Faculty of Design

2014

The many faces of design: From adaptive response to creative agency to reflective engagement

Ruttonsha, Perin

THE MANY FACES OF DESIGN:

From Adaptive Response to Creative Agency to Immersive Engagement

Perin Ruttonsha[1] & Stephen Quilley

Waterloo Institute for Social Innovation and Resilience (WISIR), University of Waterloo

Abstract

In its broadest sense, design with a 'D' might be characterized as the unique human ability to reflect on, reorganize, reimagine, manoeuvre within, reengineer, and therefore recreate one's lived experiences (Edmonson, 1986; Chaisson, 2001; Cross, 2007; Berger, 2009). With this in mind, and in light of contemporary social-ecological pressures, designers have recently been considering how strategic design thinking might be tasked more broadly within the enterprise of social-ecological sustainability. Social innovation and resilience literature indicate that profound change amidst complexity is not a one-stop operation, neither is it direct, nor prone to absolute control (Gunderson & Holling, 2002; Westley, Patton, & Zimmerman, 2006). Rather, it requires alignment across multiple domains, and the order in which this takes place will depend on the point from which one begins, as well as the nature of the barriers and opportunities at hand (Westley et al. 2006; Geels & Schot, 2007; Westley & Antadze, 2009). Interpreting design through its 'many faces' — that is, the many definitions that it encompasses, the ways of thinking and behaving that it engenders, and the functions that it serves — is conducive to the development of a flexible and phased approach to change. This paper embeds 'the many faces of design' within a social innovation and resilience framework, to examine how its mechanisms can engender a multi-layered approach to long-term, adaptive systems transformation, navigating leverage points for change within dominant basins of attraction.

[1] Special thanks to the Institute without Boundaries (www.worldhouse.ca), whose work in interdisciplinary design strategy has inspired this working paper.

Introduction

Design is pervasive, both as act and outcome. For this reason, the term itself moves casually across domains, rendering the boundaries of a specific design discipline evasive; especially recently, where those in the field are deliberately extending the reach of their expertise into territory beyond classic design problem spaces. Against a backdrop of rising complexity and the social-ecological pressures that this yields, designers have been stirred to reform their project work to speak to these dynamics, while also considering whether the field itself has a broader role to play in navigating the wicked problems[2] indicative of the contemporary global stage. Some purport that it does (Papanek, 1971; Fuller, 1969; Brown, 2009; Mau, 2010; Kolko, 2012), and for this reason have been infusing design practice with social processes and mandates, bidding to occupy the realm of social innovation and systems transformation (Brown & Wyatt, 2010; Westley & McGowan, 2014). Here we will seek to unravel the nature of this opportunity, by examining the role of design's many faces as they relate to complexity thinking. Before we begin, we will clarify a few of the basic premises on which we base this interpretation.

The term 'design', as verb and noun, is already applied openly outside the context of a professional design practice, for example, the term finding common use to refer to devised plans, or acts of conception, planning, and execution toward an end (Allen, 2006). More conventionally, design as a professional practice is most easily associated with work within graphic, fashion, interior, industrial, architectural, urban, and more recently, multimedia and interaction disciplines. Expanding characterization of capital 'D' design further confounds interpretations of the word; not to mention, when designed outcomes refer to whole systems, the association of design with concrete artifacts evaporates. Furthermore, some portray acts of designing as innate and habitual (Cross, 2007; Berger, 2009), the realm of design characterizing the natural human tendency to reflect on, reorganize, reimagine, manoeuvre within, reengineer, and therefore recreate one's lived experiences to some desired effect (Edmonson, 1986; Chaisson, 2001; Berger, 2009). Thus, not only are the terms 'design' and 'designing' not exclusive to a specific domain of expertise, but the work of designers could be argued to be, in some respects, a conscious engagement of an innate habit; one which engenders a mechanism for adaptive or transformative change at a personal scale; and, one which is highly dependent on the specialized knowledge of other fields of expertise. In this light, what has been emerging in strategic design thinking is the codification, systemization, and centralization of a practice that is both timeless and universally accessible, consciously extending common sense approaches to problem solving and innovation. In facilitating the use of the term beyond the walls of design studios or the fixed boundaries of classic design projects, design is relieved from the constraints of the specific design disciplines, and instead becomes an interpretive lens in understanding mechanisms for adaptive transformation.

Nevertheless, out of this natural human capacity for problem solving (and, specifically building on the use of symbolic representation of ideas) has grown an art and skill in which the work of designers sits squarely— one that has developed historically through practice, builds on a formalized knowledge base, and demands a certain degree of technical, conceptual, and aesthetic proficiency. In other words, while design in its broadest terms may have emerged as an approach to creative problem solving, it has since evolved to include a repertoire of solutions with which one

[2] For a ten-point definition of 'wicked problems' see: https://www.wickedproblems.com/1_wicked_problems.php.

requires specialized knowledge to engage, as well as the ability to continue to reinvent this repertoire. So, while design thinking shares ties with creative thinking and innovation thinking, the practice of design itself is more specific. In addition to the open exploration of new ideas, the literal designing of something concrete within a given set of constraints generates the mindset of the design thinker. Moving through a schematic ordering of parts (Edmonson, 1986) toward intended objectives is less about creative dreaming as much as an iterative sequence of decision-making relating to the design's purpose, form, structure, function, composition, materiality, and contextual significance. Recognition that each of these specific choices can have a resonant impact on both environmental and human quality of life factors at a global scale (Papanek, 1971) establishes designers' accountability to social-ecological systems. From this, sustainable (McDonough & Partners, 1992), biomimetic (Benyus, 1997), universal (Zec, 2009), human-centred (IDEO, n.d.), and responsive design (Duke, n.d.) principles take stage; but more notably, beyond applying these principles in what might be deemed to be classic design problem spaces, practitioners have embraced broader social-ecological issues as a cause, with a view to expanding their reach. This transition is really just expressing the complementary face of ecological footprint measurements. Acknowledging the inherent lifecycle impact of discrete design choices on social-ecological systems implicitly teases out the question of how design practice could potentially produce net positive results. This aligns clearly with the move to stop settling for 'less bad' behaviours and start searching for one that are, on the whole, beneficial (McDonough & Braungart, 2013). This has effectively launched design practice into open and choppy waters, wherein designers are asking not only how they might render their work more sustainable, but also what their work can do for the enterprise of sustainability — or, in other words, *how 'good' can we be?* In this way, designers are exhibiting a greater degree of social agency in their approach. No doubt this raises questions. It positions something that is most easily associated with the production of concrete artifacts on ground that is inherently wicked and complex. But designers have always operated in the domain of wicked dilemmas, as Rittel and Webber (1973) remind us, as related to urban planning — this never really being a mechanistic procedure taking place within fixed states, or subject to absolute control. Only recently, perhaps, these wicked qualities have become more apparent, and also intensified. Alexander (1964) notes, as the pace of change accelerates, designers are increasingly expected to reconcile more information within their decision processes. As well, the increased interconnection permitted by increased complexity means the potential cascading impacts of discrete design decisions theoretically expands, and in ways that can neither be predicted nor specified. Thus, present-day designers are asked to plan for the unknown—a task that is equally confounding in other domains of practice.

