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Theory of and within foresight – "What does a theory of foresight even mean?"

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Abstract

There has been an argument for a while now that foresight lacks a coherent theoretical basis. The discussion on theory of foresight calls for a theory, but rarely expounds on what the scope of theorizing is. The discussion has been centered on philosophy and different frameworks for theorizing, but the scope and form of theorizing have not been explored. We contribute to this discussion by examining foresight through

the lens of established theory building literature to map what constitutes a theory in the first place and how it applies in foresight. The main guiding question is “What does a theory of foresight mean?”

We fist draw on the literature on theory development in social sciences to discuss a framework for theorizing and then examine the scope of theorizing through it. Our main argument is that when we propose developing (a) theory of foresight, we need to separate three levels of analysis: one is foresight as knowledge creating activity, second is foresight as a process and as a social/organizational intervention, and foresight as theorizing about the future of a given socio-technical system.

Keywords: foresight; theorizing; theory development; epistemology

Highlights

- Literature on foresight calls for more theory, however the scope of theorizing is not clear
- We argue that theory development in foresight has three levels of analysis
- The levels are epistemology of foresight, foresight as a process and theorizing within foresight
- We analyze these levels of theory development to provide a framework for further research

1. Introduction

There has been an argument for a while now that foresight lacks a coherent theoretical basis (Öner 2010; Hideg 2007; Marien 2010; Mermet, Fuller, and van der Helm 2009). The discussion on theory of foresight calls for a theory, but rarely does it expound what the scope of theorizing is or should be. Some propose that innovation studies or systems theory would provide a foundation for a theory of foresight (Andersen and Andersen 2014; Saritas, Pace, and Stalpers 2013; Samet 2012). Similarly, some authors propose that the system of thought know as critical futures studies provides a theoretical basis that carries foresight and futures studies (Hideg 2007). Others have instead discussed philosophy and different frameworks for theorizing (Öner 2010; Voros 2007).

Despite these contributions, serving as reviewers for journals and conferences which deal with foresight leads us, the authors, to note that in the mainstream of foresight the link to theory and thus contributions to scientific knowledge are relatively weak. In this paper, we argue that the difficulty in making progress towards developing a theoretical basis for foresight is in part due to a lack of understanding of what the possible scope of theory or theorizing in and about foresight is. The main guiding question is "What does a theory of foresight mean?", as posed to M. A. Öner by a reviewer when proposing a paper on theory of foresight (Öner 2010). To answer this question, we examine foresight through the lens of established theory-building literature in order to determine what constitutes a theory in the first place and how it applies to foresight. The outcome of this analysis is a framework for theorizing in foresight. We conduct this analysis on theorizing mainly from an empirical realist point of view, but we will argue that it is also compatible with the whole spectrum that goes from positivist to constructivist epistemologies. In terms of disciplinary scope, the analysis is focused on exploratory "strategic" foresight, but also discusses vision or agenda setting, "backcasting", foresight.

Our main argument is that proposing a theory of and within foresight requires three separate levels of analysis. One is foresight as a knowledge creating activity; this level is meta-theoretical in the sense that it is not foresight per se, but rather about foresight (its philosophical underpinnings). The second level is foresight as a process leading to a social/organizational intervention, which implies paying special attention to the practical consequences of the foresight activity. Lastly, we propose foresight as theorizing about the future of a given socio-technical system. We further argue that the latter two are the most fruitful for foresight, given that they should establish more precise conditions for how to do foresight, how to measure its effectiveness and how to ground it into context-dependent theories of the future.

The contribution of the paper is an explicit and state-of-the-art framework for theory development in foresight expounded through the three levels of analysis mentioned above, as well as pointing out potentially fruitful directions for further research.

The rest of the paper is organized as follows. The second section discusses what constitutes a theory and how to present one. The third section reflects on the definition of theory as applied to foresight and offers an answer to the question "what does a theory of foresight mean?", pointing out examples and potentially fruitful new directions. The fourth section concludes the paper with discussions.

2. What constitutes a theory - A framework for theory development

Starting from a general definition, a theory is a "systematic ideational structure of broad scope, conceived by the human imagination that encompasses a family of empirical (experiential) laws regarding regularities existing in objects and events, both observed and posited. A scientific theory is a structure suggested by these laws and is devised to explain them in a scientifically rational manner." ("Scientific Theory" 2013).

In essence a theory establishes a causal link between constructs, predicting their interdependent behavior. Thus, a theory explains phenomena in terms of causal links between constructs through a set of laws or principles of interaction. To this end, a theory needs to include definitions of its embedded constructs, their principles of interaction, descriptions or predictions about expected behavior of the system and associated testable propositions or hypotheses. That is to say that a theory should be both positive and exclusive, i.e. it should be explicit about which phenomena it explains, with which assumption, and which it does not. (Gregor and Jones 2007; Dubin 1969; K. R. Popper 1963).

In less general terms, management and business administration research, a field adjacent to foresight, has also paid significant attention to what constitutes a theory. Whetten builds on Dubin when posing four questions that need to be answered (Dubin 1969; Whetten 1989; Bacharach 1989):

- *What* constructs and factors are relevant to explanation of the phenomenon of interest?
- *How* are the constructs related; what are relationships?
- *Why* the constructs are expected to behave as posited by the theory; what are the underlying dynamics of the interaction that manifest in the expected behavior?
- *Who, where, when*; what are the boundaries of the expected interaction; what is expected to happen between the constructs, where and when? What is not supposed to happen? These questions set the geographic, social and temporal limits or scope of a theory and its corresponding applicability.

