral landscape to understand current relevant moral views, practices and regulation, preferably through a historical or a genealogical lens, 2) generating potential moral controversies with their of plausibility in focus, preferably using a repository of the dynamics of ethical controversies surrounding NESTs, along with typical ethical arguments as a basis for this phase and 3) constructing a closure by judging the plausibility of the social outcomes of these moral controversies.

Projecting past controversies, arguments and dynamics into the futurity in Boenink et al.'s (2010) way is problematic for two reasons. Firstly, it risks a recourse into utopic or dystopic discourses (if only as reference points) because it is precisely these extremes that often structure (lay) debates and controversies regarding NESTs. Micro-scale dynamics, for example, might not be widely represented in past controversies for the same reasons they have not prominently featured in (lay) debates in liberal societies generally, as is mentioned in section 2.1.

Secondly, the complexity of anticipation work grows and thus the speculativeness of anticipatory propositions increases when the temporal gap between the empirical evidence that is used to anticipate upcoming events and the point in time of those upcoming events themselves widens.



Since the complex co-evolutionary dynamics of technology and society introduce a great deal of uncertainty into anticipation, the safest way to anticipate soft impacts in a nuanced manner is to exclusively anticipate *short-term soft impacts* which do not yet imply technomoral change to the extent that long-term soft impacts do. Per Kiran et al.'s (2015, 7) definition, short-term soft impacts entail a focus on the restructuring of relations and norms within specific technological practices as opposed to the focus on the moral landscape of the long-term impacts. To sum up, Boenink et al.'s (2010) reliance on *similar* controversies in the grounding process reveals the length of the inferential leaps the approach entails: As Boenink (2013), Guston and Sarewitz (2002, 101) all acknowledge, the historical cases cannot fully inform NEST development due to changed circumstances.

Accordingly, carrying out the empirical grounding to establish possibilities or plausibilities for anticipatory propositions in the present can help address the current context better. In CTA workshops, potential stakeholders are represented more directly than in scenarios in the present as opposed to Boenink et al. (2010). Thus, CTA can delegate a part of the epistemic responsibility regarding anticipatory propositions from the scenario designers (constrained by their own limited set of lifeworlds) to the participants of the workshops who get to simulate broader societal dynamics in a microcosm of sorts (Rip and Robinson, 2013) where the promoters of NESTs (ie. designers and engineers) deliberate on them together with 'outsiders' to the NEST development or as CTA literature often conceptualizes them, *selectors* of technology (Rip and Robinson, 2013).

Nordmann (2013) also argues that the plausibility of scenarios depends on their *credibility*. Such plausibility echoes an instrumental defence of democracy (see Christiano 2015) where including more viewpoints increases the quality of deliberation of given topics, a logic shared by most STS-inspired future-oriented governance approaches (Konrad et al. 2017, 482). Accordingly, CTA-type stakeholder meetings can be seen as grounding the (propositions included in) scenarios and thus avoiding excessive speculation. CTA workshops where scenarios play the role of “platform[s] for interaction” (as Rip and Robinson [2013, 37] see them within CTA), act as cross-pollinating contexts for lifeworlds enabling more credible anticipatory propositions regarding future matters. They reduce the uncertainty regarding future stakeholder dynamics by subjecting the scenarios to the perspectives of a set of stakeholders (in the present) during CTA workshops. In practice, the (anticipatory propositions in the) scenarios should in any case be plausible enough to be able to engage workshop participants (2013, 38). Thus, also the participants indirectly influence the creation of the scenarios.

Even though, as opposed to Boenink (2010), CTA workshops explicitly address the NEST of concern and not merely *similar* cases, they do not generate direct knowledge about actual contexts of interest but rather scrutinize ready-made scenarios referring to such contexts. Thus, also CTA attracts criticism regarding its lack of context-sensitivity: While involving potential stakeholders in the present partly addresses the socio-epistemological deficit in scenarios whose anticipatory propositions stem from a limited set of visionaries constrained by their lifeworlds, attending a CTA workshop is a more abstract experience than enacting an actual or even a manufactured application context. CTA workshops could also be criticised as somewhat one-dimensional due to the lack of material aspects in the anticipatory process.

### **3.2. Enriching the participants' lifeworlds through material deliberation**

Building upon the postphenomenological rejection of the longing to 'pure' experience (Verbeek 2005), it can be said that no unmediated route to futures exists. Also in the domain of philosophy of mind, body and technology, cognition is seen not only as mediated but also embodied, distributed into artifacts, as well as situated in action and enacted (see e.g., Aydin 2015, Malafouris 2008). Thus, utilizing or not utilizing different media in acquiring knowledge about soft impacts changes the nature of the knowledge attained. This is why postphenomenological anticipation of soft impacts deserves more attention in terms of the media it uses than is granted by eCTA and related approaches. As discussed in section 2.2.3., Adam (2004, 7) describes how images of the future (such as scenarios and imaginaries) mediate between the present and futures. There are also ways of 'transporting (parts of) the future into the present' that can enable more plausible anticipatory propositions. Within the domain of sociology of expectations, for instance, Konrad et al. (2017, 481) point out how "the future [...] can be mobilized in the present as embodied in artifacts". These images can then transform (parts of) 'the future' into something that can be sociologically studied (Adam 2004, 7). This section will go through two theoretical arguments for doing so.

The first argument concerns the role of the co-constitutive interplay of humans and technologies when grounding anticipatory practices. Verbeek's (2005, 117) statement of how technologies "[...] are what they are [...]" in (non-)use contexts encapsulates the relevance of co-constitution. Thus, postphenomenologically speaking, anticipating phenomena such as soft impacts is a two-sided equation that should involve two elements: a human and a non-human one; a stakeholder and an artifact. In other words, one could find a similarly problematic flaw as with the generic use(r)-knowledge generation by giving the artifactual side of the equation the same treatment Peine and Herrmann (2012) do for the user side of it and end up with a similar conclusion too:

As such, scenarios offer and are informed by merely generic information about artifacts. More specifically, simulating larger societal dynamics by abstract and textual means does not bring out their nuance as forcefully as could be done or fulfil the promise of postphenomenology in a setting where a crucial part of the dynamic is absent. However, the omission of artifacts does not only hinder *their* accurate representation: As both sides of the postphenomenological equation are inseparable, Verbeek's (2005, 117) acknowledgement of how technologies are co-constituted in use contexts could be turned on its head to say that the stakeholders are co-constituted by technologies. Thus, producing stakeholder knowledge should in many contexts feature an artifactual element.

Ideally, the grounding should entail an acknowledgement of the situated nature of the phenomena that include adequately represented human and non-human elements, simulating not only larger societal dynamics as in CTA workshops, but also and especially, micro-scale dynamics. The previous sections have described the epistemological implications of a constrained set of lifeworlds and how they have been addressed in CTA. Lifeworlds can also be limited in experience in relation to the NESTs of concern. Ihde (1990) views lifeworlds as something accessed through perception which, again, is likewise mediated by technologies and artifacts. Thus, in postphenomenological terms, mediating futures through artifacts rather than abstract scenarios should change lifeworlds by affecting microperception which is the element of perception that incorporates micro-level dynamics and mediations (Verbeek 2005, 122). Accordingly, the lifeworlds of actors participating in futures processes in which they can interact with artifactual representations of the NEST of concern could be seen as epistemically (positively) affected compared to non-experiential CTA workshops.

The other argument for material deliberation concerns the inclusion of participants in TA methodology. While on the face of it, it might seem like a concern more related to democratization of technological development, it has a deeply epistemic and methodological relevance due to plausibility being dependent on credibility in the eyes of actors. Rip and Robinson (2013, 38) emphasize the effort needed to keep scenarios engaging enough for participants of CTA workshops. In the context of critiquing participatory urban planning practices, Davies et al. (2012, 352) recognize that argumentation and meaning-making can be medium-specific pointing to “[...] knowledges and views which draw upon, for example, the unspoken, material or affective [...]”. Scenarios, even when deliberated in citizen workshops, can be argued to systematically disregard certain types of knowledge. Davies et al. (352) point out how practices of deliberative democracy rely rather exclusively on spoken word and specific forms of argumentation.

While analysing different ways to enhance public participation in urban planning, Davies et al. (2012) highlight the potential of including artifacts in deliberation processes in practice by proposing *material deliberation*. The authors do not present material deliberation through elaborate definitions but construe it as the opposite of traditional deliberative (urban planning) practices and merely characterize it as something sensory, affective and material (353), charting the signposts for the remainder of this thesis. In practice, not just any artifact but an artifact representing a NEST of concern<sup>2</sup> in the near future could be a medium that enables the representation of socio-technical dynamics and soft impacts more plausibly.

### **3.3. Finding a suitable temporal niche for postphenomenological anticipation**

As sections 3.1. and 3.2. have established, a postphenomenological approach to anticipation of soft impacts should gather empirical data about human-artifact interactions in the present through material deliberation. This section will take on the task of making sure that the proposed approach remains anticipatory in spite of this reliance on this feature. Thus, making anticipatory propositions should be located in relation to both empirical data gathering in the present and the near future that is of concern. This section will chart whether different technology-oriented anticipatory approaches such as van de Poel's social experiments approach, Guston and Sarewitz's real-time TA (henceforth r-tTA) or Kudina and Verbeek's moral mediation approach can offer something to further specify a suitable temporal niche for anticipation.

van de Poel (2011, 2013), trying forcefully to minimize speculation, proposes treating technology as social experiments in accordance with eCTA's aim of not resorting to a priori binary judgements regarding the acceptability of NESTs and steers his experimental approach towards a more empirical and context-sensitive direction. Instead of focusing on soft impacts, however, he is concerned about risks which he defines, as is common, as “the probability of an undesirable event and the impact of that event” (2011, 285). To assess risks, one must know the magnitude of the impacts of a technology and their probability (2011). The calculability of risk evokes the notion of hard impacts and differentiates van de Poel's epistemic ambition from the one of this thesis which will not propose a methodology that engages in assigning probabilities. van de Poel (2013, 353) analyzes two broad, risk-focused approaches that deal with uncertainty in technological development: I) risk-cost-benefit analysis and risk standards as well as II) “the precautionary principle and scenarios”.

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<sup>2</sup>A postphenomenological method should avoid an analytical perspective too fixed on old technologies and instead recognize the empirical uniqueness of each NEST by materially representing them where fruitful.

