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Design as Anticipation and Innovation

Co-creating a future by learning from the future as it emerges

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Abstract: In this theoretical and conceptual paper we claim that there is a close connection between design, innovation, and anticipation. What they have in common is that they want to make sense of a future and they want to bring about change to a future that is only partly known. This applies even more, if design has to come up with completely new solutions for highly complex problems, such as the big challenges of our current economic or social systems.
We will develop a future-oriented perspective on innovation and design. Both design and innovation are operating in the field of uncertainty. That is why we will take a closer look at anticipation and how it deals with various forms of uncertainty. In highly complex domains it turns out that the future is not only unknown, but also unknowable. For design this means that we need completely new strategies and skills that have to go beyond problem solving and rather involve the notion of potentials and the creation of new niches and new problem spaces leading to new spaces of meaning. In the final part we will develop the notion of design as "co-creating the future by learning from the future as it emerges" and derive an alternative set of (epistemic) attitudes and skills.

Keywords: anticipation, change, design, future-oriented, innovation, skill, uncertainty.

1. Introduction

In the face of the world´s huge challenges (e.g., climate change, financial crisis and an ongoing collapse of capitalism, migration, education, etc.) design has received new attention over the last decade (e.g., Binder et al. (2011)); not so much in the sense of making things aesthetically more appealing, making devices smarter, or enhancing the usability of user-interfaces, etc., but rather as a means and as a tool for creating solutions for these grand challenges.

As we are living in a highly complex world and high-speed economy we are confronted with changes and problems that exceed our capacities to solve them by classical means of science or analytical tools only. These are problems that go far beyond bounded rationality (Felin, Kauffman, Koppl, & Longo, 2014; Simon, 1996), ill-structured, or wicked problems (Dorst, 2006), as they are dealing with *uncertainties* about a *future* that is not only unknown, but also *unknowable* (Sarasvathy, Dew, Velamuri, & Venkataraman, 2003). As soon as we have to cope with living systems, social systems, economic systems, or technology we have to be aware that we are facing these kinds of problems and uncertainties. That is the point where design comes into play.

Following Krippendorff´s stance on design as "making sense of things" in the sense of not only deeply understanding a phenomenon, but also as making something *new*, or *creating new meaning* or a new understanding (Krippendorff, 1989, p. 9), this paper proposes that there is a close connection between *design*, *innovation*, and *anticipation*. This seems to be a necessity as we are confronted with dramatic changes in society, economy, and technology that are both hardly understood and—at the same time—have to be shaped actively in a new way so that they become beneficial for society.

Here are some examples of questions that do not have (yet) an adequate answer, because it is very hard to "make sense" of them in the above mentioned manner (as understanding and creating new meaning): What is the impact of the internet of things on our society and/or economy; how can we make sense of the observation that the classical capitalist dynamics is in a process of decline and how could we possibly design for a post-capitalist system or an economy of abundance (instead of scarcity) (Mason, 2015); what is the meaning and what are the implications of a zero-marginal cost society (Rifkin, 2014), etc.? Of course, these are extreme questions; they are crucial, however, as they are at the root of many challenges and problems. It has turned out that they cannot be answered by scientific means only, as (i) the classical scientific paradigms simply do not (yet) account for these developments in a sufficiently satisfactory manner and (ii) their complexity is so high that it would surpass classical analytical tools.

Despite these shortcomings, there is—already today—an urgent need to design eco-systems that do not only react to these changes, but that anticipate what "wants to emerge" and, by that, proactively provide environments assimilating these developments in order to enable a thriving future and create value. We refer to such environments as Enabling Spaces (Peschl & Fundneider, 2013a, 2014a). We are proposing that one possible way that such a design challenge can be coped with is to join forces and concepts from a designerly approach and way of thinking (Buchanan, 2015; Cross, 2001; Krippendorff, 2006) with recent concepts from the fields of innovation and anticipation. The core idea is to understand design as a kind of innovation process in which we are "learning form the future as it emerges" (compare Scharmer (2007, p. 52)) and shape it accordingly.

