Complexity by Design

Wieland, Heiko[1] – Kaartemo, Valtteri[2]

1: University of Hawai'i at Manoa, USA
hwieland@hawaii.edu; Department of Marketing, Shidler College of Business
2404 Maile Way, #C303, Honolulu, HI 96822, USA

Heiko Wieland is a Doctoral Student in Marketing at the University of Hawai'i at Manoa. His research interests include innovation, social networks, and service-dominant logic. Prior to his doctoral studies, Mr. Wieland held various management positions in the technology industry. He earned a bachelor's degree in electrical engineering and an MBA in Marketing.

2: Turku School of Economics, University of Turku, Finland
valtteri.kaartemo@tse.fi; Department of Marketing, Turku School of Economics,
Rehtorinpellonkatu 3, FIN-20500 Turku

Valtteri Kaartemo is a Doctoral Student in International Business at the University of Turku, Finland. He acted as a visiting Fulbright student researcher at the University of Hawaii at Manoa during the academic year 2010-2011.

Introduction

Today's dynamic market environment highlights interdependent and networked relationships as critical components of innovation (e.g., Chandler and Wieland, 2010). Similarly, contemporary marketing research views value creation as networked (e.g., Morgan and Hunt, 1994), interactive (e.g., Grönroos, 2006), and contextual (e.g., Chandler and Vargo, 2011). These dynamic network conceptualizations explicitly include the customer and his or her resources and networks (Vargo and Lusch, 2008), which points to the importance and interdependencies of dynamic marketing systems. According to S-D logic, for example, the service ecosystem perspective provides an important venue for understanding how actors interact with other actors as they co-create value for themselves and for others by integrating available resources (Lusch et al., 2010).

Vargo and Lusch (2011) posit that the service ecosystem framework refocuses the role of the firm on (re)creating or (re)designing new markets rather than developing new or better products. Stated somewhat differently, Vargo and Lusch suggest that the understanding of service ecosystems can enable firms to introduce nonlinear behavior (complexity) into these systems, resulting in new patterns of relationships and system trajectories. Following Michel et al. (2008), we call these shifts in relationship structures, system trajectories, and the resulting changes in human practices *discontinuous innovations*. In the current research, we show that service ecosystems, almost by definition, are the prototypical examples for open complex adaptive systems and therefore susceptible to nonlinear and complex behavior. In other words, service ecosystems are potential catalysts for discontinuous innovation.

However, we posit that an understanding of these non-linear service ecosystems might only be a foundational step of the discontinuous innovation process. We highlight the fact that

social structures, schemas, cognitive limitations, mental frames, and cognitive styles of design team members play a major factor in the design of discontinuous innovations and new markets. Paradoxically, these social structures, schemas, and mental frames both enable actors to function in complex environments while, at the same time, constrain their abilities to capture and accurately process the richness of these environments and thereby constraining their abilities to create discontinuous innovations. Our ontological position hereby needs to be one that views social reality as being shaped and reshaped through recursive processes (Kjellberg and Helgesson, 2006; Law, 1994). Additionally, we are not basing our epistemological claim on different perspective of a single reality but assume instead that social practices enact different realities (Kjellberg and Helgesson, 2006).

As a final step, we suggest that the intersection between design thinking and complex adaptive service ecosystems can elucidate ways to overcome some of the innovation constraints that social structures, schemas, cognitive limitations, mental frames, and cognitive styles provide. We hereby follow Simon's (1996) definition of design which states that design is any action that is aimed at changing existing situations into preferred ones. Design thinking is therefore not limited to design and marketing departments but includes and involves all actors in the service ecosystem. While S-D logic has already been successfully linked to design thinking (e.g., Cautela et al., 2009; Wetter Edman, 2009), we posit that this literature has not uncovered the full richness that this intersection can provide. We show, using the IDEO design thinking methodology as an example, how the processes, tools, and artifacts of design thinking can help to facilitate discontinuous innovation in complex adaptive service ecosystems. IDEO is one of the most prominent design consultancies in the world. We conclude by proposing that design thinking components can enhance the service ecosystem framework and thereby provide an

improved venue from which firms can change the trajectories of these systems—that is, markets can be (re)created and (re)designed. We start our analysis by reviewing systems thinking in the marketing literature.

Systems Thinking in Marketing

Many scholars have recognized systems thinking as a necessary prerequisite for the study of marketing (e.g., Carman, 1980; Hunt, 1981). However, despite its established importance for marketing theory, the concept of marketing systems has received little scholarly attention in recent years (Layton, 2007). The origins of systems thinking can be traced back all the way to the principle of holism in Greek philosophy. Aristotle's famous statement that "the whole is greater than the sum of its parts" can still be viewed as the quintessence of a basic system conceptualization (Bertalanffy, 1972). Today, almost 2500 years later, the study of systems has not lost any of its relevance for science in general and marketing in particular (e.g., Boulding, 1956; Layton, 2007; Vargo & Lusch, 2011).

One of the first introductions of systems thinking into marketing research was Alderson's (1965) attempt to utilize Von Bertalanffy's general systems theory (GST) to develop a general theory of marketing. Subsequent work has continued to highlight the importance of systems in various areas of marketing (e.g.; Dixon, 1984; Dowling, 1983; Layton, 2007). Relationship marketing is one of these areas. Scholars in this field have recognized the relational interdependencies of marketing systems. Arndt (1986), for example, proposed that marketing systems should be thought of as relational networks. This network view was later advanced by Morgan and Hunt (1994) and the members of the Nordic School (Grönroos, 2000) who broadened the conceptualization of these networks to include all stakeholders. The

contemporary service-dominant (S-D) logic framework from Vargo and Lusch (2004; 2008) greatly contributed to this literature stream by deepening the understanding of resource integration and value creation in these relational systems which they defined as service ecosystems.