Sutton and Staw (1995) clarify the matter further by presenting a set of related ideas which are commonly mistaken for a (complete) theory. The list includes important (yet in themselves insufficient) parts of a formalized theory, underlining that while a theory has many components or facets, the heart should be a causal explanation of the phenomena of interest:

- *References are not theory*: Summarizing the existing body of literature without explaining how the literature forms a body of principles that explain the phenomena of interest is not a (contribution to) theory.
- *Data are not theory*: Data describe what has been observed, theory explains why the observations are such as they are.
- *List of variables or constructs are not theory*: Definition of constructs and/or associated variables is a necessary condition for (testing) a theory, but insufficient by themselves.
- *Hypotheses are not theory*: Just as constructs and variables, hypotheses or predictions are part of a theory, but not the theory itself.
- *Diagrams are not theory*: A diagram can be helpful in illustrating causal connections between constructs, but it is not a theory in itself without explanation of why the constructs are connected.

3. Theory of and theorizing in foresight

It is not just theory that poses a problem, there is an ongoing discussion about the very nature and definition of foresight (Miles et al. 2008; Sardar 2010) and its relation to futures studies. We do not intend to enter into this debate here; for the purposes of this paper we adopt a broad definition following Joseph Coates (through Miles et al., 2008, p. 7) that *Foresight is a purposeful process of developing knowledge about the future of a given unit of analysis or a system of actors, which is aimed at action in the form of public or private policy making, strategizing and planning,* and that *foresight is frequently a participatory, involved and collaborative process.* Stemming from this definition, we propose that foresight is

1) An organized social process; an intervention (in an organization),
2) to create actionable and domain/context specific information or knowledge about the future.

Now, if we move on to define what theory in foresight is, as a starting point we suggest three different perspectives on that question (c.f. Figure 1). First, our focus may be on developing a 'Grand Theory' of foresight as a knowledge creating activity, which directs us towards the philosophical and methodological underpinnings of foresight to answer the question: How can we gain knowledge about the future (or futures)? This first level of theorizing concerns an ontology and epistemology of foresight. Second, we may be interested in theorizing about foresight methods, which we argue means conceptualizing foresight as an organizational or social intervention and developing a theory of why foresight has the impact we observe or expect. The associate questions are: How do we organize foresight effectively? What impacts can we expect from foresight and why? Third, the original question may be aimed at developing a theory of foresight in the sense of a domain-specific theory, a 'theory of the future', that explains and predicts the behavior of the socio-technical system of interest and gives grounds to conjectures about the future. The generic question is: What is likely to happen in the future (-s), and why? The first level will be addressed under the heading "Epistemology of foresight"; the latter two levels under the heading "Theorizing in foresight".