He claims that the former are doomed to lack knowledge about probabilities they need to be informed with when being applied in the context of NESTs whereas the latter “focus on the anticipation of consequences” which he thinks are surrounded by a shroud of uncertainty unremovable due to “practical and epistemological limitations” and the fact that technologies emerge in a co-evolutionary relation with society (353). He concludes that only his approach, treating technologies as social experiment, recognizes the fundamental uncertainty that characterizes technological development, impact assessment and anticipation (353).

To further elucidate his approach, van de Poel (2011) uses nuclear energy technology as an example, pointing out that its safety could neither be tested beforehand in “realistic circumstances” such as a laboratory setting nor could it be confirmed through calculation, modelling and computer simulation because these ways rely on assumptions that cannot be scrutinized rigorously enough before the nuclear technology would be activated and applied. van de Poel (2011, 287) distinguishes his preferred social experiments from what he calls “standard experiments” in that social experiments are less controllable experiments carried out outside of the laboratory setting and not necessarily explicitly labelled as experiments or conducted as such, sometimes entailing the absence of actual rigorous data gathering. Crucially, as Kudina and Verbeek (2018) point out, social experiments, unless accompanied by forward-looking anticipatory elements, risks becoming mere trial-and-error. This is especially the case as it seems van de Poel (2011), relies on already functioning technologies on a large scale.

CTA and r-tTA allow a better peek into the impacts of a technology not yet available to a general public and thus avoid letting the optimal data gathering circumstances (of social experiments) water down the anticipation. Broadly characterized, and as mentioned in section 3.1., CTA contributes to the question of timing by closing the temporal gap between phases of development and reflection by potential stakeholders. By including more stakeholders early in the development process, 'social factors' become embedded in it before the technology becomes less governable and adaptable by and for them (Guston and Sarewitz 2002, 98). Building on CTA's anticipatory practices, Guston and Sarewitz (2002) have conjured the real-time TA (henceforth r-tTA) approach that lets participants reflect on scenarios. Echoing section 3.1. in implying that short-term anticipation is ambitious enough, r-tTA anticipates in increments and to further the technological development, iterates on feedback from stakeholders (generated in workshops, for example) after each incremental phase of anticipation (100). Like postphenomenological works, Guston and Sarewitz seem willing to avoid the utopic and dystopic discourse that often surround NESTs (99) but include deliberation on how to mitigate what is considered by broader publics 'undesirable impacts'

(106). To understand undesirability, the approach integrates a historical view on relevant controversies. In addition to the problems of a strong commitment to historical cases discussed in section 3.1., the scenario element of r-tTA can be seen as similarly problematic as within other heavily scenario-reliant approaches.

Through their scenario element, CTA and r-tTA do remain clearly anticipatory. Additionally, the scenarios are scrutinized in the present when they are subjected to the (ideally) diverse views of the bridging workshops. Crucially, however, both in CTA and r-tTA, the anticipatory propositions (as parts) of scenarios are made before the empirical data gathering which is too early for the latter to inform the former. In other words, the scenarios are not informed by empirical data gathering in the present, increasing their speculativeness and enabling less plausible anticipatory propositions.

Kudina and Verbeek's (2018) case study on Google Glass analyzes a dilemma in anticipating technomoral change regarding the impacts of NESTs on the frameworks through which they are ethically evaluated. Such considerations are important in terms of anticipation but as the focus of this thesis lies on concrete impacts of NESTs more generally, it is mostly what can be derived from Kudina and Verbeek's methodological approach that can be applied to the task of this section. The article shares with eCTA an implicit ambition to introduce a postphenomenological point-of-view and embed mediation theory into anticipatory practices that concern NESTs. Kudina and Verbeek avoid excess speculation through empirical inquiry and staying ahead of van de Poel's likewise empirical experiments and reach an optimal timing at the *threshold of society* which can be uniquely examined as the social commentary in response to the pioneering launch of Google Glass first as a limited 'explorer edition' that has since turned into an intermittent re-launch of the product aimed at different contexts (2018). This empirical case study, however, means that Kudina and Verbeek steer away from a constructive accompaniment of technology development 'from within'. In practice, the authors operationalize this social commentary as reactive comments to a video regarding the usage etiquette of Glass on YouTube and examine how they envision the Glass mediating privacy with regard to different practices after identifying the types of values and issues at stake in those practices (2018).

This limited release of (a version of) Google Glass into the midst of a larger but still very limited, pre-vetted public can be used as a basis to epistemologically build on while still retaining an anticipatory take in relation to an indiscriminate release of the product to larger markets. Echoing the practice of searching for 'weak signals' of broader future phenomena within futures studies (see Heinonen and Hiltunen 2012), the anticipatory aspect of this approach can be seen as directed towards the impacts of the technology in the midst of a

*broader public* than is exposed to it in the 'explorer phase'. Kudina and Verbeek manage to isolate speculative elements regarding the social dynamics of Google Glass by basing their analysis on empirical material. Still, they (2018, 17) do not mean their work as a conclusive or representative take on the impacts of Google Glass (on moral frameworks) but intend more of an explorative and in situ approach.

The main takeaway from this section is that a suitable temporal niche for postphenomenological anticipation of soft impacts is positioned both *ex ante* or 'before the event', and a posteriori or 'after the experience'. In the context of soft impact anticipation, 'the event' refers to a NEST that has been released 'into the wild'. Product launches and introductions of public infrastructure, for instance, can serve as demarcation lines between *ex ante* and *ex post*. The term *ex ante* overall then refers to an anticipatory activity (as opposed to *ex post* knowledge of soft impacts). Here, of course, the a posteriori knowledge generated is not generated about the socio-technical dynamics after the event per se but a representation of them. Still, such a grounding allows for a nuanced, non-generic, embodied and materially deliberative grounding and ultimately, more plausible anticipatory propositions. To achieve this, it is better to rely on present state representation than historical accounts of similar cases.

This niche is suitable because it allows to experience the co-enactment of complex social dynamics and the artifactual elements that are representations of artifacts that are actually meant to bring about the soft impacts. In other words, the combination of *ex ante* and a posteriori positions enables an anticipatory approach which is yet empirical in that its images of the future can facilitate actual socio-technical dynamics based on and scrutinized by an empirical process as opposed to abstract imagination which can be crystallized in scenarios like in eCTA and its related approaches.

## **Chapter conclusion**

The chapter has begun by rudimentarily outlining the deficits in context-sensitivity in the two anticipation methods of eCTA, imagination and scenarios. In Boenink's (2013) footsteps, this chapter presents the plausibility of anticipatory propositions as dependent on empirical grounding. Section 3.1. has argued for the grounding to be done by exposing anticipatory propositions to scrutiny by diverse lifeworlds through participation of stakeholders in the present to make them non-generic. Section 3.2. has argued for further situating the concept of soft impacts highlighting how it should be understood as bi-directional:

Technologies impact stakeholders but stakeholders can also relate to them in various ways. This two-sidedness in the ontology of technology also has epistemological implications in the context of anticipation. Thus, section 3.2. has advocated the material side of socio-technical

dynamics to be represented. Thus, an improved way of knowledge-generation compared to eCTA practices has to carefully represent both of these sides in interaction to properly grasp soft impacts. An increased plausibility of the anticipatory statements regarding soft impacts is then achieved not by a standard process of anchoring but by, in effect, co-creating representationally adequate impacts (under specific conditions). Echoing Nordmann (2013, 125), if something can be socio-materially enacted, it is plausible that it can happen later.

Section 3.3. has grappled with how anticipation and *direct* empirical data about how users and technologies interact are not an easy match since the former implies a future tense and the latter involves a posteriori work. To be anticipatory, a practice needs to precede the phenomena of interest that have not yet occurred. To be able to produce plausible anticipatory propositions (and to be truly postphenomenological), it needs to refer to experiences and actions related to the NEST of interest which are a matter of empirical study. Accordingly, an ideal approach would include an empirical inquiry into a diverse set of lifeworlds that interact with an artifactual element representing the NEST of concern. At the very least, such a dynamic should be able to highlight certain future possibilities better than standard scenario development. Given these parameters, section 3.3. has explored a suitable temporal niche for soft impact anticipation. What Kudina and Verbeek (2018) call *the threshold of society*, referring to a point in time when knowledge of the impacts of a specific technological artifact on the society can be empirically accumulated before that artifact has become societally entrenched and widespread on the market comes so close that the upcoming chapter will suggest a similar temporal position to enable a materially deliberative ex ante a posteriori anticipation.



## 4. Crossing the experiential gulf into ex ante a posteriori socio-material futures

So far, chapter 2 has introduced soft impacts and methods to anticipate them as well as critiqued such methods due to their lack of context-sensitivity. Chapter 3 has pointed towards empirical inquiry into the interplay of stakeholders and artifacts as an appropriate means to address these deficiencies and charted the signposts of a suitable temporal niche for doing this type of a posteriori work but still retaining an anticipatory take that was argued for in chapter 2. In other words, chapter 3 has established that a suitable temporal niche for soft impact anticipation is both ex ante and a posteriori: before the act (of a product release, for instance) but based on experience.

This chapter will provide a more detailed and practical view on how to incorporate other approaches' epistemically beneficial features identified in the previous chapters to achieve an ex ante a posteriori socio-material deliberation for the purposes of soft impact anticipation. To do so, it will look to the domain of futures studies and more specifically, to experiential futures methods (henceforth EFMs) and related design approaches. It will also consider practical methodological questions and illuminate the combined power of eCTA and EFMs through two hypothetical case studies. Also the limitations of such an approach will be considered.

### 4.1. Crossing the experiential gulf

While charting ways to experience futures, Baerten (2016), a foresight-oriented designer, claims that “[a]lthough the future is essentially about what does not yet exist, it often pays to pretend that it is already here because that allows people to engage with the future through their senses and physical interactions. This helps elicit valuable information that can inspire anticipatory action” (230). This is one way to summarize the idea behind EFMs that are still an emerging set of practices without a form set in stone (Baerten 2016, 237; Candy and Dunagan 2017). For roughly the past decade, the domains of futures studies and design have become more intermingled in that designers have sought to address futures more explicitly through scenarios and other foresight methods into their work and futures professionals have expressed interest in activities such as prototyping and design fiction (Candy and Dunagan 2017, 136). Within futures studies, the focus has moved from predictive approaches towards participatory methods and a recognition of a plurality of futures (see e.g. Inayatullah 2013).