Enabling intentional transformative change in complex systems is a murky pursuit. It should be emphasized that adopting a generative, organic, and emergent design process does not necessarily indicate an adaptive response to a specific context, or its emergent properties. Rather, designing within complex systems demands total immersion. It requires a return to the notional roots of the practice, wherein design-like activities may have taken place as trial and error engagement with place, as a means of testing one's limits or improving one's circumstances, and drawing on both tacit and explicit ways of knowing. The continued accumulation of knowledge over time, expanded means of sharing this, and increase in social-ecological complexity, changes this game in contemporary settings — though only in the sense that designers are afforded a wider repertoire of tools and contextual material to work with, while the density of the interactive

dynamics in these contexts has, perhaps, also increased. Ironically, as the collective capacity to interpret the conditions of and act within this complex planetary system has heightened, so too have the terms of uncertainty which render the exercise nearly insurmountable. In the face of this, the best one can do is to determine the most effective ways of deploying the skills and tools one has on hand, while continuing to expand this toolkit. As this relates to design practice, while the capacity for creative agency is reassuring, designers must also seek out refined means of tuning in to the currents in which they are operating. Perhaps through close reflection on context, combined with the conscription of creative agency, one might develop the skill to simultaneously sit within a current while also gently influencing it. This evokes a philosophical stance in which one takes accountability for one's presence in a system *through* active engagement with it — one's acts of intervention viewed as the means through which one shapes and sustains one's position in a system. In other words, one takes responsibility for one's existence in a system by clearly defining its nature and properties. In this light, 'creative human agents' are an embedded element of systems, and their acts of agency critical to the functioning of these systems as a whole. This suggests that responsible existence obliges participation. Importantly, intentional choices of non-intervention are still valid as an expression of creative agency. The need for renewed competencies, as well as co-generative transdisciplinary processes, in order to discover this balanced approach, must not be underestimated.

Central to this would be the sharpening of one's senses and tools of interpretation in analyzing the nature of the contexts in which one is embedded — an undertaking that necessarily extends beyond the expertise of designers. This demands dexterity in moving between acts of observation and acts of intervention. While it is tempting to position acts of observation within the realm of science, and acts of intervention within the realm of design, Midgley's (2000; 2003) writing implies that this is an overly simplified view. Where Midgley's (2000; 2003) work portrays scientific acts of observation as one type of intervention, here we consider design and design thinking to contribute unique approaches to observation and analysis. Designers employ 'ways of looking' through which different interpretive analyses of contexts might be derived, not merely suggestions for feasible interventions. At the same time, the practice must not become overly distanced from work in the natural sciences, social sciences, and humanities, as it is the observations emerging from these core research areas that can keep design decisions grounded. As such, one role of strategic design thinking might be to reframe research findings from traditional disciplines relative to an integrated view of decision contexts, and the options at hand. Also distinctive of design discernment is sensitivity toward the multitude of plausible scenarios that could exist with the slight adjustment of variable factors. In other words, designers are at ease in the realm of *'what could be'*, or what Luigi Ferrara (personal communication, 2007) refers to as the 'designscape'. Importantly, the tools and sensibilities that designers bring to this exploration set them apart from the imaginative exploration that takes place in various kinds of arts-based practices (although, of course these categorical distinctions of practice often blur). For example, while fantasy aims to achieve coherence within mentally constructed worlds, designers are often expected to accomplish functional solutions within a real one. (We will not attempt here to question the nature of reality and the extent to which its parameters are mutable.) Still while, designers are accustomed to working within specified constraints, they often stretch the capabilities of these known and perceived realities. This mindset is crucial when attempting to dissolve intractable issues, as it leads one to ask if a puzzle's pieces could possibly fit together in a different configuration, thus producing new results. Moreover, this process

is key in understanding adaptive change. Reconfiguring a known reality, stepwise, in which problem and solution frames co-evolve (Cross, 2007; Gamble, 2008), simulates natural, adaptive processes of evolution, more so than a constructed jump of the imagination to a distant future. Of course, this does not guarantee transformative change, and therein sits a paradoxical challenge. Designers require long-term visions for orientation, or risk getting caught in a cycle of direct response to immediate issues; yet, trying to implement a plan according to a fixed understanding of the future contradicts the wisdom of resilience thinking.

Interpreting the role of design through its 'many faces' — that is the many definitions that it encompasses, types of thinking that it engenders, and functions that it serves — is conducive to the development of the kind of flexible and phased approach encouraged when navigating the non-linear dynamics of complex systems. Moreover, many have described contemporary design processes as non-linear and integrative, and therefore a useful tool in complex systems thinking (Rittel & Webber, 1973; Buchanan, 1992; Cross, 2007; Kolko, 2011; Martin, R.L. & Christensen, K. 2013; Westley & McGowan, 2014). The intention of this paper is not, however, to articulate the lateral or integrative quality of design thinking techniques, as this can be found in other work. Rather, it will embed 'the many faces of design' within a framework through which to assess its potential role in navigating systems transformation within uncertainty. The hypothesis explored is that these 'many faces' already exhibit a nascent potential to feed into such purposes, however, require articulation in order to facilitate fluency in drawing upon each, methodically, as contextually appropriate. This paper aims to contribute to such an articulation. Inspired by discourse in social innovation (Westley et al., 2006; Geels & Schot, 2007; Westley & Antadze, 2009) and resilience thinking (Gunderson & Holling, 2002; Walker & Salt, 2006; Folke, 2006), which depict transformative change within complex systems as a process of cyclical fluctuation, cross-scale alignment, and interaction within nested holarchies, the structure of this interpretation conjures each of these. Moreover, underpinning this conversation is recognition that cultural complexity, in its present form, has emerged contingent on many of the design-based processes discussed — at the least, the ability to depict a schematic idea through a drawn plan allows designs to proliferate and change, permitting the kind of cumulative complexity described by (Arthur, 2009). By this right, the question examined here is not whether design and strategic design thinking can contribute to adaptive and transformative systems change, as they have already been complicit in this, if only emergently. Even when working within a narrow set of constraints, the cumulative complexity arising from the recombination of variables (Arthur, 2009; Whitesides, 2010) can inadvertently champion a march toward a radically transformed future. Rather, here we ask how designers might hone their proficiency in moving effectively and responsibly within a climate of change that only continues to accelerate.