S-D Logic and the Service Ecosystem

Relationships and networks are an imperative component of S-D logic as shown by Vargo (2009) who has cited relationship marketing and, more generally, service marketing and business-to-business marketing as foundational to S-D logic. Based on this tradition, S-D logic conceptualizes service provision as a relational process where providers and beneficiaries co-create value through a reciprocal exchange of competences for the benefit of the other party. These mutual service provisions require networks of interactions since no actor alone possesses adequate resources for value creation (Vargo and Lusch, 2008). In these networks, the attention on the exchange of competences mandates a shift of focus from static and tangible operand resources (those which must be acted upon to provide benefit), to dynamic and intangible operant resources (those which act upon other resources) (Constantin and Lusch, 1994; Vargo and Lusch, 2004).

More recently however, Vargo and Lusch (2011) noted that, as much as the idea of networks contributed to the understanding of value creation and context, its consideration lacks a critical characteristic of systems, which, as we show in the next section, are dynamic and self-adjusting. Vargo and Lusch consequently posit that each action in a service ecosystem changes the nature of the system to some extent, and thus influences the context for the future actions and the determination of value creation. S-D logic therefore conceptualizes networks not just as

networks (aggregations of relationships) but as dynamic and contextual systems. More specifically, S-D logic introduces the concept of the "service ecosystem" and defines this system conceptualization as "a spontaneously sensing and responding spatial and temporal structure of largely loosely coupled value proposing social and economic actors' interaction through institutions, technology, and language to (1) co-produce service offerings, (2) exchange service offerings, and (3) co-create value (Vargo and Lusch, 2011, p. 185). In the next section, we discuss the dynamic and self-adjusting properties of service ecosystems in more detail.

All Ecosystems are Open Complex Adaptive Systems

The term ecosystem has its roots in the ecology literature. Willis (1997) defines an ecosystem, from an ecology stand point "as a unit comprising a community (or communities) of organisms and their physical and chemical environment, at any scale, desirably specified, in which there are continuous fluxes of matter and energy in an interactive open system (p.270)." Levin (1998) claims that biological ecosystems are the prototypical example of open complex adaptive systems. Arthur (1999), however points out that human agents—as opposed to simpler organisms or elements—react with strategy and foresight by considering outcomes that might result as a consequence of their actions. He concludes that this adds a layer of complexity to economic and social behavior that cannot be found in the natural sciences. The rules of human interactions are constantly changing, making it impossible to express them as linear equations with constant coefficients (Wollin and Perry, 2004). We therefore conceptualize service ecosystems as open complex adaptive systems with a high degree of complexity due to human

interactions. To highlight the dynamics in open complex adaptive systems in more detail, we continue by providing a short review of complexity theory.

Complexity Theory

Complexity theory grew out of chaos theory and seeks to identify patterns in apparently random behavior of complex systems (Wollin and Perry, 2004). Chaos and complexity theory, like GST, emerged from the realization that a reductionist view of the world, where objects and events could be understood in terms of their constituent parts and where these parts fit together like cogs in a machine, could not adequately capture the complexity of adaptive systems (Faulkner and Russell, 2003). Chaos and complexity theory take into account the fact that many systems operate in a non-linear, non-probabilistic, non-deterministic and dynamic manner (Lewin, 1999). While some scholars view chaos and complexity theory as two disparate theories (e.g., Axelrod and Cohen, 1999), most marketing scholars (e.g., Doherty and Delener, 2001; Holbrook, 2003) seem to concur with Hayles' (1991) definition which combines the two theories by defining complexity as the emerging science at the edge of order and chaos.

Holbrook (2003) highlights the fact that the concept of the open complex adaptive system is the single most important idea in all of chaos-and-complexity theory for the field of marketing. He defines a complex adaptive system as being "composed of inter-related parts, interacting with its environment, subject to resulting feedback effect, evolving over time adaptively to fit the pressures imposed on it, perhaps attaining a sustainable advantage, and in the process generating certain emergent phenomena (Holbrook, 2003)."

Complex Adaptive System Behavior

Vargo and Lusch (2011) posit that each event in a service ecosystems changes the context and patterns of relationships among loosely coupled actors. Stated somewhat differently, Vargo and Lusch suggest that the understanding of service ecosystems can enable firms to participate in these systems in a way that leads to new markets (new patterns of relationships and system trajectories). In this section, we introduce some of the system behaviors that are common in dynamic, open complex adaptive systems.

Due to the high pace of change and interconnectivity in social structures, most service ecosystems fall into a state which is defined by a tenuous equilibrium between order and chaos. The order in these dynamic systems at the edge-of-chaos (between order and chaos) emerges in a bottom-up, self-organizing way from micro-interactions taking place among individual actors in interconnected networks (Wilkinson and Young, 2002). These systems are not "managed" but actors participate in and respond to these systems rather than directing and controlling them (Mason and Staude, 2009).

This type of emergence and bottom-up organization can often be found in ecological systems where a population following simple rules of interaction can behave in very surprising ways. Complex systems therefore often behave in a life-like fashion and the life-like metaphor is frequently applied to non-biological systems. Holbrook (2003), for example uses this metaphor when he states that the ultimate goal of companies is survival and that they have to constantly adapt to threats and opportunities in their ecosystem to achieve this goal.

The tenuous equilibrium in complex adaptive systems is maintained through nonlinear positive and negative feedback loops. "Negative feedback pushes the system back to its original state, producing regular, predictable behaviors. Positive feedback amplifies changes, pushing the system away from equilibrium, towards instability (Mason and Staude, 2009)." Service

ecosystems on the edge-of-chaos with just the right amount of disorder can be the catalysts for creativity and innovation. Too much disorder can cause system ossification but the right degree of positive feedback can reorganize the system into new patterns of relationships, from which new markets emerge (Holbrook, 2003; Mason and Staude, 2009).