Although, as Konrad et al. (2017, 480) note, a motley crew of materially deliberative ways of futures engagement have sprouted during the 2010's, perhaps the most formative

literary work in the field of experiential futures is Candy's doctoral dissertation, *The Futures of Everyday Life: Politics and the Design of Experiential Scenarios* (2010). As the name of the dissertation reveals, Candy (2010, 76) especially wants to make the existing medium of *scenarios* more tangible. He also stresses that all images of the future – from an abstract policy paper regarding climate change to being cast as a climate refugee in the year 2050 – provide experiences of some kind (2010). The focus on scenarios has arguably directed his thematic focus on macro-scale dynamics such as climate change and geopolitical developments (2010). However, he has also applied EFMs in the context of hypothetical NESTs such as the NaturePod virtual reality nature simulator (2016, see picture below) meant to spur discussion about human-nature relations on a more micro-scale. While still thematically macro-scale, such questions are investigated through micro-scale interactions.



Image 1: This picture illustrates an exercise in an architecture and design trade show where Candy (2016) and his working group took the NaturePod nature simulator meant to spark discussion about humans' relation to their environment (image from [futuryst.blogspot.com](http://futuryst.blogspot.com), courtesy of Stuart Candy, photo by Connie Tsang).

According to Candy and Dunagan (2017, 137), two pioneering figures within the narrow(ly defined) academic experiential futures community, experiential methods seek to transform (notions of) possible futures into flesh, matter and tangible action. Instead of utilizing more abstract media such as white papers or workshops reliant on textual and verbal exchange to mediate possible futures, EFMs include a wide range of possible media, encompassing prototypes, art installations, drama, games and digital simulations including virtual as well as augmented reality (2017, 137) in order to cross what Candy (2017) calls the *experiential gulf*, separating abstract and concrete as well as general and specific modes of futures work. Many application fields and forms are available to experiential methods and also Candy and Dunagan (2017, 137) want to keep the palette of possible media and techniques broad. In practice, the aim is to bring people into contact with tangible representations of possible future artifacts (called *stuff*) or 1:1 scale, visitable, immersive encounters representing a time and a place called *situations* (148-149).

Since the field of experiential futures contains a variety of media and methods bound together (among other things) by a belief in facilitating deliberation about futures rather than actually accounting for potential impacts, often experiential cases lack a structured written conclusion or even a documentary trail of any kind (Candy and Dunagan 2017, 139). Design-driven futures professionals Kelliher and Byrne (2015) have identified this lack and have called for a more rigorous collection and description of experiential case studies. The combination of technology anticipation and eCTA in particular with experiential methods might not only enable material deliberation at the right time for the former but also add the desired rigour to experiential futures.

### **Overlapping and related approaches and practices**

Futures studies often borrows methodological elements from other disciplines (Kelliher and Byrne 2013, 1). A variety of practices that overlap with and relate to EFMs also exist, many of them design-related and associated only with a narrow set of actors. For instance design fiction, critical design and design probes are among such practices (see e.g. Candy and Dunagan [2017, 137] or Kelliher and Byrne [2015, 69]).

One of the most prominent related approaches is speculative design. Auger (2013, 11), a prominent speculative designer, considers speculative design as an amalgamation of “informed extrapolations of an emerging technology” and a host of techniques borrowed from different domains such as ecology, comedy, film, literature and psychology capable to “develop and present plausible futures”.

Auger (2013) sees speculative design as having two purposes: enabling thinking about the futurity and critiquing current practices which both are under the purview of anticipation and constructive TA.

Auger (2013, 11) also points to a variety of closely related approaches such as critical design, discursive design, design probes and design fiction. These approaches are also recognized by Candy and Dunagan (2017, 138) as being related to experiential futures. Auger (2013, 11) outlines some commonalities between these approaches: a disregard for the constraints commercial actors set on normative design processes and the use of models and prototypes as well as fiction to present socio-technical alternatives. All of these practices seem relevant for the (eC)TA context envisioned in this thesis as they combine material deliberation and anticipation. Still, EFMs seem to align with the ambitions of this thesis best not only because it explicitly a futures practice but also because is meant to be very broadly applicable enabling a multitude of images of the future, seems the most theoretically ambitious and is tightly aligned with what postphenomenology aims to achieve: a methodology beyond the utopia/dystopia binary. For these reasons, it is perhaps the easiest practice to be associated with the complexities of socio-technical co-constitution.

Also the practice of usability trials shares some characteristics with EFMs. Both utilize prototypes and anticipate interactions between future artifacts and humans (see e.g. Woolgar [1990]). The practices, however, clearly diverge in terms of their goals: Usability trials can also contribute to a more static view of technologies' teleologies whereas EFMs have a far broader, barely defined field of applications, more suitable for augmenting (e)CTA activities. Additionally, the (eC)TA application context that this thesis prepares for EFMs rather focuses on stakeholders, including non-users. The distinction between usability trials and experiential futures in the service of soft impact anticipation will be further deliberated in section 4.3.

## **4.2. How do EFMs and (e)CTA fit together?**

In Candy and Dunagan's (2017, 137) view, EFMs have responded to the reliance of futures studies on abstract images of the future and the following ineffective exploring and communication of potential futures, estranging (lay) actors from debates about different future visions. Similarly, Baerten (2016, 236) views that by diversifying futures communication, EFMs can spark and deepen discussions about future dynamics. Incidentally, these qualities can also benefit CTA workshops. Baerten also specifically states that experiential methods are suitable for a workshop context (237) and can help in addressing the communication issues in CTA workshops identified by Krabbenborg (2013) as well as Rip and Robinson (2013, 38).

Whereas within the domain of futures studies experiential methods are recognized especially as capable of communicating and affectively engaging participants in futures work, in the context of TA and from a postphenomenological perspective, they can actually do much more.

### **Beyond utopia and dystopia**

Postphenomenology and empirical philosophy of technology are in accordance with Candy's approach in that they all aim to challenge abstract discourse on 'technology' which relies partly on the utopia/dystopia binary. In fact, the first chapter of Candy's (2010) dissertation is titled *Beyond utopia and dystopia*. Candy starts his PhD project in which he explores the potential of experiential methods by criticizing the utopia/dystopia dynamic as too limiting considering that the futurity is widely recognized to be rather open as opposed to merely bipolar. In line with this thesis, Candy (33, 36) sees futures neither as deterministic nor random but contingent – a result of combination of accident and design.

Consequently, Candy (2010, 24-25) favors the generation and in-depth exploration of a broad set of alternative futures and deferring the evaluation of them only after the exploration thus echoing the role CTA grants to diversifying the viewpoints of scrutiny of anticipatory propositions regarding future matters in broadening the horizon of future deliberation. Candy (2010, 38) also recognizes the perspectival characteristic of creating images of the future and what has in this thesis been termed lifeworlds as “[...] subjectivities – one per person, per moment, at least [...]”.

### **Including embodied socio-material deliberation**

While experiential futures studies typically feature artifacts not meant to become actual products (e.g. Candy's (2016) NaturePod) and other types of material instances such as physical signs of future climate change as mentioned in the previous section as opposed to prototypes of NESTs about to be introduced to broader publics, the core elements of these methods can be incorporated into the service of TA. It can be assumed that these two categories of artifacts are epistemically similarly interesting.

While Candy does not refer to the notions of material deliberation, embodied knowledge or even phenomenology, his principles are compatible with them. For instance, he views the experiential approach as a suitable reaction to the overturning of the Cartesian paradigm of a separated mind and body (2010, 77).

In practice, he criticizes how most scenarios, graphs and other more abstract mediums fail to engage people affectively. Such engagement is relevant firstly, because it corresponds with the ambition of retaining the participants' interest in CTA bridging events (Rip and Robinson 2013, 38), potentially encouraging participants to engage more with TA exercises. More crucially in the context of this thesis, however, the artifactual element can provide insight that would not arise (as likely) if it was not present. In line with the cognitive qualities of artifacts and the notion of material deliberation discussed in section 3.2., Candy and Dunagan (2017, 137) call these methods “intellectually distinctive”.

Adding the material element into the deliberation would make (e)CTA practically more cognizant of how, as has already been established in section 3.2., the notion of impact should be understood not as a unidirectional but a bidirectional concept: If the ontological assumptions of Verbeek (2005) are taken seriously, soft impacts should be taken to be phenomena that emerge in (use and non-use) contexts and that anticipation should rely on contextually sensitive methods. As EFMs enable representing relevant contexts (socio-)materially, they enable the generation of knowledge regarding both potential stakeholders and the artifacts simultaneously. Letting a socio-technical dynamic involving representations of both be played out *ex ante* is a more contextually sensitive way to anticipate different possible impacts of technologies compared to merely letting people 'freely' deliberate on hypothetical events. Thus, especially from a postphenomenological perspective, the potential of experiential methods is in some cases higher than the potential of traditional CTA workshops to plausibly anticipate soft impacts of technologies.

In fact, experiential methods do not *per se* ground existing anticipatory propositions like CTA but enable co-enacting them in a situated arena for embodied insight. The output of such an experiential exercise should be considered plausible as it is something that has already been observed in the present and so the methodology of eCTA augmented with EFMs should be able to contribute to more plausible, nuanced and even surprising content to propositions regarding future soft impacts. Additionally, it should be able to stimulate anticipatory thinking about the impacts of the NEST of interest.

### **Varying time spans of interest, optimal temporal niche**

Some experiential scenarios aim to address phenomena decades away from the vantage point of anticipation (e.g. drawing lines with blue chalk across Honolulu streetscape to make climate change related water level rise expected until the century's end materially visible [Candy 2010, 226]), some, more reminiscent of the mission of this thesis in the TA context, focus on the near-term horizon of 3-5 years (Candy 2010, 244). In contrast, as already

mentioned in chapter 3, this thesis seeks methodological solutions for *short-term* anticipation. Also Auger (2013, 12) prefers artifactual anticipation to focus on the short-term as such a focus increases the poignancy of anticipatory practices.