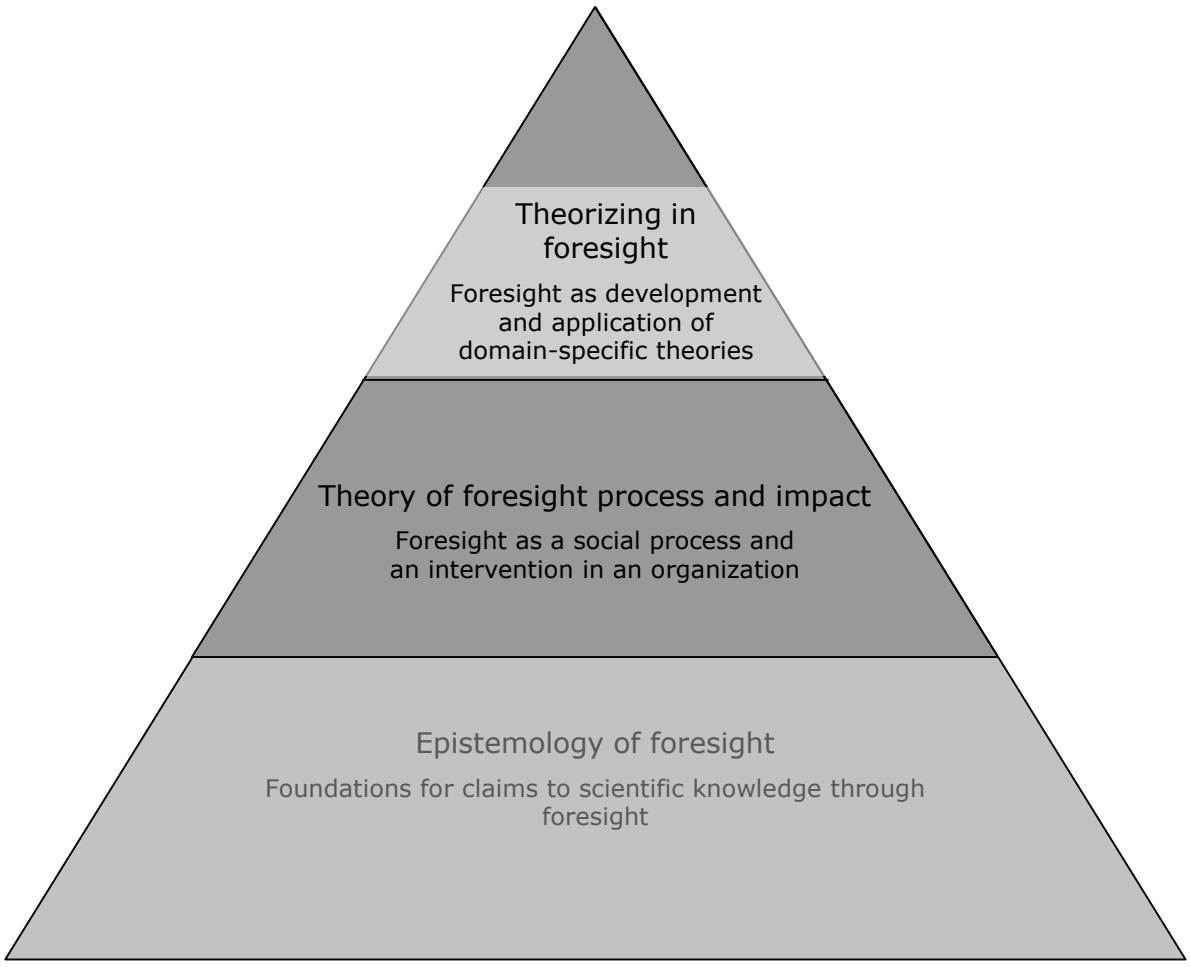

Figure 1: Proposed levels of theorizing in foresight

3.1 Epistemology of foresight

If we think of a theoretical basis for foresight as an activity to create knowledge of the future, in a manner similar to futures studies, we need to turn to philosophy of science, particularly ontology and epistemology as well as existing futures methodologies. A search in the ISI Web of Knowledge (September 2013) with the keywords "epistemology AND futures OR Foresight" in the topic field returns a large number of articles, and if narrowed down to core futures journals there are over 200 hits, but a review of abstracts uncovers that they mostly discuss instances of foresight or futures studies. Thus there are very few papers that explicitly discuss theory or epistemology of futures and foresight (Voros 2007; van Vught 1987; Aligica 2003; Bell 2009; Bell and Olick 1989; Slaughter 2001; Slaughter 2002).

In this section we review epistemology critically. We discuss what a theory of foresight in terms of epistemology means and what ramifications different philosophical outlooks have for theorizing and knowledge generated in foresight. Thus our purpose here is to review the dominant epistemologies as a platform for a theory of foresight, not to argue for or against any of the epistemologies as such.

3.1.1 (Post-) Positivist or empirical realist epistemology of foresight

This sub-section follows a post-positivist or empirical realist discussion as presented by Piirainen et al. on the nature of knowledge of the future (K. A. Piirainen, Gonzalez, and Bragge 2012) and updates it based on a literature review. Piirainen et al. (2012) adopt the common-sense realist viewpoint originally introduced by Moore (1959) and follow Popper's cosmology. Differing from earlier views of empiricists later known as (logical) positivists, Popper (e.g. 1978) argues that three 'worlds' exist; world one (W1) that is 'real' in the traditional sense, immutable, unchanging and independent of the observer, a world of physical objects and events. The second world (W2) is the world of human observations, emotions, in effect a kind of representation of the first world inside human psyche. The third world (W3) is a world of the artificial (to use Herbert Simon's (1996) word). The third world contains the product of human mind, such as language, ontologies and theories; de Jouvenel (1967) would call these 'representations'.

Popperian ontology highlights challenges, or even paradoxes in creating future knowledge: if we adopt the view that there is an immutable reality and our inner worlds are connected to it, we have to be interested in what happens in the world (W1) because it links us and our inner worlds (W2) to other thinking entities. If there is nothing else than a "phenomenon" of interaction in inner worlds, we can further argue that the effort of trying to foresee the future becomes a moot point, as we cannot be sure whether there is anything outside us nor can we be sure that we can convey any meaning to anyone else. However, there is the challenge of acquiring reliable information or knowledge of the world (W1) because of the limits of the human condition in observing the real world and translating our knowledge of either one of the worlds to representations that are able to convey the knowledge between the senders' and the receivers' inner worlds in the artificial world (W3) (e.g. Simon 1985; Simon 1986; G. Wright and Ayton 1986).

Following the definition of knowledge as fact-based, critically built and examined, empirical knowledge, i.e. "justified true beliefs", the schema for developing knowledge about the future within the (post-) positivist paradigm, in so far as it is possible, follows the same logic as empirically verifying a theory (Ketonen 2009; van Vught 1987). That is, we devise a theory that predicts that given the circumstances the system of interest will develop in a certain manner. However, there are philosophical obstacles for developing these predictions, which we will discuss next.

Aligica argues against this symmetry of logic of explanation and prediction, also known as nomological-deductive model of explanation, largely on the grounds that assuming this epistemological position constrains the field of scientific inquiry and that the model is based on an abstraction of the discovery of Newtonian physics (Aligica 2003; Aligica and Herritt 2009). Arguing that the nomological model of prediction limits futures research and foresight seems like an argument from adverse consequences (Sagan 2007) more than a genuine refutation of the epistemology. Further, arguing that because the model of explanation and prediction is based on limited observations, and is to a degree idealization, is or at least borders the naturalistic fallacy. We can indeed learn from history of science that developments in (natural) science are often extraordinary, but that fact does not logically invalidate prescribing this mode of inquiry, without making the argument that because this prescription is based on extraordinary circumstances it is thus invalid, which is almost a textbook, albeit exclusive or negative, example of deriving what ought to be from what is.