The notion of a chaotic system, however, does not imply a complete lack of order. Even in chaos conditions, systems make "smoothing adjustments" influenced by their history. Arthur (1994) and others refer to this effect as path dependence. "Initial conditions, although not unalterable, tend to have a residual pervasiveness, a behavioral stubbornness that makes them less vulnerable to the effect of similar forces than later additions to the system (Russell and Faulkner, 2004)." Some aspects of systems can therefore be immune to even radical shifts despite the fact that the conditions that made these aspects necessary no longer exist. In the following section, we show how a complex adaptive system conceptualization changes the design process.

Design in Open Complex Adaptive Systems

Most of the traditional linear design models can be divided into two distinct phases (Buchanan, 1992). Buchanan defines the *problem definition* as the phase in which the designer determines all of the elements of the problem and specifies all of the requirements that a successful design solution must have. The *problem solution* phase, on the other hand, is defined as the phase in which various requirements are combined and balanced against other to establish a final production plan (Buchanan, 1992).

Action that is exclusively oriented towards means and considered adequate to attain clearly-defined goals is referred as instrumentally rational behavior (Weber, 1981). Traditional linear design can be viewed as an instrumental rationality model, as it aims to precisely calculate the means for a given end. In marketing, this approach can be found when "market research" is used to calculate the rules between means and a priori given end.

It is rather obvious that this approach cannot work in nonlinear and non-deterministic open complex adaptive systems. In open complex adaptive systems, the problem is instead most often unstructured or "wicked" (Churchman, 1967; Rittel & Webber, 1973). Rittel, a mathematician and designer, argues that most problems addressed by designers are a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing (Churchman, 1967, p. 141)." Rittel is hereby implicitly describing design activities in complex adaptive systems and he termed these design activities *wicked problems.*

Wicked problems differ from "tame" problems of instrumental rationality in that there is no definitive formulation for the problem or, stated differently, enumerable solutions to the problem. Wicked problems have no stopping rule or right solution, as problems are only improving or hindering a situation. Importantly, solutions cannot be tested before-hand but only once in action, as all solutions are unique, and change the problem after the test. In fact, all solutions are considered as symptoms of another wicked problem. (Rittel & Webber, 1973.)

In line with this thought, Buchanan sees the key distinction between traditional linear and wicked problem design in the relationship between determinacy and indeterminacy. The linear, deterministic model of design has clearly defined problems (ends) with calculable solutions

(means). Wicked problems, on the other hand, suggest a fundamental indeterminacy in all but the most trivial design problems which implies that there are no definitive conditions or limits to design problems (Buchanan, 1992). Wicked problems therefore lack definitive problem definitions (ends) and calculable problems solutions (means). As mentioned, we hereby view wicked problems from an ontological position that conceptualizes social reality as being shaped and reshaped through recursive human practices, which, in turn enact different realities (Kjellberg and Helgesson, 2006).

In the next section, we elucidate how humans cope with these complex systems in which most design problems are defined by indeterminacy. As mentioned, social structures, cognitive processes and schemas, both enable actors to function in complex environments while, at the same time, constrain their abilities to cope with the universal scope of wicked design problems.

Cognitive limitations

Neoclassical economics and traditional marketing thought are, to a large extent, based on instrumental rationality. As previously defined, instrumental rationality refers to the most efficient or cost-effective means to achieve a clearly defined end (Weber, 1981). Neoclassical economics hereby views human actors and their decision making as fully rational and aimed at optimal choice. In traditional marketing, this thought aligns with the idea that rational marketing managers can use market information (collected through market research) to win market share in predefined segments by tuning the 4Ps. Consequently, the importance of "market research" is also broadly highlighted in the innovation literature (e.g., Schneider and Hall, 2011).

In the previous section, we have already addressed the fact that an instrumental rationality, which assumes clearly defined ends, cannot be adequately applied to complex social

systems. In this section, we explore the behavior and decision making of human actors in open complex adaptive systems in more detail.

Bounded Rationality

Herbert Simon (1959) was one of the first scholars who described the inconsistencies between normative (how actors should behave) and positive (how actors do behave) behavior and decision making. Simon highlighted the fact that the rationality of human actors is bounded by their restricted access to information, cognitive limitation, and the finite amount of time they have to make decisions (Simon, 1996). In complex environments, due to bounded rationality, human actors lack the ability and the resources to arrive at the optimal solution. Instead, Simon views human actors as satisficers, positing that they seek satisfactory solutions rather than optimal ones. Bounded rationality thus refers to rational principles of non-optimizing adaptive behavior of real people (Selten, 2002).

However, Simon's bounded rationality assumes well-defined, static ends in decision making. Hatchuel (2001) and others have criticized Simon for grounding his research on solvable problems, such as chess and labyrinths, which do not adequately reflect the complexity of social interaction. To gain a deeper understanding of how actors with cognitive limitations cope with more dynamic, self-adapting, and contextual social interaction in service ecosystems, we now borrow from the sociology literature.

Social Structures and Schemas

By pointing out the importance of institutions, technology, and language in their definition of service ecosystems, Vargo and Lusch (2011) point towards a link with structuration

theory which describes human actions within social systems as enabled and constrained by social structures. The central idea behind structuration theory is that "social systems, as reproduced social practices, do not have 'structures' but rather exhibit 'structural properties' and that structure exists, as time-space presence, only in its instantiations in such practices and as memory traces orienting the conduct of knowledgeable human agents (Giddens, 1984, p. 17)." In other words, social structures can be viewed as both the medium and the outcome of human practices.