While the time span of interest differs between EFMs in their typical futures studies context and TA, EFMs enable the optimal temporal niche for anticipation established in section 3.3 by positioning itself both *ex ante* and *posteriori*: before the proliferation of a NEST but enabling empirical data gathering in the present. It also enables the anticipation to happen after the grounding, thereby increasing the plausibility of the anticipatory propositions as the temporal gap between the point in time of interest decreases. By setting up an experiential exercise where empirical evidence can be gathered of a socio-technical dynamic that simultaneously can be deemed plausible or at least possible with regard to the near future, the best of both worlds, *ex ante* and *a posteriori* can be utilized.

### **4.3. Integrating experiential exercises into (e)CTA practices**

For the context of TA methodology, a change in the images of the future requires adaptation in current anticipation practices. The differences in the context and goals of TA and futures studies or relevant design approaches such as speculative design present challenges when transferring methodological elements from the latter to the former. Signalling the mutability of the approaches of concern in this thesis, Parandian (2012, 6), a CTA-focused scholar, emphasizes the contextual nature of CTA by stating that methodological contributions to it must be systematically variable according to different conditions. As already mentioned, experiential methods can be applied in a variety of ways. They do not rely on a particular medium or an application field. This section will present two hypothetical case studies to illustrate how current (e)CTA anticipation practices can be augmented by adapted EFMs in practice.

Integrating experiential images of the future into (e)CTA anticipation practices can be demonstrated by referring to actual practices. eCTA will serve as a reference point through the content outlined in Kiran et al. (2015). In an eCTA process, it would be the first of the three application levels, namely, anticipation that would be altered. While the way that the anticipation process would be conducted according to the changes proposed in this thesis would mean that also evaluative statements of the NEST of concern could be made by the participants, the levels of evaluation and design of mediations would largely remain as they are. While eCTA itself has not explicitly been applied in practice and thus the insertion of experiential methods cannot be described in detail, a related approach can elucidate how it could be done. One apt approach to do so is CTA+ which like postphenomenology and eCTA

builds on the pragmatist tradition or more specifically, the work of Dewey (Krabbenborg 2013) and includes role-play-like dramatic rehearsals of soci(et)al embedding of NESTs and in Krabbenborg's case study, a lab-on-a-chip-technology for measuring lithium levels. It is specifically the workshops or *bridging events* of CTA+ and CTA more generally that are of interest in this section because they involve the anticipatory, participatory and embodied learning elements that experiential exercises are meant to hone. Overall, the methodological choices will be heavily influenced by contextual factors which cannot be exhibited exhaustively in this thesis. The influence of the perhaps the single most important contextual factor, the NEST of concern, will be elaborated in a separate section below.

#### **4.3.1. NESTs of concern**

Experiential methods will not be a panacea for soft impact anticipation. It should be recognized that a question of return-on-investment will likely accompany the decision process about whether an eCTA process augmented with experiential methods would be carried out. Among other factors such as the degree of volatility of the technical development and the amount of resources available, the NEST of interest itself is of great importance in assessing the utility of an experiential anticipation. NESTs come in different shapes and sizes some of which lend themselves to a participatory ex ante material representation more resource-heavy than mere scenarios and imaginaries better and some worse. Additionally, some NESTs are not easily witnessed by stakeholders at all since parts of them are concealed behind a wider socio-technical system. For example, many data-driven technologies conceal power dynamics effectively. While no direct formula can be given as to which kinds of NESTs would be best analyzed experientially, some categories can point the way heuristically.

The rigidity of the technology is of relevance: If a technology can be modified to omit unwanted and unforeseen impacts with little effort, an elaborate materially aided anticipation process is less useful. For example, different software can be improved through updates without disturbing stakeholders considerably. A related aspect is the rate of proliferation of the NEST of concern. In practice, this rate often depends on whether or not the NEST is expected to enter mass-production. If it is, then its soft impacts would likely reach more stakeholders, making their anticipation more lucrative. However, there are also technologies that have significant soft impacts without mass-production such as different satellite technologies.

The utility of experiential methods is not merely based on the expected magnitude of the impacts but it can also depend on the specificity of the use context which helps the inductive work from the material representation towards the NEST set in a future context.

The exposure of specific stakeholders is also a factor of concern. If even a small amount of



stakeholders would be exposed to a NEST intensively for an extended period of time like they would in a newly designed prison, its soft impacts are bound to be more pervasive, again, depending on how forceful the NESTs impacts are generally. If it is possible to foresee that the NEST will be operated by a small, given set of stakeholders, it would be easier to assume that the use-dynamics would remain similar in the near future. In other words, if the set of relevant stakeholders is expected to be either small, constant or both, and its behavior easily foreseeable like in the case of new designs for professionally used vessels (e.g. fishing ships, patrol boats), the plausibility of experiential methods could increase due to the stability of the socio-technical dynamics over time.

#### **4.3.2. How can experiential exercises be used to anticipate future soft impacts?**

Beyond the NEST of concern, Baerten (2016, 225) has categorized different characteristics of experiential methods to be considered when pairing experiential exercises<sup>3</sup> with different application contexts. Such categories include, for instance, *the goal of the experiential exercise*, *its target group* and *the level of detail or realism in the image of the future*. They can be utilized to structure the form of experiential exercises also in the context of TA and will be used as reference points in this section while discussing experiential methods in practice. The goal of experiential exercises in the context of this thesis which, to reiterate, proposes augmenting (e)CTA with EFMs for epistemic gain, will be briefly stated below. Discussion on methodological choices regarding the target group and the level of detail and realism of such exercises will follow later after two illustrative examples of such exercises.

Implicitly echoing Kiran et al. (2015) and explicitly Dewey, Krabbenborg (2013, 171-172) acknowledges how (first-time) interactions with NESTs can lead to indeterminate situations that prompt the questioning of existing norms, relations and practices. As opposed to promptly transforming such indeterminate situations into problems<sup>4</sup> to deliberate on like Krabbenborg's dramatic rehearsals do (173), the approach this thesis proposes tries to establish what Krabbenborg calls a *diagnosis* of them (170) which can inform anticipatory propositions. In other words, indeterminate situations are an apt arena for gathering data about soft impacts of the representations of NESTs and making sociological diagnoses that can ground and be turned into anticipatory propositions concerning near future soft impacts. Thus, the goal of the experiential exercises in the (e)CTA context is to create conditions for such

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<sup>3</sup>For the sake of readability, hypothetical experiential TA anticipation practices will be referred to as “experiential exercises” during the rest of the thesis.

<sup>4</sup>Echoing the eCTA refrain from a priori judgement of NESTs (2015, 6), the exercises should be built so that NESTs are not framed in positive or negative light. Problematizing should be left to willing participants and the evaluative phase of eCTA where the produced propositions regarding future soft impacts get ethically interpreted.

research.

### **Illustrating experiential exercises**

This section will conjure two examples that borrow elements from design research practices and CTA. Self-driving vehicles are an apt NEST to showcase the complexities of artifactual representation as they are not only a materially rigid technology with high potential for being mass-manufactured but also a technology that has already been materially represented in different ways, making visible different types of dynamics.

#### **Example 1: Confined, respectful and pre-programmed**

This example takes influences both from Parandian's (2012) CTA workshop in the context of TA-Nanoned, a prolific CTA project and design studio Tellart's design research project aimed to stimulate debate about future governmental services the Dubai Museum of Future Government in the United Arab Emirates in 2015 (n.d.). The influences concern respectively matters of organizing the exercise as well as the material setting.

As in Tellart's exhibition, the artifactual instance needed for the material deliberation could be a mock-up of an autonomous car in a shape that signifies a non-functioning vehicle in a controlled environment like an exhibition space. Likewise, as in Tellart's exhibition (n.d.), its use context could be governmental services and it could be fitted with a work station to enable a way to bring government services closer to where citizens live: Driving the office to their doorstep. The below real-life example from Tellart's non-TA context illustrates how such prototypes could look like:



Image 2: This picture depicts a mock-up of an autonomous car adopted for the particular use of making governmental services more accessible in Tellart's exhibition intended to inspire deliberation among its visitors (Tellart, nd.). Even though this case study is not conducted by TA specialists, it can illustrate one way of materially representing futures, also for the purposes of TA and soft impact anticipation. (image retrieved from <http://www.tellart.com/assets/img/projects/mofgs-2015/smart-city-mobility-2@2x.jpg>)

While the exercise could be framed in multiple ways, here, unlike in the Tellart project, the participants could be immersed in a scenario performed by role-players, invited to test the autonomous cars in the role of a (potential) user (instead of merely being led into the room with the artifact, for instance). As in Parandian's (2012) CTA workshops, an expedient amount of participants could be around 13. The inclusion criteria for participants would be the diversity of their lifeworlds. A rudimentary time table for the exercise is below:

<b>Day 1</b>	
<b>The first round of individual human-technology interaction (20 minutes)</b>	The participants interact with the artifact individually and successively, under the unintrusive observation of a researcher. The duration of this phase is modelled roughly after typical interactions between artifacts and visitors in (experiential) exhibitions which, despite their short duration, are already seen as epistemologically useful. Also for the sake of realism and strain of role-playing and time-constraints of successive visits the schedule is suitable.
<b>A non-experiential intermission (40 minutes)</b>	The participants write a diary-type entry in private about their experiences during the first round. This is also the time when potential individual interviews can be conducted.
<b>Day 2</b>	Extending the exercises into a second day would make it possible to extend the reflective engagement of the participants. Additionally, it would reduce the amount of time the participants would have to wait on the spot.
<b>The second, social round of human-technology interaction (120 minutes)</b>  <b>After the exercise</b>	This round features a group interaction with the artifact and a discussion between the participants. A researcher (who could also pretend to be one of the participants) would be present to encourage and structure the discussion and to keep it focused.  The mediation analysis (or other type of analysis) aimed to understand soft impacts could then be carried out while the potential stakeholders get to experience and interact with the artifact representing the potential NEST. The knowledge generated during an exercise can then be presented to the people who are in charge of the evaluation of the technology.
<p>Table 4: This table presents a crude exemplary agenda for an experiential exercise. It is a modified version of Parandian's (2012, 60) agenda for an 'Actor perspective' workshop within a CTA process related to the TA-NanoNed program.</p>	

Candy and Dunagan (2017) as well as Kelliher and Byrne (2015) have identified a need for a more rigorous approach to documenting experiential exercises in general. TA, as it stems from a methodologically more rigorous ground of STS research, is an appropriate domain to search for a more rigorous take on data gathering and documentation. Accordingly, this example would distinguish itself from current experiential futures exercises in that it would be rigorously documented and treated as if it were an object of STS research.