A Nebulous Definition, A Multi-Faceted Approach

Design inherently engenders some degree of change — the manifestation of something that is not yet, or the improvement of something that is already — even if only on a marginal scale. This is perceptible in the ideas of Fuller: "Only human beings are able to discern such truths (science) and thereby participate in their own evolution (design)…humanity alone has access to the design laws of the Universe and that has determined our unique evolutionary function" (Edmonson, 1986, p.288). From an evolutionary perspective, design is a reproposition of possibility; to redesign is to redevelop the properties of something's existence. (While to 'make' without redesigning is to repeat the

parameters by which that something has found success in the past.) In this way, design-based activities are already situated within a change framework, the amalgamation of marginal changes perhaps partially responsible for impelling civilizations through state shifts over the course of centuries. Also described by Fuller as a "deliberate ordering of components" (Edmonson, 1986, p.288), design with a capital 'D', from an anthropocentric perspective, might be regarded as the coordination of parts into the systems that shape human living: "As social animals, human beings do not only *act,* we also strive to *co-ordinate* our actions…We act in co-ordination with others, and [design] language supports the co-ordination of these co-ordinations" (Midgley, 2000, p.55). If one understands design as a way of relating to self, other, and place (L. Ferrara, personal communication, 2012), then the designed world becomes a mediator for human interactions with and within inhabited places. It is from these broad premises, wherein we consider strategic design thinking as a means by which the human species is able to redefine the conditions of its own existence and the relational dynamics that these implicate, that one might examine design as a tool for social innovation and transformative change. By the above-listed terms, segregation between the domains of science, technology, and design are blurry. Edmonson's quote presents a frame that we will adopt for the purposes of outlining boundaries for this discussion: we will consider the domain of science to be concerned primarily with the discovery of new truths (or, following Arthur's [2009] thinking, the discovery of phenomena — natural or social[3]); technology will represent the various possible applications of these discoveries; and, design the delivery system for these technological applications, rendering them accessible and relevant within the social realm. Within this, the practices classically associated with the 'd' design professions still have place as a set of expanding techniques — part of a broader repertoire of means to ends.

Strategic design thinking already shares much with social innovation thinking, so it is not a far stretch to imagine how these two worlds can connect, as is beginning already (Westley et al, 2011). They both align with innovation theories (Kelley & Littman, 2000; Westley & Antadze, 2009; Kolko, 2010). They both draw on the human capacity for agency. They both operate with loose and continually shifting views of final destinations (Westley, Patton, & Zimmerman, 2006; Cross, 2007). They both witness punctuated moments of convergence; for example, in social innovation contexts, this referring to alignment across niche, regime, and landscape levels of action (Geels & Schot, 2007); and, in design contexts this often experienced as pattern recognition during intensive phases of concept exploration (Kolko, 2011). They both carry an inexpressible air of magic (Kolko, 2011), neither of their processes being entirely comprehensible without direct experience — 'being in the flow' (Westley et al., 2006) something that is easier to enact than describe. Needless to say, design is also a social process, and frequently endowed with explicitly social purposes (if only to the extent that it creates shared properties or implicates sets of users). Where strategic design thinking could expand its adoption of the social innovation angle more explicitly, is in its use of a multi-layered approach. Social innovation literature indicates that profound change amidst complexity is not a one-stop operation, neither is it direct, nor prone to absolute control (Westley et al., 2006; Westley & Antadze, 2009). Rather, it requires alignment across multiple domains, and the order in which this takes place will depend on the point from which one begins, as well as the nature of the barriers and opportunities at hand (Westley et al., 2006; Geels & Schot, 2007; Westley & Antadze, 2009; Westley,

[3] In examining historical cases of social innovation, the Waterloo Institute of Social Innovation and Resilience (WISIR) applies Arthur's (2009) view, and links the emergence of new social phenomena, or new 'truths', to opportunities for innovation (Westley & McGowan, 2013).

Olsson, Folke, Homer-Dixon, Vredenburg, Loorbach, Thompson, Nilsson, Lambin, Sendzimir, Banerjee, Galaz, V., & van der Leeuw, 2011). Moreover, the types of methods and expertise required to break through the barriers and nurture the opportunities will shift as a change process progresses (Westley & Antadze, 2009). As such, a layered, adaptive approach is vital when navigating the dynamics of complex, non-linear systems (Gunderson & Holling, 2002; Folke, 2006). Contemporary, integrated design processes (IwB, n.d.) are often already phased and iterative (see Figure I). Here we will examine how strategic design thinking and practice can be coordinated and expanded into a set of mechanisms that might be appropriate within complexity contexts, and especially characteristic of post-normal[4] or democratic science processes (Funtowicz & Ravetz, 1993; Kitcher, 2011). For example, designers can play a role in the conceptual reframing of data, navigation of the reflexive relationship between behaviour and form, and the detailing and evaluation of alternative future scenarios. In doing so, designers will invite evermore contextual information into their frames; and, while one advantage of design processes is the generation of novel perspectives, it is important to also maintain a rigorous analysis of this data.