Social structures can hereby be conceptualized as combinations of schemas (rules in Gidden's terms) and resources (Giddens, 1984). Giddens defines these schemas (rules) as generalizable procedures applied in the enactment and reproduction of social life. Stated differently, schemas are relatively abstract and generalizable rules, which humans generate in order to understand the regularities in the co-occurrence between events (Stotland and Canon, 1972). Structuration theory therefore also rejects the notion of a rational and optimizing human actor. By reproducing structural properties, actors also reproduce the conditions that make such actions possible (Giddens, 1984). This constant flow of action can be conceptualized as a co-evolutionary world (Conlisk, 1996) in which the context is continuously changing. In the environment of changing context, ends are continuously adapted by actors who not only reflexively monitor their own activities but also all other aspects of their social systems.

The previous two paragraphs highlight the importance of social structures and evolving contexts in social systems. As mentioned, structures simultaneously enable and constrain actions within these systems. "Actors employ typified schemes in the course of their daily activities to negotiate routinely the situations of social life (Giddens, 1984, p. 22)." Structural properties can therefore be viewed as the glue that allows the reproduction of discernibly similar social practice

across varying spans of time and space in complex social systems. However, social structure in general and schemas in particular also constrain the views actors in complex adaptive systems. We now explore the constraining properties of schemas in more detail.

As defined, a "schema is an abridged, generalized, corrigible organization of experience that serves as an initial frame of reference for action and perception (Weick, 1979, p. 50)." In organizational settings, schemas are abundant and reflect cognitive maps that member infer from their organizational experience (Axelrod, 1971; Weick, 1979). The concept of groupthink (Janis, 1983), for example, can be conceptualized as a subset of schema theory. In groupthink, dominating shared schemas create dysfunctional consequences when group members direct their attention toward the environment and sample it in such a way that the belief embedded in the schema becomes self-validating (Weick, 1979). A recent and salient example of groupthink is the Enron case. The Enron reward system and the "win-at-all-cost" culture (Sims and Brinkmann, 2003; Kersten, 2005) constructed schemas which guided employees to rationalize their obvious transgressions. While this is an extreme case of constructed rationality, it is easy to find other examples.

Weick (1979) posits that actors with bounded rationality might be more interested in confirming their schemas than in actively trying to disprove them. In the context of innovation, for example, Dougherty and Corse (1995) point out that schemas suppress the ability to recognize complex realities of markets and technologies. Schemas are a significant component of what Doughety and Corse (1995, p. 61) call an inward orientation which suppresses the actor's "ability to appreciate the external work of customers and markets, to see how customers would use the product, to understand how they perceive value, and to translate customer issues into product attributes."

The impact of schemas in a corporate environment is amplified by the fact that, as mentioned, actors utilize multiple sets of schemas. In addition to the overall corporate practices, disparate schemas are also recreated by the practices of inter and intra company teams. Dougherty (1992) has shown, that, in cross-functional design teams (e.g., sales, marketing, product design, and manufacturing), schemas from the respective home organizations can become barriers to effective technology-market linking. More specifically, Dougherty showed that two schemas, departmental thought worlds and organizational product routines, kept innovators from synthesizing their expertise. In summary, if an organization fails to implement a culture of change, as a whole and within subunits and teams, the actions oriented toward maintaining the status quo become rationalized and the complex realities of markets and technologies are ignored.

Mental Framing and Creativity Blocks

The impact of positive versus normative decision making has also been explored by decision and prospect theory which were developed to explain the inconsistencies between observed human behavior and the normative expected utility theory of neoclassical economics. (Kahneman and Tversky, 1984). Kahneman and Tversky emphasize that human decision making is context dependent. By framing the same decision problem as either a risk or a gain, they empirically showed that human actors do not derive at the same outcome, thus they violate the normative rule of invariance which states that different representations of the same choice should yield the same preference (Kahneman and Tversky, 1986). In line with this finding, White et al. (2003) have shown that managers respond with a greater magnitude to market situations that are framed as an opportunity than to those that are framed as a threat. Threat

perceptions from the environment reduce the number of considered alternatives and, at the same time, intensifies concerns about efficiency (Staw et al., 1981).

Mental framing has also been linked to barriers of creativity. Adams (2001), for example, describes four creative blocks; namely perceptual, cultural and environmental, emotional, and intellectual and expressive blocks. Perceptual blocks refer to the tendency of human actors to not look beyond obvious solution in regards to ends and means. Analogies, conceptualized as information from familiar and existing categories, are the fundamental building blocks for new ideas (Finke et al., 1992). Dahl and Moreau (2002) have shown that human actors typically rely on near analogies as foundations for their idea generations. This leads to an effect that they call unconscious plagiarism. If, for example, a human actor wants to solve a problem related to vertical human transportation, he or she will most likely start with the analogies of elevators and escalators in mind. As a result, the outcome of this idea generation process is likely to be an adaptation of elevators or escalators instead of a radically new idea.

Cultural and environmental blocks refer to creativity limitations based on expected social behavior. It is therefore strongly influenced by the social structures and schemas discussed earlier. Actors in many organizational environments are expected to act in a serious and logical manner. Overly creative or unconventional ideas are often judged harshly and they are often not voiced due to a fear of failure (an emotional block). Lastly, intellectual and expressive blocks refer to the fact that human actors often lack problem solving skills or try to solve problems using an incorrect "language". For example, inflexible or ineffective problems strategies are utilized, problems are addressed verbally when it would be beneficial to address them visually, and ideas are recorded using inadequate skills.