The methods of data gathering should enable the exercise situations roll on their own weight and be as unintrusive as possible during the actual, interactive situation. Unintrusiveness is also what Kelliher and Byrne (2015, 4) recommend for people documenting experiential futures studies events. Accordingly, observation of the participants in the exercise would be a primary method of accumulating use knowledge. Also, depending on to what extent the data gathering would be structured, methods such as asking the participants to fill in a diary entry or interviews could be utilized. At least in the latter case, mediation theory frameworks presented in section 2.2.3., for instance, could be used as a way to structure the interviews due to the relative ease of grasping the terminology. Soft impacts that concern the cognitive, subjective, hermeneutic experience such as different types of alterity relations towards the autonomous car might not become visible through mere observation which further warrants the use of other methods. Writing diary-type entries privately could play an important role in encouraging the participants to express themselves to plug the epistemic gaps of observation.

To highlight the multifacetedness of experiential methods and their applicability in different contexts, a stark contrast can be drawn between the hypothetical example 1 above and the following one. As both have the intention to understand how autonomous vehicles could reshape practices, relations and identities, they make an apt comparison. Example 2 epitomizes the notion of *guerilla futures* which can be considered a subset of EFMs: Uninvited guerilla futures are meant to expose people to images of the future in their everyday settings, often in a provocative way (Candy 2010, 208-257). Candy (2010, 228-229, 240) exemplifies guerilla tactics by a project that aimed to spark discussion about city development by hanging banners announcing counterfactual but imaginable upcoming gentrifying real-estate development and emergence of franchise businesses on a vacant building in Honolulu's Chinatown district,

previously an area commercially dominated by small businesses and staging faux protesters of such development engaging with passers-by. Often guerilla futures rely on the notion that current contexts can passably represent future dynamics.

### **Example 2: 'Move fast and break things'**

This example is mostly based on a field study conducted by Rothenbücher et al. (2016) in two intersections on the Stanford University campus in 2016 with 67 participants. While likewise not explicitly tied with EFMs, it indicates how an experiential exercise could be organized and also highlights how many existing current practices have potential with regard to experiential exercises. The main aspect to be changed in their study for the purposes of this example is the location which should better reflect the aim of a diverse set of participants such as the vicinity of railway stations.

Rothenbücher et al.'s (2016) basic methodological elements in their human-robot-interaction case study are as such applicable: masquerading a regular car into a mock autonomous car by adding to it stickers claiming it to be autonomous and concealing its driver with seat fabric. The car was let into the public and pedestrians' and bicyclists' reactions to it while crossing the road in front of it were recorded (2016). Bringing artifacts into the public can effectively suspend participants disbelief. Yet, such an invasive mode of research combined with a such a random sampling and a seemingly potentially dangerous artifact can raise research ethical issues.

The data gathering methods of mere (possibly camera-assisted) observation or, like Rothenbücher et al. (2016) do, combining camera-assisted observation with having most participants fill out a survey with open-ended questions after the interaction with the car. Indicating how differently different groups act in traffic, many bicyclists rode too fast to be caught for the survey, leading to a selection bias (2016).

### **The target group of the exercise and the organization of their participation**

Second on Baerten's (2016, 225) list of methodological variables that structures this section is the target group of the experiential exercise. Even though he does not define the term, here it is taken to mean the participants of such an exercise, a factor with epistemic relevance. Different ways of distinguishing relevant participant groups for the purposes of TA exist. For instance, the division into enactors and comparative selectors is the dichotomy that structures CTA whereas Kiran et al. (2015) highlight the importance of non-users.

Overall, picking different (combinations of) participants and ways of interacting with them will likely significantly affect the output of an experiential exercise.

In accordance with the goal of the exercises laid out earlier, the sampling of the participants should reflect the notion that the diversity of participants' lifeworlds in many cases makes the anticipatory propositions more plausible. Given an otherwise fruitful exercise arrangement, an increased amount of participants in an experiential exercise can in theory increase the plausibility of the anticipatory propositions generated within it. The other side of this consideration pertains to resources like time, money and connections to willing participants unless a guerilla futures approach with a random sampling is chosen. In the context of example 1, imagining expected application contexts as a pre-screening for the exercise could help choose the most suitable participants. Due to the limited number of participants in example 1, representing diverse lifeworlds in the form of spokespersons from organizations that represent and have experience of generally underrepresented minority-positions (e.g. disability rights NGOs) might make practical sense. Such a representation of the broader society, however, starts to resemble CTA pre-engagement.

When determining the target group of an experiential exercise, CTA workshops are a telling reference point. The difference in the goals of CTA workshops and experiential exercises also constitutes a large part of the differences in choosing the target group for the interaction. Generally, CTA lays more emphasis on the structural differences in society with regard to NESTs, entailing more emphasis on groups to be bridged (Rip and Robinson, 2013). While orienting how to choose participants for CTA workshops, te Kulve (2011, 141) points to demographic or professional characteristics as relevant factors to consider as well as the role or lack of a role in specific socio-technical dynamics. More specifically, Parandian (2012, 7) suggests that the selection of participants be made based after an analysis of relevant socio-technical dynamics. Experiential exercises would entail such an emphasis on the structurally different positions becoming less relevant during the preparation.

Firstly, as the emphasis of experiential exercises is on experience and exposing artifacts representative of NESTs to interaction with different lifeworlds, including enactors in the

interactive parts of the exercises would be somewhat redundant: The (outcomes of the) fact that they design NESTs constrained by their bounded rationality and limited experience is among the main reasons as to why TA activities are needed to begin with. Since generating knowledge about the soft impacts of a NEST relying on a very limited set of lifeworlds, be they designers' or TA researchers' and ethicists', would be antithetical to the spirit of experiential exercises, a broader set of lifeworlds is preferred to be interacting with the artifacts. In other words, while (e)CTA merely transfers (a part of) the anticipatory responsibility from designers or engineers (enactors) to researchers and ethicists, experiential exercises aim to break that pattern and distribute the epistemic responsibilities. Thus, the meticulous, preparatory charting of potentially relevant socio-technical dynamics is less necessary for experiential exercises as the representations of socio-artifactual dynamics are supposed to 'do the bulk of the talking' with the participants engaging in 'the discussion' as the other co-constituents. Some artifacts are better suited for achieving this than others: As Krabbenborg's (2013) case study on a lab-on-a-chip technology can illustrate, some artifacts need a diverse and specific socio-technical system including specified actors (e.g. insurers) in order to fulfil the purpose intended by its designers.

As experiential exercises are meant to generate knowledge about potential issues that arise from the proliferation of a NEST of concern, predefining it too tightly (around existing camps) should be avoided. Instead, experiential exercises approach potential emerging issues from the point-of-view of what Marres (2007) calls “object-oriented accounts of public involvement practices” or STS-influenced perspectives according to which it is the *objects* that engage debate, break technocratic behavior patterns and constitute *issues*. Thus, space will be left for potential issues to emerge on the spot, during the exercises. More specifically than calling for the primacy of the exercise situation and letting the issues emerge from it, within CTA, the name for the approach that experiential exercises as they are proposed in this thesis aim to facilitate is, as coined by Parandian (2012, 47), “putting 'Actor perspectives' up front” as opposed to “putting 'Dilemmas' up front” (which could entail a rather tightly defined exercise): In other words, also the issues should be co-defined by the participants and the artifacts.

To achieve such goals and to honor the postphenomenological ambition to do *philosophy from things*, in example 1, the participants would immerse themselves in the representative situation individually in succession and write about their experiences afterwards. This way it could be guaranteed that the NEST, through its representation, would become exposed to multiple different lifeworlds and not merely to one dominant view articulated by some participants. The risk for such dominating behavior drowning out some participants' input



exists: Krabbenborg (2013, 183) concludes that unless encouraged by moderators, the participants of the workshops did not let their own roles, values or responsibilities to be challenged but instead mainly broadcast their initial views to others. Likewise, Parandian (2012, 47) points to a “conversational path dependency” during CTA workshops: The start(er) of a conversation might determine how the topic is framed and ultimately, discussed. Also Baerten (2016, 229-230) points out that especially inexperienced participants sometimes have difficulties in expressing their reactions to experiential images of the future without guidance and suggests that in such cases, the exercise would benefit from encouraging them to draw a comparison between the contemporary socio-technical conditions and the representation of the NEST and the future conditions it implies. One way of helping the participants to express themselves and gathering data about the exercise could be to have participants fill in a written diary-type entry after it in private.

However, as mentioned earlier, wider contexts frame human-technology interactions. People also often encounter technologies in groups and framed by socio-cultural factors. If useful, a 'second interactive round' could be arranged where all of the participants interact with the representation of the NEST together, simultaneously discussing it similarly as in CTA workshops. Such discussions could be oriented either merely for the gathering of further information about the impacts of the artifact or be expanded into more elaborate bridging events discussing how to improve the technology or its embedding in the wider society. To further encourage the participants express their views, adopting the Chatham House rules for this second, social, round of human-artifact interaction, as Krabbenborg (2013, 178) has opted to do for CTA+ workshops, would likely be expedient. The relevance of the individual and group rounds depends also on the NEST of concern: Some NESTs (e.g. personal hygiene products) are rather clearly meant to be used alone, adding a communal, second round of human-artifact interaction might not be as useful.

Example 2 differs from example 1 in having a very different sampling method. As Rothenbücher et al. (2016) admit, *their* study, as it is done on a Silicon Valley university campus, entails participants well prepared to confront autonomous cars. Increasing the diversity of lifeworlds should entail multiple radically diverse contexts to understand a widespread general purpose NEST like autonomous cars. Such a NEST should be subjected to participants of different cultural backgrounds, disabilities, and ages perhaps including animals such as pets and actual automata.

### **The detail, realism and framing of the image of the future**

In relation to the images of the future – which, as has now been established, in the context of experiential exercises are concrete artifacts or combinations of them and to different extents, the acts of actors within the exercises – a crucial question concerns their framing: How should they be presented in experiential exercises? Whereas CTA processes begin with a charting of the socio-technical terrain in which the NEST of concern would be embedded, augmenting anticipatory methods with experiential exercises would give primacy to the arrangement of the exercise situation in which the human-technology interactions are enacted in the present. A variety of factors such as the type of NEST and the willingness to take risks in terms of plausibility influence the detail, realism and framing of the images of the future in experiential exercises. While these factors are context dependent, a spectrum of the alternative techniques can be presented.