To us, there are two legitimate critiques for the nomological-deductive model of forecasting. The first criticism is the arguably inherent determinism on the nomological model. In one account, von Wright

(2009) presents Laplace's Demon, a hypothetical omniscient observer who, based on its perfect knowledge, can predict the state of the world exactly at any given time. The prerequisite for this predictive power is full knowledge of the properties of the world and the processes that shape it. In relation to ontology, the demon knows the exact properties of W1 and can predict them based on this knowledge. It is often supposed that this implies that the world is deterministic and that the knowledge of the demon is limited to W1 instead of W2 and W3. Even though it may seem that this Laplace' Demon is the philosophical precedent to the forecaster, who based on the analysis of historical development and the present, gives an estimate of the future, von Wright argues that determinism and thus such an extensive foreknowledge is impossible. It follows that we cannot know the future in the sense of having verified logical sentences or systems of rules, as we cannot validate claims about the future until the future has come (Ketonen 2009; G. H. von Wright 2009). However, if we build the model of explanation and prediction on robust theory and validate the underlying model of prediction with past data, we may predict with some confidence (van Vught 1987). In fact, this is the practice on which the whole practice of (quantitative) forecasting relies, but it can be just as well extrapolated to qualitative prediction (Malaska 2009).

Second challenge is the application of Hume's truism to futures studies (see e.g. Lynch 1996; orig. Hume 2006). Namely, by nature the knowledge of the future is often based on analysis of the past and present and extrapolation of existing structures. This logic is challenged by Hume's critique that observation of a recurring phenomenon alone is not a guarantee that it will continue to occur in the future, thus naïve extrapolation has an inherent risk of failure (van Vught 1987). Successful generalization or extrapolation basically demand that we know the underlying causal laws and can assume that they are unchanged for the period of interest, which can be interpreted that we need sufficient knowledge of the world so as to be aware of the boundaries of our knowledge and validity of our predictions.

To condense the discussion, what we can know about the future is based on extrapolation of past and present structures into the future. However, we must consider Hume's truism, and from this it follows that the knowledge of the future is probabilistic and uncertain at best and, as we cannot be certain that the structure of the world does not change within the period of interest, subject to limitations that follow from the assumptions the extrapolation stands on, effectively nullifying our knowledge in the positivistic sense.

3.1.2 Interpretive and critical epistemology of foresight

The philosophical problems of positivist inquiry have been recognized in the futures field, at least implicitly, quite early, and it seems that the field holds quite largely constructivist-interpretivist views (Voros 2007; Fuller and Loogma 2009). In short, these hold that (future) reality is socially constructed and thus belongs to the realm of the inner world (W2) and the artificial (W3).

This constructivist orientation is often combined with critical philosophy, which adds the perspective of emancipation and claims that the discourses about the future hold an intrinsic value (e.g. Hideg 2007). An early proponent for critical foresight was Richard Slaughter, who strongly argued that foresight should be used to improve lives (Slaughter 1995; Slaughter 1996). Slaughter has presented what is called integral futures agenda that aims to integrate multiple perspectives and methods within each foresight process (Collins and Hines 2010).

Hideg (2007) presents an exemplarily lucid delineation of critical futures epistemology and we use the article in the following analysis as a primary source. Hideg (2007) describes the central tenet of critical

futures studies as they are applied to foresight in the following way: "… the future is interpreted as something that already exists in the present in the thoughts and emotions of people. … Future thoughts are forming and reforming in the process of discourses, so the futures existing in the present are open and humanly constructed" (Hideg 2007, 37).

If we take the statement "the future … already exists … in the thoughts and emotions of people" as meaning that the future of the real world exists in peoples' minds, it is a logical falsity from a realist view. Arguing that the future in any real-world (W1) sense can be inferred (alone) from individuals' (expert or lay person, many or few) thoughts (W2) does not hold scrutiny. We can, however, say without controversy that images of the future exist in peoples' minds. Positioning this statement within the Popperian ontology, these images of the future when spelled out are essentially a representation (in W3) of the participants' internal representation (W2) of the real world (W1). Thus, in this view, foresight is also subject to the condition called "double hermeneutic" (introduced by Giddens, 1993), i.e. we quickly end up interpreting someone elses' interpretation of the empirical phenomenon we want knowledge of (Harbers and de Vries 1993), which adds another degree of separation from reality. In common sense wording: this line of inquiry conveys knowledge of what the people think of and feel about the future, but not necessarily knowledge of the future or present state of the real world.

There have been several forays to the challenges of this hermeneutic stance, which futures and foresight literature in general have failed to take into account, for example Sackman's (1974) criticism of the Delphi method and Loveridge's (2004) survey of use of expert knowledge and the inherent challenges, as well as the long standing research on human psychology and bias in foresight and forecasting (see below, section 3.2.2). In the light of this literature it seems that lay and expert knowledge is most readily suited for positioning foresight in relation to existing attitude climate and power structures, and getting cues for describing the present. Whereas the use of (expert) knowledge in structural analysis of the world and framing the main change processes which shape the future requires critical appraisal of the input.

Hideg's (2007) underlying suggestion in the finding that all humans can formulate conjectures about the future seems to be that discourses about the future have intrinsic value. She also argues that consensus is something that should not be forced in a foresight process. These tenets exemplify an emancipatory or empowering orientation. In relative contrast, she recognizes that if the foresight is managed by a facilitator with no substance knowledge, the results will likely suffer from cognitive biases, and there is a need for an expert "who deals with the possible futures, their degree of desirability and inherent risks" (Hideg 2007, 41). We use the word contrast, as these two lines of reasoning are inherently in conflict: when all future conjectures are equally valuable and correct (factually plausible and their impacts equally understood) representations of the future, there should not be the need to adjust or complement them with other knowledge, and thus the value of the participatory process is in the discourse. The problem from a practical standpoint is that if there is no consensus, foresight does not produce actionable results, and while empowering, may be useless in concrete terms. Thus consensus and discourse are two sides of the same coin; we encourage discourse in the foresight process to build a consensus around some actionable futures, and thus we need both 'elitist' factual knowledge and participative discourse.