Cognitive Styles

So far, we have focused on cognitive limitations and social structures and framing aspects that can be generalized to all human actors. We now want to briefly shift our focus to individually appraised aspects of the relationship between a person and the environment. Cognitive appraisal theory (Folkman, 1984), for example, proposes a dynamic relationship between a person and the constantly changing environment. This particular bidirectional relationship, in which the person and the environment each act on each other, is defined as stress (Folkman, 1984). Folkman posits that, in this definition, "stress is not a property of the person or the environment, nor is it a stimulus or a response (Folkman, 1984, p. 840)" but a person's appraisal of the relationship as taxing or exceeding his or her resources and as endangering his or her well being. The stress level is therefore idiosyncratically appraised and cognitive appraisal theory point to the personality trait of locus of control as a mediating factor. Rotter (1966) defines internal locus of control as the conviction that events are contingent upon one's own behavior, and external locus of control as the conviction that events are not contingent upon one's actions but upon luck, chance, fate or powerful others. Thus, a highly ambiguous environment might be appraised by a person with a high degree of internal locus of control as controllable, whereas it might be appraised by a person with a high degree of external locus of control as uncontrollable (Folkman, 1984). In a marketing setting, for example, White et al. (2003) have shown that the cognitive styles of managers (i.e. extrovert-introvert, judging-perceiving, sensing-intuiting, thinking-feeling) influence their locus of control perceptions and hereby their perceived control of market situation. As mentioned, this influences their responses to these situations. Based on this research, it can be concluded that individual cognitive styles also influence the way actors perceive and appraise their environments.

The previous paragraphs have shown that social structures, schemas, cognitive limitations, mental frames, and cognitive styles greatly influence the way in which human actors perceive and appraise complex environments and how these perceptions and appraisals influence decision making and idea generation. Hereby, it was not our goal to provide a comprehensive review of the cognitive decision making literature as this would go far beyond the scope of this paper. Instead, we just want to elucidate that, as in line with gestalt theory (Wertheimer, 1944), the cognitive context with which actors approach problems greatly influences the way they solve them. Decisions and the idea generation processes of actors in open complex adaptive systems are greatly influenced by social structures, schemas, cognitive limitations, mental frames and, cognitive styles which reduce and bias the environmental complexity to a level that allows human actors to function at a relatively low cognitive load and dissonance. As Weick (1979) pointed out, this complexity reduction is detrimental for the innovation field. In the next section, we show how a design thinking approach can enable human actors to process a higher level of non-biased contextual complexity in a way that is cognitively manageable.

Design Thinking

Design thinking is an assortment of methodologies that aspire to frame problems and opportunities from a human-centered systems perspective. More specifically, problems and opportunities are framed using a contextual perspective which incorporates the signs, resources, actions, and environments that influence the concrete needs and values of human actors in various situations (Buchanan, 1992). Thus, design thinking departs from the traditional linear design models in favor of a human-centered solution perspective which is capable of addressing dynamic and wicked design problems. Design thinking hereby utilizes various expressive methods to explore and generate ideas and engages in a co-design relationship with potential

users and stakeholders (Kimbell, 2009; Brown, 1998). Furthermore, Kimbell (2009) sees designing for service (in line with the service conceptualization of S-D logic) as an exploratory process which aims to create new kinds of value relation between diverse actors within a system.

To demonstrate how design thinking can overcome some of the constraints that social structures, schemas, cognitive limitations, mental frames and, cognitive styles place on the innovation process, we now discuss the IDEO design thinking process in more detail (as described in Brown (1998). As mentioned, IDEO (www.ideo.com) is one of the most prominent design consultancies in the world. It is important to note, however, that many similar design thinking methodologies exist and that our findings can be generalized to some of these other methodologies (Kimbell, 2011).

The IDEO design thinking process is a circular process with three main components (Brown, 1998). First, Inspiration is the identification of problems and/or opportunities that motivate the search for a solution. Second, Ideation is the process of generating, developing and testing ideas that may lead to solutions. Third, Implementation is the execution of the vision by charting a path to a market creation.

Inspiration

The first step of the inspiration phase is the formation of a cross functional team. IDEO, for example, uses teams that include designers, behavioral scientists, marketers, and engineers. These multiple backgrounds do not only provide expertise in many different fields but also a diversity of schemas which are applied by the various professions. Once the design team is formed, designers go out to the field to observe the customers and their contextual environment (Beyer and Holtzblatt, 1998) to identify what people do, how they think, and their explicit and

latent needs and wants. This contextual inquiry is based on an ethnographic approach to understanding end users' experiences in their own terms. Additionally, this approach involves these users as co-designers (Kimbell, 2009). Hereby, particular attention is paid to "extreme" actors to ensure that even the most radical perspectives are captured. Especially the use of behavioral scientists as design team members, who are trained in the observation of social practices, can hereby shed light on the underlying social structures that are reproduced in the observed practices.

The outcomes of these observations are large amounts of information which are communicated to the rest of the team by sharing insights, telling stories, and by providing pictures. Additionally, this information is recorded, organized, and displayed. In regards to social structures, schemas, cognitive limitations, mental frames, and cognitive styles, the following can be observed. The cross functional team members utilize their disparate schemas to construct multiple perspectives of the problems, opportunities, clients, end users, customers and other stakeholders. These multiple perspectives are documented and displayed. Information is therefore being created rather than just collected. Rich and organized information is hence made accessible to the team which helps to overcome bounded rationality information processing constrains.

Another key aspect of design thinking is the exploratory and positive approach to complex human systems. This optimism is based on the notion that, even in the most challenging and constrained environments, it is always possible to identify solutions that improve situations (Brown, 1998). As discussed, this positive view of situations provides an environment in which human actors are more likely to fully utilize their creative and cognitive

abilities. This last point is not only true for the Inspiration phase but throughout the whole design thinking process.