In Candy and Dunagan's (2017, 148-149) relevant distinction between *stuff* and *situations*, the former could involve maquettes or more elaborate prototypes of NESTs whereas the latter would often require a more resource-heavy mobilization of multiple artifacts as well as non-participant actors such as actors and roleplayers to create the desired experiences. Role-playing would be especially warranted in cases that where the NESTs of concern require the presence of operators or co-(non-)users as in example 1. The epistemic benefit of role-playing is that changes in practices can be made more tangible.

Related is Baerten's (2016, 225) singularity-integrality axis which maps the extent to which other aspects of an imagined future than the NEST of interest in its imagined form would be represented. The singular take would attempt to stimulate thinking about specific future developments (e.g. a new NEST) whose representations he calls *singular futures* (i.e. representing a *single* 'future artifact' without representing broader societal changes) and thus favor the foremost commitment to representing the NEST itself whereas integral futures entail more immersive experiences that would depict a future context holistically, as a result of multiple developments that in conjunction make it differ from the present (225). However, integrality increases the complexity of the target system thus risking excessive speculation and the decline in plausible propositions that can be made about soft impacts. Choosing to focus on near-term futures also partly defeats the purpose of specifically constructed integrality: As guerilla techniques deployed in example 2 show, even current contextual elements can in many cases passably represent elements of the near future as they cannot be expected to change in a relevant way.

On the other hand, concerning favorable exercise conditions, Baerten (2016, 226) points out how commitments to certain contextual elements might close up the space of possibilities

in deliberation and consequently draw criticism. Thus, attention should be put in the artifactual setting so that the dynamic it is supposed to facilitate does not fall prey to the pre-established utopia/dystopia dynamic or otherwise needlessly tight framing through existing frameworks but actually invites thinking from the situation.

In reference to the aim of eCTA to understand changes in socio-technical roles and practices (2015, 15), while organizing experiential exercises, one has to walk a fine line between 'situations' so excessively determined that no surprise can emerge in the participant-artifact interaction and mute 'stuff' not engaging enough for fruitful interaction. Again, the question of to what extent the use and non-use dynamics are to be predetermined is highly relevant. As Kiran et al. (2015, 12-13) note, technologies shape also non-users' actions and interpretative frameworks. Framing the images of the future in a specific way – through a user manual, for example – moulds and restricts the ways in which participants interact with them: Firstly directing them towards a role of a user (as opposed to a non-user) and then defining the ways of use. One risk in the TA context is if the participants perceive the exercises as usability trials and thus refrain from commenting aspects that are not directly related to usability. In a tightly defined situation it could be less likely to encounter 'creative' forms of non-intended use. The approach presented in this thesis merely points to the possibility of structuring anticipation (experiential exercises) more loosely than what the imagination or scenarios promoted by Kiran et al. (2015). Also, the more tightly defined an exercise becomes the more it resembles usability trials by tightly pre-defining the teleology of the artifact of interest and the roles of interaction with it.

The location of the experiential exercise is also epistemically relevant as it can significantly influence how the human-technology interactions play out during the exercise. Krabbenborg (2013) does not stress the importance of the location as much as should be done with materially deliberative experiential exercises. She (2013, 184) maintains that it is not the task of a CTA+ workshop organizer to find a suitable location for the bridging. Also within methodologically less rigorous experiential futures studies, locations have varied from outdoor public places (see Candy and Dunagan, 2017) to museums (see Tellart n.d.) and specific exhibitions or events (see Candy, 2016). In example 1, a necessary imaginative and inferential leap concerns the fact that the maquette car does not actually arrive at anyone's doorstep.

Example 1 is integral as it does not only assume a future in which autonomous vehicles have become widely spread but also a co-constitution of governmental services along with such vehicles and a situation as opposed to stuff as it involves role-play of a meeting between a governmental official and a citizen. While the details of the vehicle in the picture do not

evoke an image of a street-ready, operating vehicle, it is optimally realistic to act as a fruitful platform for simulating socio-technical dynamics.

Example 2, as it is meant to catch random passers-by by surprise, does not necessitate much suspension of disbelief among them in making certain socio-technical dynamics visible. At least Rothenbücher et al.'s (2016) car was considered truly autonomous by most participants. The example paints a picture of a singular future as it only assumes that cars have, unlike in the present, obtained self-driving capabilities, but refers to a 'situation' in traffic, disrupting otherwise routinely behavior patterns in traffic. However, it does hastily define the (perhaps unwilling) participants as non-users, separated from the users by the car's metal cocoon.

### **4.3.3. What can be learned from these types of experiential exercises?**

This thesis, having not actually conducted these experiential exercises, is restrained by its author's limited lifeworld and granular imaginaries. Still, preliminary categorizations and speculative, heuristic hypotheses of the types of observations that can be made within experiential exercises to understand potential epistemic benefits and disadvantages of applying EFMs can be made. One structuring categorization is based on the variation in the unit of analysis in social sciences, forming an axis between microsociology and macrosociology. Crudely, these two ends of the axis can be operationalized as interaction-focused and structure-focused research on micro- and macro-level phenomena, respectively (Pyyhtinen 2016). In between lies the meso-level that concerns organizations and social networks (2016). Overall, the data gathering methods crudely correspond with specific types of impacts: observation with the existential impacts concerning practices and diaries as well as the second, social and more discussion-based round of human-technology interactions in example 1 with hermeneutic ones, concerning interpretative frameworks (see section 2.2.2. for clarification).

### **Micro-scale empirically contained insight on soft impacts**

#### *Nuance and empirical validation of propositions*

The mediation theory concepts that structure technological impacts can only elucidate a part of the vast category of soft impacts. However, in line with eCTA's ambitions to chart micro-level dynamics (Kiran et al. 2015), the hypothetical case examples could likely make visible interactions such as human-technology relations, the persuasiveness, coerciveness, seductiveness and decisiveness of impacts as typified by Tromp et al. (2011) or the loci of

impacts such as the physical or cognitive introduced in section 2.2.2.

For instance, both examples could see alterity relations triggered with 'autonomous' cars, indicating an increase in alterity relations compared to non-autonomous cars in comparable situations, probably more so in the encounters with the more surprising and convincing mock autonomous car in example 2 driving towards a crosswalk than in example 1: Reactions like “Please don't run over me, robot!” accompanied by facial expressions signalling a sense of threat are conceivable and observable, signalling a potential shift in pedestrian-motorist power-relations and pointing to not only a *decisive physical* impact but also a *coercive cognitive* one (see Dorrestijn et al. 2014). Rothenbücher et al.'s (2016) interviews indicate increased discomfort in crossing the road only marginally but a research setting enabling more diverse participants could conceivably do it more. While a correct assumption regarding how 'in some cases' alterity relations would emerge could be made based on imagination or scenario-work as in eCTA, experiential exercises add value in that they can empirically ground such assumptions and thus increase the plausibility of propositions regarding future dynamics made in (e)CTA. Additionally, the exercises can reveal details such as the intensity and emotional type (e.g. terrified, happy) of such alterity relations as well as sociological factors (e.g. age, educational and professional background, etc.) regarding their distribution which imagination and scenarios cannot be expected to do.

Generally, the reorganization of relations and roles of already established practices can be more easily observed if such practices themselves, including relevant actors and circumstances, can be represented. Example 2, as it relies on guerilla tactics, could represent such practices by actually absorbing actual current practices into experiential futures exercises where they can be disrupted on the spot. For instance, the practice of crossing a road would likely be reorganized due to autonomous cars and example 2 can provide embodied insight into the ways it could conceivably happen. A part of the participants' reaction would be based on a disruptive feeling of novelty due to what is likely their first encounter with a supposed autonomous car.

A nuanced and empirically backed proposition like this regarding future soft impacts could be backed up by the exercise of example 2:

“Autonomous cars will coercively instigate fearful alterity relations especially in older people with a low level of education when crossing cross walks like the ones in the experiential exercise 2”

*The expansion of propositions to include unconsidered dynamics and hermeneutics*

Only a fraction of potential hermeneutic changes can be considered by a priori methods of imagination or scenarios. While the same is true of experiential exercises, they can transcend the constrained lifeworlds of the designers of scenarios through inclusion. The more peaceful example 1 would likely elicit more considered reactions and insights and thus can well elucidate potential changes in hermeneutics. For someone who would not want to let her neighbours or family know about her dealing with governmental services, it could trigger privacy-related concerns when imagined to occur on her doorstep. For someone with (personal) experience about homelessness, the meaning of bringing governmental services 'to one's doorstep' would, again, have a different meaning.

Also the understanding of behavior can improve. As some groups such as children or elderly citizens are systematically underrepresented in professionally driven (e)CTA processes, a better way to understand their potential behavior and in relation to the NEST of concern would be to let them interact with representations of it. Example 2, by exposing the image of the future, a supposed autonomous car, to passers-by in public, can effectively include said groups. Additionally, it could help taking into account complex dynamics of different forms of mobility ranging from dog-assisted walking to personal transporters like self-balancing scooterboards and unicycles. It could also lead to insights about antiprogrammatic behavior more easily as it could, in a surprising manner, happen on the spot. For instance, a group of adolescents might suddenly encircle the mock autonomous car and start filming it being stuck.

A proposition like this could exemplify a conclusion drawn based on the exercise of example 2:

“More than non-autonomous cars, autonomous cars are susceptible to antiprogrammatic behavior like harassment in (specific types of) road crossings”

In sum, there is plenty of micro-level insight that can be empirically witnessed and almost as such assumed to apply in the near future as long as the contexts do not differ considerably. Compared to scenarios and imagination in (e)CTA, such a posteriori insight would be empirically grounded, adding nuance as well as highlighting unexpected dynamics, thus both validating and expanding the scope of anticipatory propositions regarding soft impacts.

Overall, the exercises could conceivably highlight different ways in which autonomous cars

lack societal acceptance in the current circumstances or point to how parts of the socio-technical surroundings are at odds with them. Such points of conflict could also prompt innovative use concepts to compensate for drawbacks experienced during the exercise.