The paper is organized as follows: in section 2 we show how design, innovation, and anticipation are connected: what is common to them is that they want to make sense of a

future and they want to change a future that is partly unknown. Building on the insights from section 2, section 3 develops a future-oriented perspective on innovation and design; it is based on the concept of various levels of uncertainty. Both design and innovation are operating in an uncertain future, especially, if they are dealing with highly complex phenomena such as mentioned above. In these domains it turns out that the future is not only unknown, but unknowable. In other words, completely new strategies and skills are necessary that go beyond problem solving and involve the creation of new niches and new problem spaces leading to new spaces of meaning rather than mere problem solving.

In section 4 we will focus on the concept of potentials and their role for creating sustainable design and innovations. Finally, we will develop the notion of design as "co-creating the future by learning from the future as it emerges" and derive an alternative set of (epistemic) attitudes and skills.

2. Design, Innovation, and Anticipation

2.1 Design as "making sense"

We are aware that the issue of finding an appropriate "definition" of design is both highly diverse and controversial. On a very general level, we follow Buchanan´s approach to design, as it relates the role of design to organizations (which makes it interesting for the field of innovation) and the complexity of our world:

> „Put simply, the challenge for design is how to influence organizations not only to affect the thinking and behavior of individuals, but also to have a positive effect on human experience in an increasingly complex world (p 6)… The role of design in our lives is to create the environments within which human intent can move forward in interaction, forming human meaning in the reach toward satisfaction and fulfillment of the original intent. (p 18)" (Buchanan, 2015, pp. 6 & 18)

On a more operational level, we suggest to stick to an understanding of design that is rather wide and that can account for the challenges mentioned above:

> „The etymology of design goes back to the Latin de + signare and means making something, distinguishing it by a sign, giving it significance, designating its relation to other things, owners, users, or goods. Based on this original meaning, one could say: design is making sense (of things)… However, making sense always entails a bit of a paradox between the aim of making something new and different from what was there before, and the desire to have it make sense, to be recognizable and understandable. The former calls for innovation, while the latter calls for the reproduction of historical continuities." (Krippendorff, 1989, p. 9)

For our argument the following aspects are important in Krippendorff´s and Buchanan´s approaches to design:

- *Understanding and making sense*: In order to bring forth novelty, it is necessary to have a profound understanding of what is already there.

- *Creating new meaning (and realities)*: Design is not only about understanding, but also about creating novelty in the sense of bringing forth new meaning and/or new realities. The premise is that only, if we have a very good understanding of the phenomenon we want to change or innovate, we will be able to change it in a sustainable and thriving manner. Furthermore, it seems that most of what one wants to change is already implicitly present in the existing reality; the challenge is to (i) identify these future potentials, (ii) to cultivate them, and (iii) to bring them into reality (e.g., by physical manifestations, such as artifacts, processes, social changes, discourses, etc. in the sense of Binder et al. (2011) or Krippendorff´s trajectory of artificiality (2006, 2011)).
- *Embedding into already existing frameworks of reference and historical continuity*: Despite their novel character, it is necessary that these new artifacts remain "understandable": in other words, we have to ensure that an external user can still find a connection between already established mental models or frameworks of reference and the novel artefact. Only then it will be possible that s/he may find orientation in this novel space of meaning(s).
- *Creating enabling environments*.

The question arising from such a perspective is how such an approach to design can be realized? On which theoretical foundations could it be based, what are its epistemological principles? Which processes, socio-epistemic practices, and skills might lead to such kinds of future-oriented and future-changing artifacts?

For answering these questions we suggest to take a closer look at the fields of *innovation* and *anticipation* as they are intrinsically dealing with these issues and could help us in forming an alternative view on design.