Ideation

The Ideation phase is the creative phase of the design thinking process. The design team hereby uses the rich information that was collected in the Inspiration phase. This information is, using brainstorming techniques, used to build creative frameworks, scenarios and journeys which center on the customer. Design thinking hereby follows Osborn's (1953) notions on creativity which promotes the use of "wild" ideas which are made possible by the absence of internal evaluations. Wild ideas provide far analogies and therefore overcome perceptual blocks. This is important, since, in design thinking, the design process does not aim at improving an object, but rather at creating new outcomes. Often, ideas are communicated visually through sketches and simple prototypes to overcome constrains that the use of language can provide. In line with Osborn's requirement of the absence of internal evaluations, the Ideation brainstorming techniques do not allow critiquing ideas. This removes cultural and emotional blocks since voicing a wild idea can never be wrong or embarrassing. Additionally, wild ideas can "survive" in this environment even if they create dissonance with mental schemas of some team members. Going beyond the comfort zone of team members to find new solutions is a mandatory part of design thinking.

Throughout this creative phase, cognitive styles of design team members are influenced by the team approach and the design thinking techniques and rules. Designers are forced to interact with others, be proactive in their decision making, and tolerate high levels of ambiguity.

This primes designers to display cognitive styles that promote an internal locus of control, which, in return, promotes lower stress levels and more creative behavior.

As a next step of the Ideation phase, ideas are explored with the help of continuous testing and retesting of prototypes. Hereby, failure is encouraged because it is seen as a way to learn and to therefore succeed sooner (Kelley and Littman, 2005). The positive approach to failure also ensures that even wild ideas which seem unlikely to succeed are tested. During this prototyping and testing phase, team members continue to communicate actively. Once one or more prototypes evolve as possible solutions, users are invited to participate in the test. In this stage, the design team is still entirely focused on finding a solution for customer problems and/or opportunities. Schemas, which can introduce implementation concerns, are consciously repressed.

Implementation

Only after the creation of sketches and scenarios about alternative solutions, the building of prototypes, the internal communication, and the prototyping with users has ended, does the team start thinking about the implementation of the solution. As mentioned, this ensures that schemas do not introduce a status-quo bias until the solution is specified. In summary, design thinking can be described as a discipline which converts discovered needs into market opportunities (Brown, 2008). The design thinking process does not start with the goal of improving an object or service (a given end), but rather with the goal of finding a solution for the customer. It hereby seeks to understand ill-formulated and dynamic problems and opportunities in social systems, in which information is confusing and in which many clients and decision makers have conflicting values and needs. As shown in this section, design thinking hereby

provides a methodology which allows teams to overcome the constraints that social structures, schemas, cognitive limitations, mental frames, and cognitive styles provide. Through the entire design thinking process, the complexity of social systems is not reduced but rather explored. Additionally, design thinking provides methods and rules that fight biases and creative blocks.

We therefore posit, that service ecosystems can be, in line with S-D logic, conceptualized as venues for discontinuous innovation. However, this conceptualization only holds if design methodologies are used that help human actors to process the richness that these venues can provide in an unbiased and effective way.

Conclusions

Contemporary marketing thought points towards the importance of dynamic marketing systems (e.g., Layton, 2007; Vargo and Lusch, 2011). We conceptualize these ecosystems as open complex adaptive systems that are susceptible to nonlinear and complex behavior. The resulting indeterminacy of these ecosystems turns innovation problems into wicked ones. Wicked problems have no conclusive formulations and no stopping rules and therefore lack definitive problem definitions (ends) and calculable problems solutions (means).

Human actors, with their cognitive limitations, can function in complex adaptive systems by employing social structures, schemas, and mental frames. These references for action and perception allow actors to appraise most relationships between them and their environment as non-taxing and non-threatening. Paradoxically, however, these social structures, schemas, and mental frames also limit the richness of system information that human actors can process. As Weick (1979) points out, this complexity reduction is detrimental for the innovation field.

We therefore posit that an understanding of these non-linear service ecosystems is only a foundational step of the discontinuous innovation process. Ecosystems can only become venues for discontinuous innovations if human actors find ways to process the rich system information in a non-biased and non-reductionist way. We conceptually show that design thinking techniques can enable human actors to process a high level of non-biased contextual complexity in a way that is cognitively manageable. More specifically, we use the IDEO design thinking process and its three main components as an example to show how this process can overcome some of the constrains that social structures, schemas, cognitive limitations, mental frames, and cognitive styles put on human actions and perceptions.

Future Research

In this conceptual work, we have explored the intersection of design thinking, the contemporary service ecosystem conceptualization, and discontinuous innovation. However, this study has not empirically tested its findings. We therefore suggest that future research should build on our conceptual propositions in order to deepen our understanding of how design thinking components can enhance the ecosystem framework. As stated, we believe that this design thinking extension of the ecosystem framework can enable firms to find discontinuous innovations and, thus create new markets.

References:

Alderson, W. (1965), *Dynamic Marketing Behavior: A Functionalist Theory of Marketing*, Richard D. Irwin, Homewood, IL.

Arndt, J. (1986), "Shared symbols, meanings, and ways of life in interorganizational networks", Fisk, G. (Ed.), *Marketing management technology as a social process*, Praeger Publishers, New York, pp. 121-138.

Arthur, W. B. (1994), *Increasing returns and path dependence in the economy*, University of Michigan Press, Ann Arbor.

Arthur, W. B. (1999), "Complexity and the Economy", *Science*, Vol. 284, No. 5411, pp. 107-109.

Axelrod, A. and Cohen, M.D. (1999), *Harnessing Complexity: Organizational Implications of a Scientific Frontier*, Free Press, New York.

Bertalanffy, L. Von (1972), "The History and Status of General Systems Theory", *The Academy of Management Journal*, Vol. 15, No. 4, pp. 407-426.

Beyer, H. and Holtzblatt, K. (1998), *Contextual Design. Defining Customer-Centered Systems*, Academic Press, San Diego, CA.