A further challenge for critical foresight is the old is-ought problem (Black 1964) and naturalistic fallacy (Ridge 2013), which dictate that what is preferable or 'good' (what should or ought to be) cannot be deduced or derived from what is, unless there is a universal and continuous preference function to

separate what is (objectively) preferable or ethical from what is not (Black 1964). First, this means that what ought to be, is a factor of value judgment separate from knowledge or knowing. And second, although Wendell Bell embarked on the journey to build a set of overarching values in his 'Foundations of Futures Studies' (Bell 2008), it is in practice highly unlikely and philosophically quite debatable whether humans can develop a unified moral code, beside certain basic ethics, and preference function outside relatively small, cohesive and/or coercive groups (for discussion, see e.g. Young 1989; C. Brown 1997; Chandler 2001). Rather if we focus on preferable futures instead of anticipating plausible and probable futures, we end up serving one interest group or another unequally.

3.1.3 Pragmatist epistemology

An alternative to the classic positivist-interpretive-critical epistemologies is pragmatism. This research paradigm is often succinctly summarized to the credo "what works, is true", attributed to Charles Sanders Pierce. Osmo Kuusi presents a lengthy discussion on pragmatist epistemological considerations related to elicitation of expert foresight through the Delphi method (Kuusi 1999). For pragmatism, it is action that enables change and action is inextricably linked to purpose and knowledge. Accordingly, the weight of knowledge claims in pragmatism is typically placed on utility; following James (1995, 79), a logical claim is valid if (1) acting upon it has the consequence which can be reasonably extrapolated from the corresponding logical sentence, and (2) the consequences prove to be useful in practice. In the context of foresight this would mean that if a (new) foresight method is useful in producing intended outputs, it is valid; or, if the outputs of a foresight program bring about the intended action, then it has been a useful exercise and the results are valid. Thus in pragmatism, knowledge (from W1-2) is embodied in the artificial (W3) and that instantiation of knowledge; how it works informs the researcher.

Aside from James and Peirce, Dewey is another key figure in this American pragmatist school; when explaining Peirce, Dewey states that "…to be able to attribute a meaning to concepts, one must be able to apply them to existence…. And the modification of existence which results from this application constitutes the true meaning of concepts" (Dewey 1998, 1:3). This implies that inquiry is by nature oriented towards future action; not just towards description or prediction (in the positivist sense) or deep understanding (in the interpretive sense).

Following the arguments by Kuusi (1999), one could even argue that the mainline of foresight has in fact implicitly adopted pragmatism. This claim is to some extent corroborated by examining the main stream of foresight methods literature, e.g. from the recent Future-Oriented Technology Analysis conference in Brussels. However, the pitfall of pragmatism, as discussed in the design science context, is that if we make an intervention in an organization without a clear theoretical (*ex post* or *ex ante*) rationale, we cannot know whether the outputs or impacts emerge because of the intervention or despite it (K. A. Piirainen and Gonzalez 2014). Thus adopting what might be called colloquially easy-going pragmatism, working ad-hoc and based on previous experience and intuition without much minding epistemology or methodology, may produce good results in practice as measured by foresight impact, but at the same time may leave a significant gap to claiming scientific knowledge as we cannot claim to know how and *why* exactly the results and impacts came about. That is to say that the link between the artificial and other worlds may be quite weak at times. Thus, while pragmatism seems to be a good fit the field, it has its own challenges when it comes to claims to knowledge.

3.1.4 Summary on epistemology

Voros (2007) notes that each inquiring paradigm - positivist, interpretive and critical – seeks and provides answers to different sets of questions. In fact interpretive inquiry by default answers a different question than realist inquiry; interpretive inquiry is perfectly suited at making representations (in W3) of what people may think is going to happen, and what they hope and fear (in W2), but that does not by default tell anything about the real processes that shape the future (in W1). Realist inquiry attempts to minimize the effect of the inquirer and make representations (in W3) of the world (W1), but can only reach a certain degree of confidence. The limitation of the positivist paradigm is that it cannot provide answers to inter-subjective meaning-making processes between conscious agents (e.g. Cunliffe 2010). As a mirror- image, interpretive inquiry is subject to its own philosophical pitfalls and while it is focused on specifically on relation of conscious agents, it does not convey any more information about the future than does realist inquiry. This observation in fact is the starting principle of the so called integral futures, which posit that futures inquiry should combine these paradigms to explore the real processes and their interplay with and effect on conscious agents (Slaughter 2001; Collins and Hines 2010).

To build on the epistemological discussion as a platform for further philosophical argumentation we conclude that while we cannot know the future in a very strict scientific sense, we can propose probabilistic conjectures about the future and present visions, alternatives, or goals (Sardar 2010; Glenn 2009). Differing slightly from the development arc of Futures Studies, foresight has had an endemic component for improving things both from a business and human perspective (e.g. Miles 2010; Slaughter 1996). The main rationale for adopting a realist platform for foresight is for want of a better word 'practical' (Bell and Olick 1989; Bell 2009); whatever we achieve within futures discourses, we need to explain, predict and control our transformation to avoid negative externalities.