If there is reason to assume that the NEST of concern will proliferate which would be a rather safe assumption in the case of autonomous cars, the observed micro-dynamics such as feelings of insecurity in example 2 can become widespread, having wider repercussions. Autonomous cars could instigate new, the micro-level dynamics observed in the exercise on the *scale* of organizations and traffic practices across the globe. Assuming witnessed micro-dynamics and hermeneutics being transferrable to increasingly different contexts than that of the exercise (e.g. with regard to example 2, into different types of crossings, geographic locations and demographics) when proposing something about autonomous cars more generally entails more speculation.

### **Meso- and macro-level impacts beyond empirical containment**

First, the main caveats for the utility of experiential exercises in producing propositions regarding meso- and macro-level dynamics will be discussed. As meso- and macro-level dynamics are too large to be empirically contained in the experiential exercises, propositions regarding them, while grounded by the exercises, would be more speculative. There are, however, caveats that have to be taken into consideration when utilizing experiential exercises to develop further propositions. It should be asked, to what extent the observed micro-level dynamics can be scaled up when making such, more speculative propositions. In contrast to eCTA, CTA often aims to account for broader societal developments (see e.g. Parandian 2012; te Kulve 2011). CTA processes are sometimes (see Rip and Robinson 2013) structured along a co-evolutionary multi-level framework developed by Geels (2005).

The macro-level of Geels' (2005) framework is characterized by the long time it takes to change which is problematic considering the focus of this thesis on short-term anticipation due to epistemological (long-term anticipation entails increased speculation) and practical reasons (the exercises do not last long enough). The limited duration of the experiential exercises as portrayed in this thesis can become a problem as, for instance, soft impacts brought about by a NEST's symbolic and semiotic features could require more time to develop than experiential exercises grant. Likewise, routines cannot be established in a short, disruptive instance.

If one aims to emphasize routines as opposed to disruption when preparing the exercise, establishing a longer timespan for the experiential exercise might be warranted in the

footsteps of Hauser et al.'s (2018) postphenomenological design research or living labs which both 'manufacture routine' by letting participants live with artifacts of interest for a longer period of time.

Geels's (2005) macro-level landscape is additionally defined by more rigid elements such as social structures and physical infrastructure, relatively sheltered from changes on the micro-level (2005). Likewise, its sheer physical vastness cannot be contained in the micro-scale dynamics of experiential exercises. There are practical limitations as to how (physically) far reaching the experiential exercises can be in facilitating understanding of wider socio-technical systems that are implicated. For example, globe-spanning manufacturing, maintenance and resource gathering processes (e.g. mining practices) of technologies as well as their environmental impacts often remain behind a phenomenological veil and integrating them into experiential exercises, with the exception of maintenance, could be difficult, albeit often worthwhile.

Even closer to the meso-level of social networks and organizations, challenges remain. For instance, more indirect relations between autonomous vehicles and potential stakeholders that might get impacted are not as visible in experiential exercises. The soft impacts of less physical or to a higher degree black-boxed NEST set-ups can exemplify such invisibility: The impacts of data-driven aspects of technologies (e.g. data-ownership) may not be as easily apprehended by laypersons within the short duration of an experiential exercise. In the case of autonomous cars, it is indeed the data-driven aspects of the NEST that remains rather opaque (for users and non-users) unless specifically made visible in the exercise which again might differ from the intended or actual future experience the NEST would generate. Thus, the complex networks beyond the visible surface of the technology might remain somewhat unscrutinized in the more evaluative phase of the augmented eCTA exercise.

While meso- and macro-scale elements cannot be visibly impacted within experiential exercises, the introduction of a representation of a NEST on the micro-level could make visible potential, upcoming conflict points in the social embedding of that NEST. Thus, propositions regarding future soft impacts on the meso- and macro-level can still benefit from experiential exercises in constrained ways. For instance, in example 2, the potential impacts of autonomous cars in the macro-level might become visible in the form of misalignments between the existing physical infrastructure or the institutional setting such as traffic rules and the mock autonomous car in a traffic context. Example 2 could prompt considerations about such conflict points of societal and physical embedding, sparking insight on necessary or beneficial changes to traffic rules and infrastructure such as the further physical separation (e.g. through bridges and tunnels where expedient) of autonomous cars from pedestrians and



bicyclists or potential macro-level societal reorganizations such as re-writing the implicit codes of conduct in traffic (e.g. increasing responsibilities for bicyclists in terms of visibility), even by law.

The experiential exercises can also provide a basis for the development of propositions that in and of themselves do not correspond with what is observed during them but with what the exercises represent and implicate. The extent to which experiential exercises are able to mimic current practices depends largely on the range and type of actors and artifacts deployed. As role-playing elements are included in example 1, simulating existing institutional, meso-level practices and thus their potential transformation becomes easier. Especially if these actors and materials are associated with institutional roles and practices as in example 1, some meso-level implications could be derived from the exercise. Rather than generic observations about autonomous cars, more specific insights about particular organizational rearrangements could be expected to be evoked by the example as, in fact, Tellart's (n.d.) own description of the project claims. In practice, this could mean considerations of a less centralized distribution of services in the form of a transition from buildings to service vehicles, for instance, implying that many governmental employees could be able to work more independently.

Even macro-level elements can be implicated in the same exercise to the extent that propositions regarding them can be augmented. For citizens with reduced mobility and difficulties reaching governmental services in a centralized form, it could trigger macro-scale considerations about how autonomous cars would in such contexts affect one's citizenship and relation to the state as rather directly operationalized in the accessibility and quality of governmental services. Based on the concrete changes in practices as well as hermeneutical changes represented through the exercise in example 1 (e.g. in relation to privacy and accessibility issues), insight on potential changes to the notion of citizenship and the relation between the state and the citizens could be conceivable.

Based on considerations that can arise in example 1, more speculative proposition heavily extrapolated from the observed micro-dynamics, concerning both meso- and macro-level could be made:

“Autonomous cars can transform the organization of public services by instigating a move towards decentralized distribution of them and ultimately, re-arrange relations between citizens and the state by bringing governmental services closer to the latter.”

As indicated above, much insight gained in experiential exercises is not merely empirically witnessed in them and translatable almost as such into propositions regarding future soft impacts but is instead, stimulated by them. In other words, to fully utilize the exercises, the

anticipatory propositions that they help produce need not be limited to only repeating the empirical data gathered during them, carefully transferred into similar near future contexts but can also be concern impacts on a larger-scale and slightly further away in time.

Increased plausibility can also be established, although not to as high a degree, by using the results of experiential exercises as a basis for (also meso- or macro-level) scenario-building. Such a use for experiential exercises would resemble Boenink et al.'s (2010) approach that uses historical cases as a basis for developing (what she considers) plausible scenarios. However, as a distinction, Boenink et al.'s (2010) references to historical cases would widen the temporal gap between the empirical evidence near future time of concern and unlike in the case of experiential exercises, would not have to refer to the same NEST of concern but to *similar* ones.

#### **4.3.4. Recasting imaginaries and scenarios**

While this thesis has sought to go beyond scenarios and imaginaries as the primary images of the future in TA processes, relying on experiential methods does not mean independence of them. A highly relevant question during the pre-engagement of an experiential exercise concerns the extent of predetermination of the dominant use case(s) for the NEST of interest or the amount of thought given to the teleology of the NEST and commitment to it. In practice, the extent is dependent on contextual factors such as the phase of development and the extent to which the artifact is meant to be framed to the participants. Knowing the major application contexts of a NEST beforehand can help produce more plausible anticipatory propositions. Doing so, however, might detract the exercises from exposing different unintended use(r)s. Ironically, knowing how to apply EFMs is difficult without reference to imagination and a form of anticipatory pre-screening of (soft) impacts that itself is methodologically less context-aware or materially deliberative.

te Kulve (2011) has outlined a framework for CTA pre-engagement activities and the uncertainty and ignorance regarding the effects of NESTs as a reason to conduct such activities. Overall, pre-engagement activities entail a necessary reduction of the complexity posed by different uncertainties of the dynamics around the NEST (2011, 139). te Kulve (139) also points out that such a reduction should be “open-ended to take the fluidity of the situation into account and to avoid biases regarding (selection of) particular options”. te Kulve (2011), however, opts for comparatively resource-heavy, STS-based pre-engagement activities and scenario building. “In general,” he states, “a key point is the degree to which socio-technical developments have become articulated and are embedded in actors' activities, because this defines how much structuring of engagement [within the workshop] must be constructed by

engagement agents” (140). By engagement agents, he refers to the professional organizers of CTA workshops whose 'impartial' role is to increase participants commitment and direct their focus on the activities of the workshops (140). For the context of this thesis, the concept can be adopted to mean the organizers of experiential exercises in general. Given that experiential exercises would often be first-encounters between certain technologies and potential stakeholders, some structuring, professional guidance and pre-engagement could be warranted. However, letting the artifacts and participants 'do more epistemic work' in the exercises would take some pressure off of te Kulve's requirements for pre-engagement activities.

Even though this thesis aims to propose changes merely in the anticipatory and supposedly more epistemological part of the eCTA process, it also affects the evaluative part, as the two are interconnected. While experiential futures can open up the epistemological grounding of anticipatory work in the TA context, the epistemic structure of the exercises is not quite decentralized. Prototypes, perhaps even more than other types of representations of future conditions, exert considerable performative power: They make one type of a future seem more tangible and associable to the participants interacting with them and thus, more realistic and relevant, possibly enticing more actors into the network around the NEST of concern. In this sense, the framing power with regards to the futurity stays somewhat firmly in the hands of engineers and designers devising NESTs and their material representations. Thus, the critical question of to what extent EFMs would do their bidding should be kept in mind while contemplating to organize experiential exercises. Also the ethical permissibility of experiential exercises should be scrutinized beforehand. Ironically, such scrutiny would have to be based on utilizing imaginaries and possibly pre-determined moral frameworks.

Ultimately, it would be unreasonable to try to eliminate Kiran et al.'s (2015) primary anticipatory methods of imagination or informal scenarios regarding upcoming experiential exercises their preparation stage. In fact, determining the parameters of relevant factors of an experiential exercise such as the details of the image of the future should be informed by anticipatory thinking of some sort. What this chapter has tried to do is to find how experiential, material deliberation can augment current (e)CTA anticipatory practices that give scenarios a larger role. To conclude, unless experiential exercises are used as a visceral and participatory platform to source more plausible scenarios, imagination and scenarios should remain in a smaller role as a part of pre-engagement activities for the exercises.