Brown, T. (2008), "Design Thinking", *Harvard Business Review*, Vol. 86, No. 6, pp. 84-92.

Boulding, K.E. (1956), "General Systems Theory-The Skeleton of Science", *Management Science*, Vol. 2, No. 3, pp. 197-208.

Buchanan, R. (1992), "Wicked Problems in Design Thinking", *Design Issues*, Vol. 8, No. 2, pp. 5-21.

Carman, J. M. (1980), "Paradigms for Marketing Theory", Sheth, J. (Ed.), *Research in Marketing*, JAI Press, Greenwich, CT.

Cautela, C., Rizzo, F. and Zurolo F. (2009), "Service design logic. An approach based on different service categories", *IASDR 2009 Conference Proceedings*, pp. 4317-4326, available at: http://www.iasdr2009.org/ap/Papers/Special%20Session/Adopting%20rigor%20in%20Service%20Design%20Research/Service%20design%20logic%20-%20an%20approach%20based%20on%20the%20different%20service%20categories.pdf (accessed 20 April 2011).

Chandler, J.D. and Vargo, S.L. (2011), "Contextualization and Value-In-Context: How Context Frames Exchange", *Journal of Marketing Theory*, Vol. 11, No. 1, pp. 35-49.

Churchman, C.W. (1967), "Guest Editorial: Wicked Problems", *Management Science*, Vol. 14, No. 4, pp. 141-142.

Conlisk, J. (1996), "Why Bounded Rationality?", *Journal of Economic Literature*, Vol. 34, pp. 669-700.

Constantin, J. and Lusch, R.F. (1994), "Understanding Resource Management", The Planning Forum, Oxford, OH.

Dahl, D.W. and Moreau, P. (2002), "The Influence and Value of Analogical Thinking During New Product Ideation", *Journal of Marketing Research*, Vol. 39, No. 1, pp. 47-60.

Dixon, D.F. (1984), "Macromarketing: A Social Systems Perspective Macromarketing: A Social Systems Perspective", *Journal of Macromarketing*, Vol. 5, No. 2, pp. 4-17.

Doherty, N. and Nejdet, D. (2001), "Chaos Theory: Marketing & Management Implications", *Journal of Marketing Theory & Practice*, Vol. 9, No. 4, pp. 66-75.

Dougherty, D. (1992), "Interpretive Barriers to Successful Product Innovation in Large Firms", *Organization Science*, Vol. 3, No. 2, pp. 179-202.

Dougherty, D. and Corse, S.M. (1995), "When it comes to product innovation, what is so bad about bureaucracy?", *Journal of High Technology Management*, Vol. 6, No. 1, pp. 55-76.

Dowling, G.R. (1983), "The Application of General Systems Theory to an Analysis of Marketing Systems", *Journal of Macromarketing*, Vol. 3, No. 2, pp. 22-32.

Faulkner, B. - Russell, R. (2003), "Chaos and complexity in tourism: In search of a new perspective", Faulkner, B. (Ed.), *Progressing Tourism Research*, Channel View Publications, Clevedon, UK, pp. 205-219.

Finke, R. A., Ward, T. B. and Smith, S.M. (1992), *Creative cognition*, MIT Press, Cambridge, MA.

Folkman, S. (1984), "Personal control and stress and coping processes: A theoretical analysis", *Journal of Personality and Social Psychology*, Vol. 46, No. 4, pp. 839-852.

Giddens, A. (1984), *The Constitution of Society*, University of California Press, the USA.

Grönroos, C. (2000), "Relationship Marketing: The Nordic School Perspective", Sheth, J.N. and Parvatiyar, A. (Eds), *Handbook of Relationship Marketing*, Sage Publications, Thousand Oaks, CA, pp. 95-117.

Grönroos, C. (2006), "On defining marketing: finding a new roadmap for marketing", *Marketing Theory*, Vol. 6, No. 4, pp. 395-417.

Hatchuel, A. (2001), "Towards Design Theory and Expandable Rationality: The Unfinished Program of Herbert Simon", *Journal of Management and Governance*, Vol. 5, No. 3-4, pp. 260-273.

Hayles, N. K. (1991), *Chaos and order*, University of Chicago Press, Chicago.

Holbrook, M.B. (2003), "Adventures in Complexity: An Essay on Dynamic Open Complex Adaptive Systems, Butterfly Effects, Self-Organizing Order, Coevolution, the Ecological Perspective, Fitness Landscapes, Market Spaces, Emergent Beauty at the Edge of Chaos, and All That Jazz", Academy of Marketing Science, 2003, No. 3, available at: http://amsreview.org/articles/holbrook06-2003.pdf (accessed March 10 2011).

Hunt, S. (1981), "Macromarketing as a multidemensional concept", *Journal of Macromarketing*, Vol. 1, No. 1, p. 7.

Janis, I. (1983), "Groupthink", Hackman, J.R., Lawler, E., and Porter, L. (Eds), *Perspectives on Behavior in Organizations*, McGraw-Hill: New York, pp. 378-384.

Kahneman, D. and Tversky, A. (1984), "Choices, values, and frames", *American Psychologist*, Vol. 39, No. 4, pp. 341-350.

Kelley, T. and Littman, J. (2005), *The Ten Faces of Innovation. IDEO's strategies for beating the devil's advocate & driving creativity throughout your organization*, Doubleday: USA.

Kersten, A. (2005), "Crisis as usual: Organizational dysfunction and public relations", *Public Relations Review*, Vol. 31, No. 4, pp. 544-549.

Kimbell, L. (2009), "Service-dominant logic and design for service", Paper presented at the Service Design Network Conference, October 2009, Madeira.

Kimbell, L. (2011), "Designing for service as one way of designing services", unpublished manuscript.