2.2 Future-oriented Innovation

Similarly as with design, innovation is discussed in a highly diverse manner (Fagerberg, Mowery, & Nelson, 2006) and comes in a wide variety of flavors. In this paper we concentrate on an understanding of innovation that has an economic and processual focus. As a first approximation, P.Drucker defines innovations as: "…the search for and the exploitation of new opportunities for satisfying human wants and human needs." (Drucker, 1985, p. 15) Among the many approaches and perspectives on innovation we have chosen the following quotation, as it characterizes the most important aspects and issues in a very comprehensive manner:

> Innovation is conceived as a process that includes the generation, development, and implementation of new ideas or behaviors. Further, innovation is conceived as a means of changing an organization, either as a response to changes in the external environment or as a preemptive action to influence the environment. Hence innovation is here broadly defined to encompass a range of types, including new products or services, new process technologies, new organizational structures or

> administrative systems, or new plans or programs pertaining to organizational members." (Damanpour, 1996, p. 694)

What are the most important aspects that are relevant for our argument?

- Innovation is a *process* and not (only) its final product. Innovation has to be understood as a socio-epistemological process (Baregheh, Rowley, & Sambrook, 2009; Fagerberg et al., 2006; Peschl & Fundneider, 2014a; Peschl, Fundneider, & Kulick, 2015) integrating knowledge processes and social practices. This is important, as the aspect of being a socio-epistemological process is essential to our understanding of design as an activity of co-creation between stakeholders.
- Innovation is not only about creativity or new ideas, but also about their *successful implementation* (e.g., in the market; see also Schumpeter (1934)).
- The source of innovation is in its "*inside*": being either the inside of the object of innovation (OOI) itself and/or in the organization (in the sense of a social system) being responsible for bringing forth this innovation.
- *Future-orientation & shaping the future*: Innovation is not only about reacting to changes in the environment, but also about *pro-actively* influencing the environment in such a way that novelty may arise in the future. From a design perspective, this second case is even more interesting, as design—understood in the above manner—is concerned with generating new meaning by changing the environment or creating new niches.
- Finally, innovation is not only about (physical) products, but covers the whole range of artifacts as suggested by Krippendorff (2006, 2011).

Innovation in that sense has clear orientation towards the future. This is not always common in the field of innovation as in many cases the creation of novelty is rather understood as extrapolation form the past: i.e., innovation is implemented in incremental steps and as a process of optimization and adaptation (to a changing environment) (compare the discussion on incremental vs. radical innovation (Ettlie, Bridges, & O'Keefe, 1984a; Leifer & others, 2000)). As will be shown below, we are proposing an approach to innovation and design that tries to "learn form the future as it emerges" in order to be able to understand and develop (future) potentials leading to radical novelty and a thriving future.

If we assume such a *future-oriented* perspective of design and innovation, we are confronted with the challenge of how to shape our future and, as an implication, how we can anticipate possible future states of our environment and/or of these aspects of the environment we intend to change. *Anticipation* is a requirement for designing the future.

2.3 Anticipation

The aspect of anticipation is included in almost any kind of design and innovation process, as —in most cases—they are dealing with future states in one way or the other. Whenever we have to make decisions (and innovation/design is about making decisions) or we intend to

change an aspect of our environment in a design activity, we are in the process of anticipating some aspect of the future. In other words, we are using the (knowledge about) the future already in the present moment in order to achieve a (hopefully) desired future state by anticipating both this future state and the necessary means for reaching this state. R.Poli describes anticipation as follows: "Generally speaking, anticipation concerns the capacity exhibited by some systems to tune their behaviour according to a model of the future evolution of the environment in which they are embedded." (Poli, 2010a, p. 770) In this context, Poli points out the importance of a "model of the future"; this is in accordance with Krippendorff´s "making sense" and profound understanding/knowledge (of the object to be changed) as a prerequisite for any kind of design process. In general, such a "model of the future" is a specific kind of *knowledge* that my assume various forms, such as an intuition, an idea, theory, a belief, guess, prediction, projection, etc.

However, what is common to all these kinds of knowledge is the following key premise of anticipatory systems: „future states may determine present changes of state." (Poli, 2010a, p. 770). This is opposed to the classical Newtonian systems thinking in which future states are *not allowed* to affect the present changes of a system. This difference is also a crucial for design (and innovation) as these processes are led primarily by a (desired or perhaps not [yet] exactly known) future state. Their intention is to change a future state of the system and/or to create a new system/artifact/...