The interpretation to follow, is intended to facilitate a layered understanding of how strategic design thinking practice might inform processes of systems transformation, and how the burgeoning interest in directing design toward such purposes (Papanek, 1971; Mau, 2004) could be further refined in alignment with social innovation and resilience discourse. The interpretive framework presented has been inspired by a particular quote from social innovation text, *Getting to Maybe:* "...influencing perspective could influence practice that in turn could influence progress" (E. Young in Westley et al., 2006, p.16). This is overlaid with two additional filters, used by this same first author: one relates to social innovation actor roles — "The poet shapes or expresses the new idea or social phenomenon, the designer converts the phenomena into an innovation (a policy agenda, a program, product, etc.), and the debater advocates for either the innovation, the new phenomenon or both" (Westley & McGowan, 2013, p.5);[5] the other defines social innovation as "a complex process of introducing new products, processes or programs that profoundly change the basic routines, resource and authority flows, or beliefs of the social system in which the innovation occurs" (Westley & Antadze, 2009, p.2). Finally, the framework packages these three social innovation lenses within the resilience literature concept of basins of attraction (Gunderson & Holling, 2002; Walker & Salt, 2006).[6] While a multi-level perspective on transition (Geels & Schot, 2007) tracks alignments across niche, regime, and landscape levels, this paper will develop a *multi-layered* perspective, which posits that within any given basin of attraction there exist interconnected, but discrete, layers of

[4] Funtowicz and Ravetz (1993) define post-normal science conditions as ones wherein decision stakes and/or systems uncertainties are high.

[5] Westley & McGowan (2013) adopt this frame from Himelfarb (2013).

[6] "A 'basin of attraction' is a region in state space in which the system tends to remain. For systems that tend toward an equilibrium, the equilibrium state is defined as an 'attractor,' and the basin of attraction constitutes all initial conditions that will tend toward that equilibrium state. All real-world SESs are, however, continuously buffeted by disturbances, stochasticity, and decisions of actors that tend to move the system off the attractor. Therefore, we think of SESs as moving about within a particular basin of attraction, rather than tending directly toward an attractor. There may be more than one such basin of attraction for any given system…"(Walker, Holling, Carpenter, & Kinzig, 2004)

activity. To follow, we postulate that in articulating a new basin, there are multiple thresholds to be crossed: (1) belief systems, points of view, and assumptions can overtly or imperceptibly shape decision processes; yet still, (2) these perspectives are sanctified through the routines or schematics that enable them; moreover, (3) alternatives for change are only as successful as the resource and authority flows through which they might be mobilized. Of course, in any given design project, these layers are intertwined. Here we separate them, categorically, in order to better understand how to work within the nuanced dynamics of the basin of attraction in view. These three categories should be seen as interdependent, but distinct, each moving in and out of focus during strategic design processes. At times, one or more of these basin layers might stand out as containing an obvious point of leverage, or representative of key drivers or barriers. For example, a project might be instigated by a shift in mandates, such as the adoption of Leadership in Energy and Environmental Design (LEED) Gold standards for new construction (U.S Green Building Council, n.d.); invention of a new technology could provoke the investigation of its many possible applications; or, a turnover in political authority could create opportunities for new development. Conversely, if a project is experiencing barriers in one basin layer, this may indicate a need to shift focus to another. For example, one might imagine a project facing delays in its implementation, not for a lack of resources, rather due to the presence of unexpressed, competing value sets. In such a case, if a design's characteristics are implicitly responding to embedded assumptions, a collective review of related belief systems might prove more effective than an ongoing redevelopment of design schemes to meet preferences that are indeterminate. These three basin layers are described using clusters of complementary but non-analogous lenses, as follows:

BASIN LAYER I

Perspective

Social Innovation Role: **Poet**
Social Innovation Domain: **Beliefs**
Design Phase: **Exploration**
Design Act: **Adaptive Response**
Design Function: **Process of Sensemaking**
Design Outcome: **Concept**

BASIN LAYER II

Practice

Social Innovation Role: **Designer**
Social Innovation Domain: **Routines**
Design Phase: **Synthesis and Iteration**
Design Act: **Creative Agency**
Design Function: **Mediation**
Design Outcome: **Program**

BASIN LAYER III

Progress

Social Innovation Role: **Debater**
Social Innovation Domain: **Resource and Authority Flows**
Design Phase: **Connection**
Design Act: **Immersive Engagement**
Design Function: **Systems Integration**
Design Outcome: **Implementation**

We begin this exploration with a theoretical development, however, the interpretive structure also

lends itself to a historical assessment; for example, in many ways, this interpretation has been inspired by Alexander's (1964) evaluation of the historical shift from 'unselfconscious' to 'selfconscious' design processes. Here, we will not emphasize a historical perspective, for risk of endowing the categories examined with an inappropriately progressive flavour. Rather, the distinctions provided below are intended to parse strategic design thinking into its many facets, such that these elements might be directed toward specific points of leverage in processes of systems transformation. All three of the design 'habits' described — semiconscious reordering, intentional manipulation, and conscientious reintegration — are relevant to any design process, and are as equally viable today as they might have been for early ancestors. So too, developing conceptual visions, programmatic schemes, and implementation plans is an iterative endeavour in any given project, these stages overlapping.