From the perspective of explorative "strategic" foresight, the emphasis on discourse and empowerment or emancipation in critical, interpretive or subjectivist epistemology, and the sentiment that foresight should give room for all shareholders' perspectives are obviously well-meaning ideas, but also risk making foresight an arena of political debate instead of a knowledge creating exercise. It seems to be a feature in especially the critical-interpretitive or subjectivist paradigm that having a discourse about the future has intrinsic value. What is rarely recognized is that putting the discourse ahead of knowledge brings individual and organizational politics ahead of facts and/or politicizes facts as well, making foretelling the future ever more unpredictable and opening a door to a host of externalities. Unless foresight results in fact-based and actionable conclusions and enable forming a consensus and commitment to action, it is of little consequence in decision-making. In rather the same vein, longtime proponent of critical inquiry, Latour argues that the mission of critical studies should be getting closer to facts by renewing empiricism, not only discussion or discourse (Latour 2004).

If we return to the definition of foresight as an activity to create actionable knowledge for decision making: for practical public and business policy purposes, discourses *as such* hold little value unless they are coupled with or convey important information. The failure of, or at least one of the most frequent criticism against, positivist epistemology has been its idealistic or even naïve portrayal of human rationality and its insensitivity to socio-political dynamics in the context of study. However, realist epistemology is not mutually exclusive with recognition of the reality of social dynamics, power structures and their interplay with foresight results, hence Wendell Bell's advocacy of critical realism (e.g. Bell 2009). Even more explicit

recognition of the different but potentially complementary properties of epistemologies is in the integral agenda, which encourages approaching futures from different epistemological and methodological perspectives for a more complete view (Slaughter 2008; Slaughter 2001).

Further, regardless from within which paradigm we work from, we can develop insights about the limits of our knowledge through recognizing the philosophical assumptions under our claims to knowledge. Recognizing these limitations in turn makes foresight more rigorous and further enables developing theory of or in foresight, as we shall discuss below. In fact, given that foresight can be called a multi-paradigmatic field in the same manner as futures studies, we propose that more explicit recognition of the different epistemologies and their implications for foresight is needed.

3.2 Theorizing within foresight

This section discusses theorizing in foresight as, first, application and/or development of domain-specific theories about the future and, second, development of theory about the process and impact of foresight as intervention. Foresight is a multi-dimensional activity in itself; it can be separately or simultaneously a social meaning-making and negotiation process, an intervention to a system or organization, and a theory building or knowledge creating study.

3.2.1 Theorizing in foresight

Early authors on epistemology of futures have argued that theory is the philosophical foundation, based on which we can reasonably claim knowledge about the future (van Vught 1987). It follows that, insofar as knowledge of the future of the real world can be created, it seems to be limited to domain-specific knowledge, or theory. This notion supports the suggestion that theorizing within the foresight process creates valid conjectures about the future. It calls for exploration of domain-specific knowledge and theorizing about the dynamics behind the present systems state and its corresponding extrapolation.

Going back to the general theory development literature presented above, the important thing about theory is the answer to the question *why* something happens. This corresponds to understanding and explaining the system of interest, answering why the system of interest is in the observed state and what processes, mechanism and drivers have brought it there, which enables conjectures about its plausible future states. As such, we posit that this embodies the most fruitful level of theorizing in foresight since it regards concrete theories about the future. Moreover, this level, we argue, and agree with previous accounts (Öner 2010; Chermack 2007), is not systematically explored in existing literature. Taking the perspective to foresight as a theory building activity, this facet of foresight linked to the process of forming conjectures on what is likely to happen in the future within a given system of interest.

The relevant body of research to construct this explanation varies considerably with the unit of analysis. It has been suggested that foresight is highly context dependent (Belis-Bergouignan, Lung, and Héraud 2001), that is, knowledge of the context, path of development and boundary conditions are essential in creating realistic foresight. This might suggest that applicability of the resulting theories are limited, but similar limitations concern most social science studies that are not based on population level large-sample analysis. Following the context dependent nature of knowledge, recognizing and mapping the boundaries of the unit of analysis and the surrounding system also helps map the generalizability and applicability of the theory that results from foresight.

In a similar fashion, one can theorize focusing on different units of analysis to develop insights about the behavior of the system, given some parameters. If the level of analysis is national (technology) foresight, the relevant theories may be (national) innovation systems and (macro) economics, either neo-classical heterodox or evolutionary, which aim to explain development and functions of (national) economies. If the area of interest is more focused on societal phenomena, for example, social and behavioral sciences can be an appropriate basis to understand the development of the system under scrutiny (Barré and Keenan 2008). On the level of industries or sectors, the relevant literature may be (sectoral) innovation systems, industrial/organizational economics, or management/business administration theories on clusters or networks (Alkemade, Kleinschmidt, and Hekkert 2007; Andersen and Andersen 2014).