From a philosophical perspective, this leads us directly to a very old concept, namely the concept of the *final cause* (e.g., Aristotle (2007)) as opposed to the efficient cause (compare also (Mitleton-Kelly, 2007)). Really new systems cannot be predicted in the classical Newtonian manner (exactly, because they are new), but they emerge in an act of (co-)creation. The final cause is the driving force (although it might also co-emerge (Mitleton-Kelly, 2007)) that "pulls" the whole design/innovation process (towards its future/destination). It is the "sense" in the process of Krippendorff´s (1989) "making sense".

Poli expresses this in the context of anticipation as: "Future actions are interpreted according to an ''in-order-to'' structure, whilst past actions are interpreted according to a ''because'' structure. In-order-to motives are components of the action: they shape the action from within. By contrast, because-motives require reflective acts upon already taken decisions. This structure helps explain why we perceive actions as free according to in-order-to-motives and as determined according to because-motives." (Poli, 2010b, p. 10)

3. Towards a future-oriented perspective of design and innovation

Bringing together what has been argued for in the previous sections, we can conclude that design (and innovation) can be characterized as dealing with a future that is not yet enacted, that is unknown, that is uncertain, a future that has yet to come, that has to be brought into existence by exactly this design process. We have seen that the process of anticipation plays a central role in this context; more concretely, the anticipation of future final causes and meanings that go beyond predictions as we know them from a Newtonian perspective of the

world in which we can extrapolate from the past into the future by making use of and adapting existing structures. The futures we are having in mind here do not yet exist, they have not been thought of (yet).

3.1 Design as dealing with uncertainty

However, they might exist as "latents" (Poli, 2006, 2011), potentials, or "adjacent possibles" (Felin et al., 2014; Kauffman, 2000, 2014). If we are interested in designing such futures, we have to direct our attention towards yet untapped and to be anticipated possibilities or *opportunities* that lie in the future. On a more fundamental level, this implies that we are dealing with the problem of *uncertainty*. Sarasvathy et al. (2003, p. 144) have developed three types of uncertainty about the future giving rise to three different kinds of opportunity:

(i) Design as dealing with uncertainty about a future in which possible solutions exist and are known

In the classical approach to design, in most cases, one identifies a gap between a known demand or need and an already existing (pool of) solutions and exploits this solution. The solutions are "downloaded" from pre-existing knowledge (Scharmer, 2007). Both the problem space and the solution space are known in advance. The challenge is to identify this gap and—from an economic perspective—to fill it as quickly and inexpensively as possible. This leads to a *recognition* and *allocation* view of opportunity. "The opportunity is any possibility of putting resources to better use… The core idea is that all products and ideas that can potentially exist are all known to be feasible but costly to produce." (Sarasvathy et al., 2003, p. 147)

(ii) Design as dealing with uncertainty about a future in which possible solutions exist and but are not known

If demand exists, but supply does not (or vice versa), the side that does not exist (yet) has to be *discovered*. As is shown impressively by Kauffman et al. (Felin et al., 2014; Kauffman, 2011, 2014; Koppl, Kauffman, Felin, & Longo, 2014) these discoveries cannot be known ahead of time as they might give rise to completely new and unexpected usages for particular artifacts, solutions, or resources (compare Kauffman´s (2014) example of unexpected usages of a screw-driver). Being epistemologically open and alert are key skills for discovering these unexpected solutions/opportunities ("discovery view" of opportunities). This means that the designer has to explore the search space (i.e., latent solutions) by repeated trials. It can be compared to an experimental setting in which he/she learns about and uncovers the possibilities/distribution of his/her new knowledge and potential innovations in a trial-and-error process over time. This is closely related to the approach suggested in the predictive mind hypothesis (Clark, 2013; Hohwy, 2013) in which one tries to reduce the prediction error (= uncertainty) by adapting one´s knowledge. In most cases this leads to an *optimization process* as it is known from incremental innovation (Ettlie, Bridges, & O'Keefe, 1984b; Fagerberg et al., 2006; Peschl & Fundneider, 2014b; Tidd,