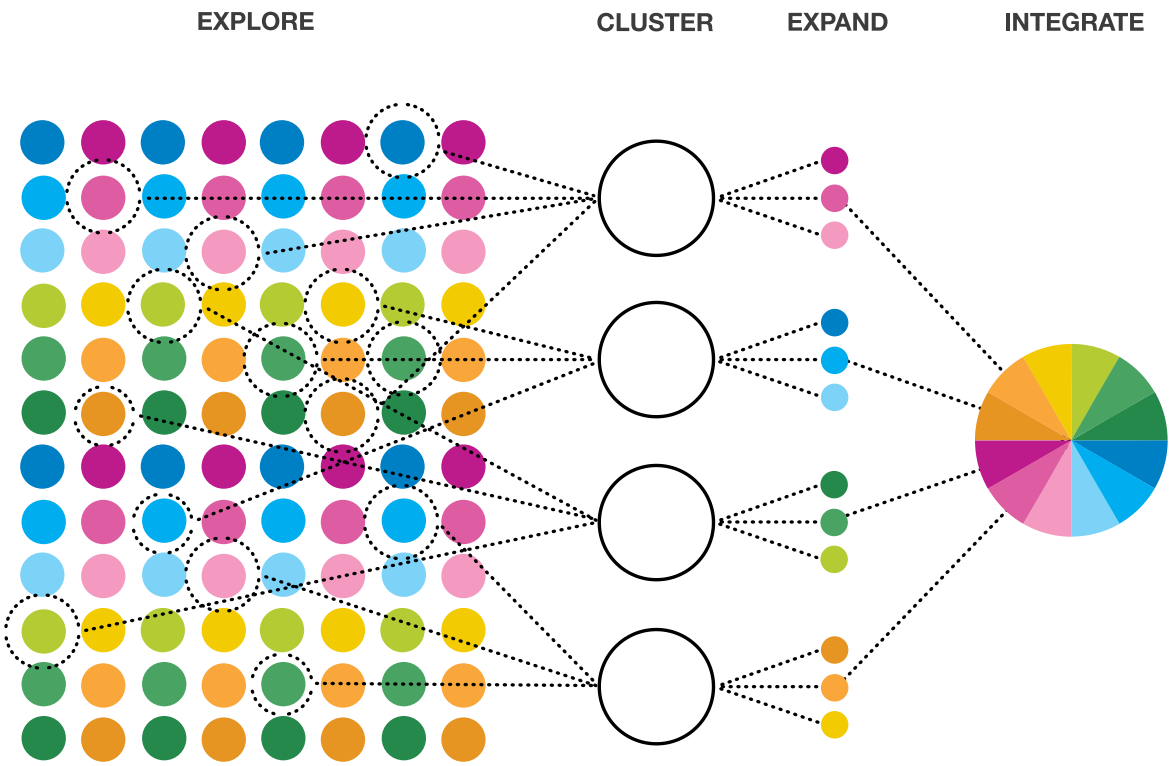

Figure I: Design Process
Modified from Ruttonsha & the Institute without Boundaries, 2008

BASIN LAYER I

Perspective

Social Innovation Role: **Poet**
Social Innovation Domain: **Beliefs**
Design Phase: **Exploration**
Design Act: **Adaptive Response**
Design Function: **Process of Sensemaking**
Design Outcome: **Concept**

> "The poet shapes or expresses the new idea or social phenomenon" (Westley & McGowan, 2013, p.5)

If one assumes belief systems, perspectives, worldviews, and assumptions to hold weight, such that conceptual frames of reality, implicitly or explicitly, inform how one works within it, then shifts in understanding would naturally fold into transformative processes: "The rules and beliefs which make up cultures both define and limit people and at the same time provide the material they need to create novelty"(Westley & Antadze, 2009, p.5). Positioning information from multiple vantage points, shifting frames of reference, and building new cognitive maps can be useful approaches in consensus building and collaborative knowledge generation, and might also lend to the dissolution of what might seem to be intractable knots within complexity scenarios. By these means, strategic design thinking can serve an interpretive role — one of collective visioning, contextual analysis, and frame shifting — that is enabled through processes of social learning. Kolko (2010) specifically emphasizes the merit of design processes as a form of 'sensemaking' (Aaltonen, 2007). Sensemaking is "defined as 'how people make sense out of their experience in the world' " (Klein, Moon, & Hoffman, 2006, p.70), and is at the heart of how we create meaning, interpret value, and subsequently make decisions amidst complexity, uncertainty, and unknowing. This might include continually drawing connections, associations, and inferences to synthesize, filter, or reconcile data with one's existing views (Klein, Moon, & Hoffman, 2006; Kolko, 2010), for example, using techniques such as mapping, storytelling, visualizing, illustrating, modeling, and combining insights (Kolko, 2010; Stirling, 2010); and, all of these acts contributing to designers' proclivity for abductive reasoning (Kolko, 2010).

Conceptual pluralism is one of the many facilities of designers. In fact, in design processes, it is not only convention but expected that one would explore and evaluate multiple solutions to any given problem as due diligence (Cross, 2007). Designers cannot help but work iteratively, expressing complementary and competing concepts in a diversity of variations. For complex systems theorist Scott E. Page (2007), this kind of cognitive diversity is key to effective problem solving, and he notes that approaches to information representation is central to how perspectives are formed: " 'The heart of all major discoveries in the physical sciences is the discovery of novel methods of representation' "(S. Toulmin in Page, 2007, p.24). Jumping between modes of representation is something else with which creative practitioners are at ease. If one considers design to enlist a specific type of visual language (inclusive of graphic, three-dimensional, and multimedia formats), then design can be positioned as an interpretive tool, and the fashioning of these many representations not merely a course of planning toward fabrication. Language translates observations and experiences of the world into abstract representations that provide perspectives on reality, this supplying a system of interpretive meaning (Page, 2007). The formation of these

interpretative representations also engenders a process of invention: “perspectives organize knowledge...mak[ing] clear what had been opaque”, but also “create superadditive effects”(Page, 2007, p.50) “[perspectives]… combined to form ever more perspectives”(Page, 2007, p.50). Thus, ways of thinking and seeing are themselves a form of technology (Buchanan, 1992), and building blocks for increasingly complex ways of knowing. There is opportunity and need for this kind of interpretive work to be expanded within strategic design work as a process of sensemaking, and means of engaging with the sets of belief systems and worldviews that are underpinning decision making. These types of processes would be equally beneficial to design outcomes, as well as stakeholder interests. Systematizing data and synthesizing knowledge through design languages can enhance the accessibility of sophisticated subject matter among diverse stakeholders. For example,‘infographics’ and ‘giga-maps’ are knowledge products that shape vast quantities of data in order to reveal underlying patterns, “connection, energy, hierarchy, and context”(Klanten, Bourquin, Ehmann, van Heerden, & Tissot, 2008, p.6). This is especially pertinent when working in scenarios requiring decision inputs from diverse groups. It is also useful for designers to spend time engaging with relevant expert knowledge through these means. Surmounting complex systems issues may call for a reorganization and expansion of one’s cognitive toolbox, understanding a precursor to actualization: “what many people call ‘impossible’ may actually only be a limitation of imagination that can be overcome by better design thinking” (Buchanan, 1992, p.21).