There are two examples that study development of industrial sectors making a link to 'innovation studies', a field which studies innovation and its effects in various levels of innovation systems (c.f. Fagerberg, Martin, and Andersen 2013; Smits, Kuhlmann, and Shapira 2012). For example, Alkemade et al. study Californian wind power markets to derive insights to wind power market development elsewhere (Alkemade, Kleinschmidt, and Hekkert 2007), and Jensen et al. use insights from innovation systems to propose an agenda for Nordic facilities management (Jensen, Andersen, and Rasmussen 2014). In both cases, innovation systems were used as a theoretical lens to structure foresight and develop an understanding of the sector dynamics to enable projections of the future. An additional example is a study by Piirainen et al. (2010) who developed a theory, in this case a causal model for supply and demand, for one product group of an industrial enterprise to simulate the effect of different market drivers. The model was based on basic microeconomic model of supply and demand, and the mainline model contained parameters that enabled quantified input through environmental variables chosen according to industry scenarios. This model enabled solid probabilistic estimates of different scenarios.

A different perspective comes from general systems theory (Saritas 2013; Laszlo 1986; Saviotti 1986), system dynamics (e.g. K. Piirainen, Kortelainen, and Lindqvist 2010) and complexity theory (Samet 2012; S. L. Brown and Eisenhardt 1997), which can also provide valuable lenses for theory development. However, these are more akin to frameworks or toolboxes made up of general principles for describing, understanding and explaining dynamic behavior of human and natural systems and phenomena. In other words, they offer tools for developing explanations, rather than offering specific explanations themselves.

3.2.2 Theorizing on foresight process and impact

Second, we can theorize about the form of the process, or foresight methodology, using existing theory and/or developing new theories to make more effective foresight interventions. In fact, if we conceptualize foresight primarily as a social negotiation process, as suggested by several definitions of foresight (e.g. Miles et al. 2008; Farhi 2002), this level of theorizing will be the most meaningful.

Barré and Keenan (2008) argue that the impact of foresight is quite poorly understood despite the accumulation of literature on the effect of foresight (e.g. Amsteus 2008; Grupp and Linstone 1999; Ahlqvist et al. 2012; van der Meulen and Löhnberg 2001; Georghiou and Keenan 2006; Harper and Georghiou 2005; Miles et al. 2008), due to e.g. the vagueness of the objectives of foresight in the first place, the distributed nature of activities, and especially because of the complexity of the cause and effect relationships and difficulties in measuring the possible impacts. Answering the question of what affects foresight impact or explaining how and why foresight works could be called building a 'utility theory' for foresight. Here we need to consider foresight as an organizational or social intervention, which opens up another level of

theory development on the effectiveness of foresight methods in achieving the impact they seek. For example MacKay and McKiernan (2004) explore failures of foresight through the lens of cognitive psychology. They identify the psychological phenomena that cause the observed failures and design a specific intervention built on existing research in their scenario process to avert the identified biases.

Besides developing a macro-level explanation for the impacts of foresight, the foresight process itself is an interesting object of study in terms of group dynamics and behavior and their effects on the results and impacts. To this end, the literature relevant to foresight methodology would be behavioral science, especially social psychology, small group theory, and the applied fields of facilitation and collaboration research as well as decision-making research and organizational studies, in the vein opened by Borch, Dingli, and Søgaard Jørgensen (2013). There is a wealth of research on facilitation, including design of collaboration processes and using repeatable interventions to get predictable results, under the label of collaboration engineering (Briggs, de Vreede, and Nunamaker 2003; Kolfschoten and de Vreede 2009; Kolfschoten and de Vreede 2007). Bragge et al. (2005) for example have used the collaboration engineering approach for the design of collaborative roadmapping.

On a related topic, thus far it seems that method development has been path-dependent and driven by context, application and previous experience more than any specific theory. Considering recent conference and journal papers reviewed by the authors, those that propose to develop and/or introduce a novel method are generally limited to summative descriptions of a single instance where the method was used. The published literature scarcely evaluates the methods or pits them against each other. While these instances may be useful in practice, they do not necessarily advance our theoretical and methodological understanding of foresight, since they mostly omit principles, hypotheses or main factors regarding their performance and success (or failure).

Elsewhere in the management and business administration literature an argument is advanced that theory-based and purposeful design of interventions would improve the impact and repeatability of such interventions. This research orientation is labeled as Design Science Research strategy, and it is most common in the Information Systems field (van Aken 2004; van Aken and Romme 2009; Hevner et al. 2004; K. Piirainen, Gonzalez, and Kolfschoten 2010). Design science envelops both theorizing and practical application, given its overall goal of searching state of the art research-based solutions to practical problems by enveloping previous knowledge and a practical context (Hevner 2007) in a process that approaches action research (Järvinen 2007; Sein et al. 2011). A practical example for application of design science strategy to foresight of futures has been the application of collaboration support software to scenario planning methods (K. Piirainen and Lindqvist 2010).

Finally, as discussed above, one overlooked contribution of behavioral science to foresight, especially participative foresight, is the body of literature on cognitive bias in forecasting, including such phenomena as optimism bias, effect of cognitive load on evaluation of future events, general future discounting, and using emotions as a source of information (e.g. Schwarz and Clore 2007; Schwarz and Clore 2003; G. Wright and Ayton 1986; Sharot 2011; Ebert 2001; Lawrence et al. 2006; Bovi 2009). The cognitive limitations, and their implications in foresight methodology, are an essential consideration for realistic foresight together with other aspects of behavior in and as a result of foresight interventions.

3.3 Summary: theory of and within foresight

Starting with epistemology, it is a topic that has sparked attention in futures studies regularly, but received relatively little explicit attention to date in relation to foresight. Epistemology is also (potentially) a polarizing topic, which has been fiercely argued over in the past. On the surface, it may seem that exploring epistemology would not move the field of foresight forward. On the contrary, we actually propose that recognition of different onto-epistemological paradigms and their limitations is very important for theorizing in foresight as well as applying foresight into policy-making. In short, what can be gained from an epistemological discussion is insight to the boundaries of and the assumptions behind the knowledge that foresight can produce.