2006). As is shown by Felin (2012), this approach is primarily driven by the external environment: i.e., the cognitive systems adapts to the environmental structures and constraints; by doing so, it tries to come up with new solutions or innovations. This implies that "they focus on what can be absorbed from the environment, on the basis of what has been experienced in the past. The structure of the environment—and not the structure of the mind itself, or the nature of the organism under study—is central to these models." (Felin, 2012, p. 285)

(iii) Design as dealing with uncertainty about a future that is not only unknown, but also unknowable

This notion of uncertainty opens up the space for the *creation* of new possibilities, niches, or solutions and is the most challenging task in the field of design and innovation, namely the creation of profound novelty and new knowledge. Economically speaking, neither (knowledge about) demand/need nor supply/solution exists ahead of time. Generally speaking, possible (sensible) future needs or functions are not known at the present point in time; they have to be brought into existence as a (completely) new opportunity or (design) solution. This requires a process of *creativity* (Amabile, 1996; Boden, 2004; Bohm, 1998; Kaufman & Sternberg, 2010; Koppl et al., 2014) that creates these new opportunities in an abductive manner. In terms of the classical approaches to cognition (Friedenberg & Silverman, 2006; Newell & Simon, 1976; Simon, 1996) or economics (Alvarez & Barney, 2007; Felin et al., 2014), this case implies that both the search- and the solution-space are unknown; rather, they have to be brought into being in a process of mutual co-creation and interaction with the environment and stakeholders, as the telos is not known. "*Telos* is neither ignored nor imposed on the phenomena concerned. Instead, ends emerge endogenously within a process of interactive human action (based on heterogeneous preferences and expectations) striving to imagine and create a better world… the crux of the creative process view is the need to build non-teleological theories of human action, wherein values and meaning emerge endogenously." (Sarasvathy et al., 2003, p. 155f). As will be shown in the sections to come, we will go one step further by claiming that dealing with this type of uncertainty in a "creative manner" is not only an endogenous process, but it is involved in an emergent process of co-creation between cognitive activities, behaviors, and the (future) potentials of the environment (in the sense of Buchanan (2015, p. 18)). This gives us a first indication as to how Krippendorff´s (1989, 2006) sense making and creating meaning could be achieved.

It is clear that these three levels of uncertainty cannot be seen separately from each other, as they mutually depend on and interact with each other (as is also evident form design and innovation practice). However, it is the third case that is in the focus of our attention, as it is not only the most interesting, challenging, and promising (in the sense of designing and creating novelty and opportunity), but also the most general case and a prerequisite for (i) and (ii) (Sarasvathy et al., 2003, p. 157).

Hence, if future-oriented design and innovation are about making sense of and creating futures, we have to be aware that we are always operating in the domain of uncertainty and the unknown. This brings us to the final issue, namely how to deal with the unknown and how we possibly could "learn from this supposedly unknown future".

4. Design as "co-creating a future by learning from the future as it emerges"

4.1 Potentials, latents, and adjacent possibles

From an ontological perspective, this "unknown future" can be seen as follows: any phenomenon, entity, system, or object is unfolding its own behavioural dynamics according to its inner workings and its interactions with the environment over time. This means that this phenomenon or object is not completely determined in its dynamics (in the sense of not being completely predictable). This perspective has its roots in, for instance, Aristotle´s metaphysics (Aristotle, 2007) and draws on the concepts of potentia/potency and actus/actuality or, as Kauffman (2014, p. 4ff) calls them, (adjacent) possibles/res potentia and actuals/res extensa; contrary to actuals, possibles are open to develop in various ways and directions that are partially intrinsic to this phenomenon/object and partially dependent on environmental stimuli, influences, or changes. R.Poli (2006) introduces the concept of *latents* and *potentials* in this context: "´Categorical openness´ means that the entity is only partially determined, some of its aspects are still hidden. Better: some of its determination may be latent. The difference between being hidden and being latent can be clarified as follows: hidden components are there, waiting for proper triggers to activate them. On the other hand, latent components do not exist at all in the entity's actual state." (Poli, 2006, p. 77f) The interesting and challenging point is to (a) identify these latent possibilities and (b) to cultivate them in a non-imposing manner so that they can develop into "interesting" and sensible innovations. This can be achieved by following a dynamics having its foundation in the concept of adjacent possibles: "New Actuals create adjacent possible opportunities in which new Actuals arise in a continuous unprestatable co-creation." (Kauffman, 2014, p. 6)