Imagination is integral in planning for a future unknown, both in the articulation of alternatives and the projection of how these options might unfold over the long term (see Basin Layer III): “Imagination applies to things or people as they are not now, or are not yet, or are not any more, or to a state of the world as it never could have been but is interesting to reflect on” (Bromwich, 2008, p.4). With the application of imagination, problem solving is propelled from a direct, and perhaps passive, response to what is to an anticipation, or active proposition, of what could be. As Lappé (2011) articulates, through the use of imagination humans adapt: “ ‘More than any other creature, human beings are able to change...The key to human nature at every level from brains to minds to societies’ is what neuroscientists call plasticity —‘our ability to change in light of experience.’ And this quality, [Alison Gopnik] underscores, depends on our extraordinary imaginations. The great evolutionary advantage of human beings is our ability to escape the constraints of evolution... We can learn about our environment, we can imagine different environments, and we can turn those imagined environments into reality”(p.101). The kind of thought leaps that have brought about the scale of invention enjoyed by contemporary human civilizations would have involved some degree of stepping out of one’s own circumstantial understanding of reality. As such, the nurturing of collective imagination is perhaps essential in untangling seemingly intractable issues. It can also be a tool for consensus building: “If we are to come together as different people in a migratory age, we must share a common ethic. It cannot be religious, political, socio-cultural or ideological. In today’s diversity, such commonality is found only in creativity, common delight and shared imagination and wonder” (Di Cicco, 2007, p.67). While imagination often conjures dreamy contemplation of that which does not yet exist, the potential rigour of this tool in collaborative decision making should not be underestimated. Nor should its many facets be overlooked, especially as they relate to unwinding controversies between multiple stakeholders. The development of collective imagination can be facilitated to a variety of ends, not merely the projection of plausible futures. For example, ‘moral imagination’ (Bromwich, 2008) can help one gain entrance into the world of others (Elliot & Elliot, 1991; Lapum, Ruttonsha, Church, Yau,

& Matthews David, 2012), developing empathy for that which has not been experienced directly. Multiple representations of circumstantial evidence and narratives can serve to reveal the diverse human experiences of complex issues, articulating the implications of decisions on involved parties. As well, in their theory on moral insight, Zhang, Gino & Margolis (2014), explain that replacing the should mindset typical to ethical debates, with the could mindset that accompanies an open exploration of possible options, can enable 'moral insight': "the realization that an ethical dilemma might be addressed other than by conceding one set of moral imperatives to meet another, and…the generation of solutions that allow both competing imperatives to be met" (p.5). Creative processes can also provide a safe space wherein stakeholders let down their guard to explore sensitive issues, the creative devices employed temporarily distancing ideas from personal or political agendas. For example, what is often established in intensive design processes, such as design charrettes (IwB, n.d.) or design labs (Westley & McGowan, 2014), is the sense of an ephemeral space that operates under the rules of collective play and co-generative creation. On these terms, participants can test the waters of a new regime conceptually, without being obligated to surrender or even critique the scripts by which they operate otherwise. As well, imagination can be useful in sneaking in between that which can be predicted and the vast unknown, bridging these positions not with fantasy, rather plausible hypotheses. Finally, for designers, the use of imagination is also an embodied (Varela, Thompson, & Rosch, 1991) phenomenon: "we make sense of complexity by doing things" (Kolko, 2011, p.11). Imagination, when unfolded through an ongoing sequence of thinking and doing, produces hypothetical futures through direct interaction with a given set of materials and contextual factors (see Basin Layer III). In this instance, the timeframe for one's projected repropositions is short, and the solutions close to home.

In these ways, designers can play an important role in knowledge generation, multiple ways of knowing contributing to a better understanding of the whole (Giampietro, 2004; Page, 2007). However, what strategic design thinking approaches achieve in the construction of innovation perspectives, they might lose in objectivity, in the strictest sense. The development of multiple cognitive frames clearly enlist subjective boundary choices (Giampietro, 2004); sensemaking can lean toward being self referential — "It is a process of deliberating over alternative plausible explanations while at the same time having our explanations guide the exploration of information" (Eskridge & Hoffman, 2012, p.58); abductive reasoning relies on a capacity for pattern recognition in data, this potentially guided by one's preferences for certain conceptual constructs; embodied knowing is user specific; imagination readily engages with implausible solutions; and, designs created relative to a specific time and place are not necessarily repeatable. This said, the field of design is open about this inherent subjectivity, and in many cases encourages it (Kolko, 2011). That is, it draws from the particularities of individual experiences as a valid way of coming to know the world, and oftentimes, customizes its responses to niche contexts and interests. In this way, designed responses as a collection, can demonstrate a kind of pluralism, by which similar principles are expressed through a range of variations, resulting in a cultural mélange that is unpredictably untidy in its non uniformity, and in this way, perhaps also exceptionally resilient in its diversity. Moreover, design demonstrates a blended epistemological approach, and an aptitude to shuffle between epistemological positions as required. For example, while early phases of work may embrace exploratory conceptualization, ultimately, any manifest 'design' must operate within the given conditions of the systems in which it is brought to life, if it is to achieve transformative impacts that are broad and enduring (Westley & McGowan, 2014). On these grounds, Basin Layer II comes into view.

BASIN LAYER II

Practice

Social Innovation Role: **Designer**
Social Innovation Domain: **Routines**
Design Phase: **Synthesis and Iteration**
Design Act: **Creative Agency**
Design Function: **Mediation**
Design Outcome: **Program**

> "the designer converts the phenomena into an innovation (a policy agenda, a program, product, etc.)"(Westley & McGowan, 2013, p.5)

Basin Layer II is perhaps the most obvious domain of the designer — designers classically positioned as creative agents, or visionaries. Creative agency implies an intentional rearrangement of what is already. It entails the willingness and capacity to move from one position to another, as well as an ability to identify that such a shift is plausible. As such, creative agents must possess the conceptual flexibility (as described in Basin Layer I) to envision new future states, as well as the proficiency to work within and transition beyond the parameters of the existing social-technological landscape, whatever they might be. Of course, creative agents will have skills in different aspects of these social-technological fields, so the technical proficiencies demanded for fundamental systems transformation is not the work of one individual. In the first basin layer we positioned the construction of ideas and perspectives as acts of invention. In Basin Layer II, while creative agency may be initiated with a vision, here we will consider it to be formalized through manifest *interventions* in any given context. These could include tangible artifacts, such as products or environments, as well as intangible work, such as programs or policies. Typically, such interventions represent some degree of change within the context in question, even if only minimally: "Design changes reality" (Stolterman, 2014). In some cases, interventions might be exploratory in nature, and represent an examination of one's creative limits; in others, interventions might push toward a desired outcome, for example, a notional understanding of 'improvement' or 'progress'. While enabling creative agency neither guarantees changes that are transformative in scope, nor a move toward any desired effects, with reference to the common claim that the act of designing represents the human species' unique evolutionary advantage (Edmonson, 1986), it is worthwhile to consider how such acts might facilitate adaptive capacity within the framework of sustainability and resilience planning. More than this, however, in the era of the anthropocene, wherein the human planetary presence is a dominant one (Steffen, Crutzen, & McNeil, 2007), it is worthwhile to tease out, not only the extent of human impact on the biosphere, but also the expanse of human-constructed reality. Doing so might help illuminate fixed and variable systems dynamics; however, this is less of an obvious exercise than it seems when one includes in this equation the relationship between structure and process (Giddens, 1984). If one considers socially-constructed artifacts to reflexively reconstruct human behaviour and nature, then the expanse of human constructed reality must be measured in depth as well as breadth. The significance of creative agency in design can be described as three-fold: there is meaning implicit in the expression of agency through one's attempts to recreate one's lived