Kjellberg, H. and Helgesson, C.-F. (2006), "Multiple versions of markets: Multiplicity and performativity in market practice", *Industrial Marketing Management*, Vol. 35, No. 7, pp. 839-855.

Law, J. (1994), *Organizing Modernity*, Blackwell Publishers, Oxford.

Layton, R.A. (2007), "Marketing Systems: A Core Macromarketing Concept", *Journal of Macromarketing*, Vol. 27, No. 3, pp. 227-242.

Levin, S.A. (1998), "Ecosystems and the Biosphere as Complex Adaptive Systems", *Ecosystems*, Vol. 1, No. 5, pp. 431-436.

Lewin, R. (1999), *Complexity: Life on the edge of chaos*, 2nd edition, University of Chicago Press, Chicago.

Lusch, R. F., Vargo, S.L., and Tanniru M. (2010), "Service, value networks and learning", *Journal of the Academy of Marketing Science*, Vol. 38, No. 1, pp. 19-31.

Mason, R.B. and Staude, G. (2009), "An exploration of marketing tactics for turbulent environments", *Industrial Management & Data Systems*, Vol. 109, No. 2, pp. 173-190.

Michel, S., Brown, S.W., and Gallan, A.S. (2008), "An expanded and strategic view of discontinuous innovations: deploying a service-dominant logic", *Journal of the Academy of Marketing Science*, Vol. 36, No. 1, pp. 54-66.

Morgan, R. and Hunt, S. (1994), "The Commitment-trust theory of relationship marketing", *Journal of Marketing*, Vol. 58, No. 3, pp. 20-38.

Osborn, A. (1953), *Applied Imagination*, Charles Scribner's Sons, New York.

Rittel, H. and Webber, M. (1973), "Dilemmas in a general theory of planning", *Policy Sciences*, Vol. 4, No. 2, pp. 155-169.

Rotter, J. B. (1966), "Generalized expectancies for internal versus external control of reinforcement", *Psychological Monographs: General and Applied*, Vol. 80, No. 1, pp. 1-28.

Russell, R. and Faulkner, B. (2004), "Entrepreneurship, Chaos and the Tourism Area Lifecycle", *Annals of Tourism Research*, Vol. 31, No. 3, pp. 556-579.

Schneider, J. and Hall, J. (2011), "40 Ways to Crash a Product Launch", *Harvard Business Review*, April 2011.

Selten, R.(2002). "What is Bounded Rationality?", Gigerenzer, G. and Selten, R. (Eds), *Bounded Rationality: The Adaptive Toolbox*, Dahlem Workshop Reports, MIT Press, USA, pp. 13-36.

Simon, H.A. (1959), "Theories of Decision-Making in Economics and Behavioral Science", *American Economic Review*, Vol. 49, No. 3, pp. 253-283.

Simon, H.A. (1996), *The sciences of the artificial*, 3rd edition, MIT Press, Cambridge, MA.

Sims, R.R. and Brinkmann, J. (2003), "Enron Ethics (Or: Culture Matters More than Codes", *Journal of Business Ethics*, Vol. 45, No. 3, pp. 243-256.

Staw, B.M., Sandelands, L.E., and Dutton, J.E. (1981), "Threat-Rigidity Effects in Organizational Behavior: A Multilevel Analysis", *Administrative Science Quarterly*, Vol. 26, No. 4, pp. 501-524.

Stotland, E. and Canon, L.K. (1972), *Social Psychology: A Cognitive Approach*, W.B. Saunders Company: Philadelphia.

Tversky, A. and Kahneman, D. (1986), "Rational Choice and the Framing of Decisions", *Journal of Business*, Vol. 59, No. 4, Pt. 2, pp. S251-S278.

Vargo, S. L. (2009), "Toward a transcending conceptualization of relationship: a service-dominant logic perspective", *Journal of Business & Industrial Marketing*, Vol. 24, No. 5/6, pp. 373-379.

Vargo, S. L. and Lusch, R.F. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol. 68, No. 1, pp. 1-17.

Vargo, S. L. and Lusch, R.F. (2008), "Service-dominant logic: continuing the evolution", *Journal of the Academy of Marketing*, Vol. 36, No. 1, pp. 1-10.

Vargo, S. L. and Lusch, R.F. (2011), "It's all B2B…and beyond: Toward a systems perspective of the market", *Industrial Marketing Management*, Vol. 40, No. 2, pp. 181-187.

Weber, M. (1981), "Some Categories of Interpretive Sociology", *The Sociological Quarterly*, Vol. 22, No. 2, pp. 151-180.

Weick, K.E. (1979), "Cognitive Processes in Organizations", *Research in Organizational Behavior*, Vol. 1, pp. 41-74.

Wertheimer, M. (1944), "Gestalt Theory", *Social Research*, Vol. 11**,** pp. 78–99.

Wetter Edman, K. (2009), "Exploring Overlaps and Differences in Service Dominant Logic and Design Thinking," First Nordic Conference on Service Design and Service Innovation, November 24-26 2009, Oslo, Norway.

White, J.C., Varadarajan, P.R., and Dacin, P.A. (2003), "Market Situation Interpretation and Response: The Role of Cognitive Style, Organizational Culture, and Information Use", *Journal of Marketing*, Vol. 67, No. 3, pp. 63-79.

Wilkinson, I. and Louise Y. (2002), "On cooperating: firms, relations and networks," *Journal of Business Research*, Vol. 55, No. 2, pp. 123-132.

Willis, A.J. (1997), "The Ecosystem: An Evolving Concept Viewed Historically," *Functional Ecology*, Vol. 11, No. 2. pp. 266-271.

Wollin, D. and Perry, C. (2004), "Marketing management in a complex adaptive system: An initial framework", *European Journal of Marketing*, Vol. 38, No. 5/6, pp. 556-572.