## Chapter conclusion

Based on the two earlier chapters which have critiqued eCTA and its related practices and as a response outlined methodological remedies to their drawbacks, this chapter has shown how such methodological remedies are already being applied outside of the disciplinary boundaries of TA. Section 4.1. has presented EFMs and related approaches in their own context. Section 4.2. has proceeded to demonstrate the compatibility of experiential futures methods with the ambitions of eCTA and CTA as well as the methodological remedies chapter 3 has proposed for them. EFMs enable a short-term, materially deliberative anticipation in an *ex ante* a *posteriori* temporal niche and echo eCTA's theoretical ambition of transcending the utopia/dystopia dynamic in producing anticipatory propositions.

Section 4.3. has showcased EFMs adapted into an eCTA context in practice through two fictitious examples related to autonomous cars which as a NEST of concern exemplify the utility of experiential exercises well due to their rigid tangibility and likelihood of being mass-produced. Based on the two fictitious examples in section 4.3.3. the epistemological benefits of EFMs manifest especially with respect to propositions regarding soft impacts on the micro-level: They can be considered more plausible assuming that the near future contexts they represent are similar enough and their content can be expanded given the data regarding potential unexpected and innovative (non-)use dynamics that can be gathered in experiential exercises. Experiential exercises can also produce insight on propositions concerning meso- and macro-level but it would have to be mostly speculative. The section has also discussed contextual factors and methodological concerns that affect what can be achieved with EFMs as a part of (eC)TA processes, including the NEST of concern, the target group of the experiential exercise as well as the detail, realism and framing of the material deliberation.

The usefulness of experiential exercises is highly context dependent. Still, some structural caveats can be identified: Soft impacts that span beyond the physical (e.g. globe-spanning logistics and manufacturing processes related to the NEST of concern) and temporal (e.g. subtle, slowly developing changes in routines) scope of experiential exercises cannot easily be grasped by propositions grounded by experiential exercises. Additionally, technically black-boxed aspects of NESTs pose a challenge to experiential exercises in that their impacts are not easily understood during a short exercise. While the EFM-augmented approach presented in this chapter demands less focus on pre-engagement activities oriented towards historical precedents than existing CTA approaches, new types of pre-engagement activities intended to facilitate a fruitful material representation come to the fore, having to relate to an *a priori* understanding of the NEST of concern and relevant socio-technical dynamics. Thus, it cannot

be said that EFMs would completely end eCTA's reliance on imagination.

## 5. Conclusions

The thesis has begun by introducing soft impacts in section 2.1. as a broad category of impacts without moral closure that are difficult to quantify with unclear causal relations. Section 2.2. has tried to understand ethical-constructive technology assessment (eCTA) along related approaches as ways to anticipate and operationalize soft impacts.

In three sections, chapter 3 has first critiqued imagination and scenarios as eCTA's primary methods of anticipation and established three conditions for it to optimally situate the anticipation of soft impacts: It should, if possible, 1) be participatory in the present in order to ground anticipation and narrow the temporal gap between it and the near future, 2) include an artifactual element to make the anticipation process truly context-sensitive and 3) enable the fulfilment of the two previous criteria necessitating empirical inquiry and still remaining anticipatory.

Chapter 4 has more concretely examined how these conditions can be fulfilled by combining (e)CTA with experiential futures methods (EFMs). After section 4.1. has introduced EFMs generally, section 4.2. has paired them with (e)CTA theoretically and section 4.3. in practice, in the form of experiential exercises. Two hypothetical examples involving autonomous cars in section 4.3. have illustrated how experiential exercises can help produce propositions regarding future soft impacts whose plausibility is higher when anticipating soft impacts on the micro-level dynamics and lower when doing so on meso- or macro-scale as the latter two cannot (easily) be represented within experiential exercises. Reflecting on the epistemic potential of EFMs in (e)CTA context also more generally, beyond the two examples, section 4.3. has considered how a multitude of methodological choices (regarding, e.g., participant sampling) and contextual factors (such as the new and emerging science or technology (NEST) of concern) affect EFMs' degree of usefulness.

Based on the explorative work done in this thesis, its main research question,

*“How can experiential futures methods epistemically enrich propositions regarding future soft impacts produced by eCTA methodology?”* warrants a threefold answer:

1) Compared to propositions regarding future soft impacts produced by scenarios or imagination, (e)CTA augmented with experiential exercises can, due to having a strong empirical element, increase the plausibility of propositions regarding future soft impacts and add nuance to them.

Insofar as plausibility can be increased through empirical grounding (as Boenink [2013] claims), playing out socio-technical micro-dynamics in the present can increase the plausibility of anticipatory propositions as the near future dynamics meant to be represented can be considered similar enough. Scenarios and imagination would have to resort on *assuming* that autonomous cars, for instance, trigger alterity relations which would make their propositions regarding future dynamics less plausible and nuanced than if there was empirical evidence that quasi-autonomous cars actually do so: The data gathered in experiential exercises can also reveal specificities such as the intensity, type and sociological distribution of the alterity relations. For instance, the extent and types of potential unease when crossing the road in front of a supposed autonomous car can better be understood in flesh and projected into the near future rather than merely imagining it.

2) Compared to propositions regarding future soft impacts produced by scenarios or imagination, (e)CTA, augmented with experiential exercises can expose more dynamics to be included in (still plausible by virtue of empirical grounding) propositions regarding future soft impacts:

In practice, the breadth of plausible propositions can be expanded by way of increasing participation and extending it to groups like children and elderly citizens that generally do not make it into (e)CTA processes by inviting them as could be done in example 1 and staging experiential exercises in public places where also such groups are represented when crafting anticipatory propositions, as done in example 2, exposing a representation of an autonomous car to different forms of mobility (from dog-assisted walking to personal transporters like self-balancing scooterboards and unicycles) and different stakeholders (with different ages, educational backgrounds, degrees of ability, etc.). EFMs would thus likely enrich the set of lifeworlds involved in the anticipation process compared to professionally driven (e)CTA and accordingly the breadth of propositions regarding future dynamics. Accordingly, having a number of participants with their different lifeworlds participating in material deliberation also means that unintended and antiprogrammatic dynamics which a narrow set of designers of scenarios could easily overlook (e.g. children 'interrupting' autonomous cars as illustrated under example 2) could be played out in experiential exercises and be included in anticipatory propositions.

3) The empirical evidence created in experiential exercises can be used to ground (in the present as opposed to historical evidence of *similar* cases) and stimulate further development of propositions regarding the NESTs of concern:

While the two previous ways of enrichment entail rather directly translating empirically witnessed phenomena into propositions regarding near future dynamics, even more ambitious, speculative ones can benefit from empirical grounding in experiential exercises. However, such propositions push into CTA's territory in that they concern broader, meso- and macro-level dynamics or the territory of longer term research (like in living labs). Either more speculation or charting of relevant contexts by way of pre-engagement activities to understand changes in such wider contexts is needed in making such propositions.

Micro-level observations contained within the exercise can still inform propositions that concern meso- and macro-levels in contexts similar to the one of the exercise when they are implicated or partially represented in it (e.g. when role-play is used to represent interactions between citizens and government officials as in example 1) and when they point to points of conflict in the societal embedding of the NESTs (e.g. highlighting the outdatedness of physical infrastructure and traffic laws as in example 2). Such, slightly more speculative, if yet empirically grounded insight concerning meso- and macro-level phenomena can be translated into propositions regarding future soft impacts and serve as a spring board for scenario development.

This more tentative and indecisive step onto the meso- and macro-level has elucidated the boundaries of experiential exercises in enriching propositions regarding future soft impacts. Accordingly, this thesis has also charted the implicit other side of the main research question: What is it that EFMs *cannot*, at least easily, augment (e)CTA with? The major methodological limitations of the combination concern the visibility of elements when propositions start to scale up towards meso- and macro dynamics (as portrayed in Geels 2005) such as 1) parts of socio-technical networks that are positioned beyond the physical reach of experiential exercises or 2) technically black-boxed and 3) ones that require long-term interaction between the artifacts and participants of experiential exercises.

This thesis can also elucidate further paths for research. To address the often black-boxed socio-technical complexity and the short duration of experiential exercises highlighted above, living labs might be a promising, perhaps even more experiential (due to their higher degree of 'organic embeddedness') path to pursue as, for instance, Botero and Hyysalo (2013) view longer term interactions as crucial in understanding socio-technical co-evolution beyond the



immediacies experiential exercises can elucidate.

This thesis has also shown a way in which postphenomenological research could be taken from a rather discourse analytical posture (see e.g., Kudina and Verbeek [2018]) towards a more artifactual, hands-on approach. For foresight scholarship, an integration with TA, as attempted in this thesis, might bring the benefits of increased methodological rigor (whose lack is identified by Kelliher and Byrne [2015]) and actor/action oriented micro-scale focus whose lack has been identified within futures research (Dufva 2017).

In conjuring the methodological additions to (e)CTA, this thesis has had to resort to speculation regarding the impacts of autonomous cars in two hypothetical examples, leading to a degree of inconclusivity in its conclusions. Accordingly, the foremost recommendation of this thesis for future research is simply empirical application of its insights: While this thesis has charted more theoretical and methodological aspects of soft impact anticipation, the value of such an approach should be tested in empirical practice. Qualitative, micro-sociological and interactionist research that, among other things, focuses on the institutionalization of practices and design research can make good use of the approach conjured in this thesis. Technologies whose physicality is not immediately visible such as data-driven technologies or virtual reality could be interesting case studies. Complex, worldwide logistics chains needed for technologies would not be easily included.

As this thesis suggests, epistemology and participation are interlinked: Questions of plausibility are interlinked with questions of citizen participation in technology development. While this thesis has aimed to create a more distributed and participatory epistemology for the purposes of soft impact anticipation, one performative aspect remains centralized in the hands of professionals: Not unlike a designer of a scenario, the designer of the prototypes and maquettes needed for experiential exercises holds considerable amount of performative power as materializing one future can entail less consideration for other possible or plausible ones. Still, the approach that this thesis suggests could also serve, broadly understood, a purpose of democratization of both technological anticipation and development, opening another strand for further research.

## 6. Literature

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