experiences; there is meaning embedded in the choices made in any given intervention, these reflective of one's values, beliefs, assumptions, and goals; finally, there is the meaning that interventions impart on the world, this being both reflexive and multifold, as these interventions may be endowed with variant interpretations across a range of user groups.

The expression of creative agency stands out as a distinct and prominent feature of human behaviour — the wealth of collected artifacts (Cross, 2007), turning over at an exponentially increasing pace, testament to this. In fact, humanity's inventive mind and hand, which can interpret the laws of nature and, as a result, work with and transform it, has been credited as its distinct evolutionary advantage (Edmonson, 1986; Chaisson, 2001). Defined by Fuller as "the deliberate ordering of components" (Edmonson, 1986), Cross (2007) describes this aspect of design practice as instinctive human behaviour: "The ability to design is a part of human intelligence, and that ability is natural and widespread amongst the human population" (p.29). Design as an innate habit is also characterized by Alexander (1964) as 'unselfconscious', reflective of a kind of sensemaking, or adaptive learning through doing (see Basin Layer I). In this way, sensemaking is enabled through direct interaction with a set of materials and environmental conditions, this engaging tacit and embodied ways of knowing. These processes of reordering represent trial and error investigations of possibilities, as well as responses to one's surroundings; most importantly, however, they are a means of actively and formally taking part in one's inhabited contexts. Through the deliberate reordering of components, one transforms from being a passive receptacle of imparted experiences to enthusiastically co-constructing their terms, and thus, the creative agent emerges. As part of this transition, one might move between spaces of 'making' and spaces of 'designing'. These two acts occupy comparable territories of practice, and Quilley (2011) attributes acts of making as similarly fulfilling an innate need for creative expression, self definition, and personal empowerment. Despite their clear intersections, the difference between the two is useful for developing an interpretation of creative agency: "If you want to produce something, and you already know what it is, if it's just a matter of creating it in a little bit of a variation, or…maybe improve it in some way, it always has a little bit of design challenge to it, but it is mostly not a design challenge" (Stolterman, 2014). In this way, making is like baking.[7] There is a repeatable formula (within which one might redeem one's creative license to make amendments) that leads toward an anticipated outcome. Crucially, these repeatable processes of making still engender a tacit experience, and approach to sensemaking, through which one might transition to new ways of doing, thus entering the purview of design. If acts of making engage ways of knowing, then out of making emerges the ability to reconceive, and out of reconceiving emerges the ability to recreate. Through active participation in one's inhabited contexts, their scripts become so familiar that one may discover a certain competency in rewriting them. This ability to reinvent suggests a degree of self determination, not just in maintaining one's environment, but also in modifying its future conditions. The scale at which this is now feasible is considerable.

In discussing the significance of creative agency in the era of the anthropocene, the ability to direct this capacity toward the remaking of reality is only half of the story. Inversely, the pervasive human habit to recreate also has implications on the kind of reality that is enabled. While the former view emphasizes a progression toward future states, the latter illuminates historical development

[7] This metaphor is borrowed from Westley, Zimmerman and Patton's (2006) comparison of simple, complicated and complex problems.

trajectories, the social-ecological consequences of present conditions, and the meaning of living in a mediated world. To this end, another role of strategic design thinking is to facilitate systems design literacy among general audiences (Dubberly, 2014). Such conversations might begin with recognition of the scale, depth, and influence of designed mediations. In the era of the anthropocene, the reach of human agency is vast, even if only indirectly (Hobbs, Higgs, & Harris, 2009). Along these lines, within the last half century, design practitioners have been increasingly encouraged to take responsibility for the implications of their design choices (Fuller, 1969; Papanek, 1971; McDonough & Partners, 1992; Mau, 2004): There are at least three significant areas where design thinking can promote what the Canadian design Bruce Mau calls the 'massive change' that is called for today. The first has to do with informing ourselves about what is at stake and making visible the true costs of the choices we make. The second involves a fundamental reassessment of the systems and processes we use to create new things. The third task to which design thinking must respond is to find ways to encourage individuals to move toward more sustainable behaviours"(Brown, 2009, p.195). This assumes that each decision made within a design process has radial sets of social-ecological associations; further, it implies that values and preferences are implicitly embedded in even the seemingly trivial decisions. It should be emphasized that design processes, especially design development and testing phases, are often saturated with strings of interdependent, marginal moves — minor details (such as the length of a screw or the thickness of a material) which, when combined, are critical to how a project hangs together. This feature of design processes forms what is, perhaps, an underappreciated part of the design mindset: the ability to focus on precision in detail, while also organically shuffling between these details throughout a development process, to alter the quality and affect of the work, as appropriate. In other words, designers maintain within their unexpressed analytical frames, what Ferrara (in conversations with, 2007) refers to as the 'designscape' — that is the complete and modulated gradient of every hypothetically plausible design option, or every possible set of coordinates along the design spectrum. This way of thinking is inherently conducive to working within uncertainty (see Basin Layer III).