The interesting question for the context of design and innovation is how it is possible to identify these potentials and how to make use of them in order to bring about new and thriving solutions and innovations.

4.2 Learning from the future as it emerges

For design (and innovation), the really interesting challenge is to not only react and adapt to changes and problems, but, above that, to actively co-create/co-evolve new environments, problem spaces, and shape the future in a sustainable and thriving manner. „Co-evolution needs to be distinguished from adaptation, which is a one-way process, when the entity adapts to changes in its environment. While co-evolution happens when the interacting entities, co-evolve with their broader ecosystem." (Mitleton-Kelly, 2007, p. 118)

This involves highly sophisticated skills and capacities on an individual/cognitive, designerly, as well as organizational level: e.g., being able to identify latent or hidden potentials (Poli, 2011), being able to redirect and reframe one´s patterns of perception and cognition (Depraz, Varela, & Vermersch, 2003; Scharmer, 2001, 2007), or dealing with self-transcending knowledge (Feldhusen, 2014; Kaiser & Fordinal, 2010; Scharmer, 2001). In other words, being able to bring forth sustainable radical innovations that are not based on the projections from the past into the future, but that are grounded in a process of "*learning from the future as it emerges*" (Scharmer, 2007, p. 52). We refer to this process as Emergent Innovation (Peschl & Fundneider, 2008, 2013b).

Our cognition and symbolic capabilities enable us to intellectually deeply penetrate the environment in order to achieve a profound understanding of the potentials that are not yet realized in a particular part of the (internal or external) environment; i.e., potentials or latents (Poli, 2006, 2011) that are already there, however hidden, that need to be discovered, developed, and cultivated in order to emerge in the future. Compared to the classical design and innovation practices this is a rather different strategy. It is partially based on Scharmer´s (2007) Theory-U and does not primarily follow the classical approach of trial-and-error, variation, selection, and adaptation in order to bring forth change, novelty, and/or innovation; it rather makes use of *deep knowledge about the core of the object of innovation* (OOI) and its potentials in order to "learn from these potentials/future as they emerge". In other words, these potentials offer a (hidden) pointer towards the future possibilities that might emerge. For the designer, learning from these potentials means to make use of this future knowledge in order to initiate an approrpiate change already in the present moment.

This approach is coherent with the concept of adjacent possibles (Felin et al., 2014; Kauffman, 2014; Koppl et al., 2014), in which actuals create a niche for new opportunities that might emerge, if the context(s) of these niches change(s). Our approach goes one step further insofar as we propose to identify the core of these potentials and cultivate them further in an enabling environment. This leads to changes that fill the classical gap and challenge of radical innovations: they fit into the environment in a sustainable manner (because they have their basis in the core of the OOI) and they are at the same time fundamentally new (because they tap yet unrealized potentials of the core of the OOI). This polarity is also a well-known phenomenon from art and design: in this domain it is referred to as the MAYA (most advanced, yet acceptable) principle (Hekkert, 2006; Hekkert, Snelders, & Wieringen, 2003) .

This brings us back to Krippendorff´s (1989, p. 9) paradox in his approach to design: "…the aim of making something new and different from what was there before, and the desire to have it make sense, to be recognizable and understandable." If we start understanding design as such a process of "*co-creating a future by learning from the future as it emerges*" we cold not only open up a highly inspiring field of cooperation between design, innovation,

and anticipation, but we could be one step closer to bringing about design and innovations that could really matter.

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