However, besides epistemology, we suggest that foresight needs to also focus on the more concrete levels of theorizing: These are developing domain specific explanations of the unit of analysis that is the subject of foresight and developing explanations for foresight impact and more effective foresight interventions. We have discussed each of these levels above, but we use the table below to summarize and make more concrete suggestions for further research. The suggestions are made primarily from the perspective of foresight as mapping plausible future developments. However, they are compatible with visionary or backcasting foresight at least on the process level.

To increase the granularity and actionability of the suggestions, we introduce another dimension to the table to complement the level of theorizing. That is the unit of analysis, which gives us three levels between individual people (micro perspective), organizations and groups (meso perspective), as well as nations or other populations (macro perspective). The rationale is plain, rigorous theory development needs to consider the unit and level of analysis and draw the border of applicability. We propose that the dimensions can be taken as guidelines and reminder to consider the appropriate level and unit of analysis when developing theory (c.f. TFAMWG 2004).

In practice, these levels are (likely to be) mixed in foresight practice and research, especially when it comes to method development and theorizing about the impact. That is to say, that we do not wish to impose pigeonholing ever foresight research project into one of the nine boxes. However, we beg to argue that keeping the level of analysis explicit, even if the research would proceed concurrently on multiple or overlapping level, makes for a better theory or theorizing as well as more mindful, critical and rigorous research.

Table 1: Summary of levels of theorizing

<table>
<tr><th>Level and unit of analysis</th><th>Individual behavior (Micro)</th><th>Individual organizations or other groups (Meso)</th><th>National or other populations (Macro)</th></tr>
<tr><td rowspan="2">Theorizing in foresight</td><td></td><td colspan="2">How does the unit of analysis function, what factors make up the behavior of the system, why?
Given the properties of the system, what is likely to happen in the future?
Theoretical basis: domain and question specific theories from natural, behavioral and social sciences</td></tr>
<tr><td colspan="2">Given the objectives, what incentives/interventions/instruments are needed to induce behavior that fill the gap from present to the goals?
Theoretical basis: behavioral science, economics, policy analysis</td><td></td></tr>
<tr><td>Theory of foresight process</td><td>How do individual biases affect foresight, and how to design foresight to minimize them?
How do individual perceptions affect impact and acceptance of foresight?
Theoretical basis: behavioral sciences, psychology</td><td colspan="2">How do group and organizational dynamics affect foresight process, how to design and facilitate foresight for best effect?
How do organizational and group dynamics affect impact of foresight?
Theoretical basis: behavioral science, economics, business administration, policy analysis</td></tr>
<tr><td>Epistemology of foresight</td><td colspan="3">How and what of can foresight generate knowledge?
What are the boundaries of knowledge generated from within different inquiring paradigms and with different methods?
Theoretical basis: ontology, epistemology, methodology</td></tr>
</table>

4. Conclusions

We may now answer the question “what does theory of foresight mean?” As discussed, it may mean three separate and complementary things. Returning to the levels presented in figure 1, it may mean epistemology of foresight, which is relevant to the claims to (scientific) knowledge produced in foresight. It may also mean theory of foresight process and impact, about the utility and attribution of foresight as an intervention in a given socio-economic system, for example a (national) innovation system, industrial sector or an organization, either by means of *ex post* evaluation, meta-analysis of evaluations or in a deliberate design research process, which both builds and evaluates an intervention. Finally, it may mean theorizing as a part of foresight activity, contributing to theory development within a field of research by building theories to explain and predict future development as a part of foresight activity, be it innovation systems and economic competitiveness or welfare and social cohesion. Here, the foresight process and its associated evaluation may serve to refine or refute existing theory.

Finally, to be critical, we need to ask the question "what is there to achieve with more theory?" First, if foresight research wants to proceed as a scientific discipline, theory development is generally considered as an important mark of progress. It is generally thought that a discipline exists when there is "an impressive" body of tested knowledge, there are faculty positions that focus on the discipline, and there are scientifically acceptable means to advancing the body of knowledge (e.g. Melton 1975; Shermis 1962; Abbott 2001). Another criteria for a field is its progressiveness, as defined by its ability to progressively create new cumulative theoretical insights (Lakatos 1971; Vasquez 1997). A review of literature and serving as a reviewer in the field reveals that the archetype of foresight article is a description of a novel method or an application of an existing method in a novel environment, followed by description of the project and/or foresight findings. This suggests that giving more attention to theory within the substance area, phenomena of interest, or foresight itself would make foresight more progressive as a field.

Second, for those who may suspect that theory development in the context of foresight is a means to satisfy academic intellectual vanity, applying and developing theory of foresight as a process can contribute to understanding foresight better. Additionally, and perhaps even more importantly for the sceptics, theory can contribute to better, more repeatable and effective foresight interventions. Third, discussion on epistemology of foresight helps researchers and practitioners understand the borders of knowledge and its applicability. Finally theorizing in foresight contributes to better, more valid, reliable, and unbiased (or recognizably biased), foresight, and may also contribute to the surrounding disciplines through refinement of the theories. As theories are essentially empirically tested codifications of generalizable knowledge, and thus contribute to building a discipline and in the field, we argue that more rigorous theory development would both improve the quality and impact of foresight as well as legitimacy of the field.

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