Design choices supporting the use of locally or sustainably harvested materials; low-waste, low-energy, and low-toxicity fabrication methods; and, equitable labour policies are obvious considerations. Measurement tools and accreditation programs now reflect these kinds of sustainability priorities in design practice (for example, Leadership in Energy and Environmental Design, and Lifecycle Assessment). Less straightforward, and not as easy to interpret through these kinds of tools, however, is how the human-constructed world supports certain economic and cultural habits over others. With regards to sustainability and social-ecological resilience, one might consider the extent to which the presence of designed modifications invites, enables, limits, or prevents certain types of behaviours. For example, design operates as a visual and three-dimensional language that can be as powerful and influential as spoken and written word in shaping one's understanding of reality (Cross, 2007; Kolko, 2007). Cross (2007) also describes this as the persuasive or rhetorical aspect of design — individual designs each a proposition to be engaged in or rejected. Processes of designing translate abstract notions into definitive, manifest forms (whether physical, virtual, or intangible), which codify how to 'be' in a given place and context (Cross, 2007; Kolko, 2007), cultural trends perhaps responding to these cues, and this inherently entrenching prevailing sets of

preferences.[8] One interacts with this constructed world both intuitively and through learned behaviour. In fact, over time, new designs may become so deeply embedded in cultural routines that they lose special consideration as designed systems, fading into the backdrop of weathered landscapes — a state that Mau (2004) refers to as "design nirvana". This state of normalization can also be dangerous, however, as it might lead to an amnesia, of sorts, regarding the original purposes of these constructions. As much as the designs themselves can become invisible, so too can the behaviours with which they are coupled become second nature. For this reason, it is important to facilitate a systems design literacy that continually calls attention to the forgotten features of the mediated world.

Embracing creative agency suggests a confidence in one's capacity to give shape to the world in which one lives, and in doing so, affect one's experience of it. In this regard, intentional acts of intervention subsequently produce the context in which one is immersed, and to which one responds with further interventions. This reflexive dynamic between form and behaviour affords much space for emergence. On these grounds, Basin Layer III comes into view.

BASIN LAYER III

Progress

Social Innovation Role: **Debater**
Social Innovation Domain: **Resource and Authority Flows**
Design Phase: **Connection**
Design Act: **Immersive Engagement**
Design Function: **Systems Integration**
Design Outcome: **Implementation**

> "the debater advocates for either the innovation, the new phenomenon or both" (Westley & McGowan, 2013, p.5)

Complex city systems as an object of study have borne many metaphors to aid in holistic design thinking, for example, 'city as' machine, organism, body, and ecosystem (Register, 2006; Tomalty, 2009; Brown, 2012; Bettencourt, 2013). While these metaphors do help to conjure the notion of whole systems, discourse in the new 'science of cities' critiques past and recent uses of this device for their emphasis on form over function (Bettencourt, 2013), instead painting these complex systems as an emergent product of the "actions, interactions, and transactions" (Batty, 2013, p.9) of their constituents: a live-action show writing itself in real time (Di Cicco, 2007), emerging urban infrastructures often reflecting the demands of commercial exchange (Lyster, 2006), their spaces and artifacts co-shaping human existence (Verbeek, 2005). From this perspective, mediated worlds are less an external imposition on the societies that inhabit them, as they are an extension of the civilizations[9] by which they are constructed — a manifest expression of the 'spirit of the times'. The trial and error exploration of designers (see Basin Layer II) represents not just a technological testing of limits, but also a cultural rewriting — civilizations searching for their collective voice through recreation, and never quite being settled. Of course, a final 'settling' may never arrive, rather, the continually renewing conditions always shifting perceptions of what there is to desire, and how one

[8] L. Ferrara cites an example from his own architectural practice in which the clients' personal biases were revealed through their design choices, despite their stated project mandates that explicitly directed otherwise (personal communication, 2014).
[9] Here we intend to use 'civilization' in the most inclusive sense of the term.

views oneself relative to the whole. If the individual sense of positioning is mapped relative to collective 'fields of meaning' — "If you live in a city or town, you get your bearings from the familiar layout of the streets: if you are on a country road, you find out where you are by looking at a map. In all cases you are relying on others who have mapped out the territory for you…"(Kearns & Kearney, 2006, p.79) — and the mediated world is partly responsible for the expression of these meaning fields, then as environments are changed through creative agency, the experience of this recreated reality can subsequently change the agents, along with the constituencies they represent. As such, as the characteristics of civilizations overturn, so too might the self-identities of their civilians. Moreover, the opposite may also be true. As described by Westley et al. (2006), in certain cases, acts of social innovation have required total immersion by agents in local circumstances, such that they were not imposing ideals from an external position, but also to the extent that it was necessary to undergo a personal transformation in order to make changes within their environment. As such, modes of operation in any civilization can plausibly outdate themselves, not necessarily because they were ineffective in the first place, rather, the collective has outgrown them, or they no longer reflect the spirit of the times — a spirit that older modalities may have inspired in the first place. In other words, continual resettling is a normal condition of social life, and one which the tendency to recreate only heightens. This emphasizes the obvious point that the idea of 'progress' is not intended to evoke a fixed notion of an ideal future, rather, phase shifts that are representative of accumulated wisdom.

Once a collective identifies that an existing mode of operation is no longer viable, the transition into new organizational frameworks is not always obvious, neither is it subject to absolute control. In contemporary urban settings, conventional modes of operation are due for reevaluation, with a need to address current social-ecological stresses. From a complexity perspective, one might say that these systems are moving through the crux of a major phase transition, the modern industrial era resettling into the digital, and new digital technologies transforming both social and infrastructural organization (Rifkin, 2013). The proclivity of designers toward reproposition, and the detachment from specific 'ways', is useful when grappling with intractable issues, as it can serve to circumvent direct focus on problems or even causes of problems. Through strategic design thinking, it becomes easy to sidestep problem spaces altogether, instead playing with contextual variables, parameters, and objectives. Referring to Midgley (2000), this becomes a co-ordination of co-ordinations, with social-political-economic dynamics integral to the shifting of parts. The designer's habit to allow problem and solution frames to co-evolve throughout the life of a project is invaluable to what might be considered a post-normal science approach (Rittel & Webber, 1973; Funtowicz & Ravetz, 1993; Cross, 2007; Gamble, 2008); so too is the use of design to articulate options for and implications of future scenarios. Both represent a kind of shuffling or pulling of strings until all of a system's parts find a satisfactory 'fit'. In this way, designers might be described as masters of trade-offs[10], negotiating between the interests of involved parties, massaging project parameters, considering how to generate more from less. Scenario planning has been identified as a valuable complexity thinking tool (Peterson, Cumming, & Carpenter, 2003; Ralston & Wilson, 2006). With a design bent, scenario planning gains the benefit of visualization (see Basin Layer I), as well as a reconceiving of options (see Basin Layer II). In other words, within scenario planning processes, one might actively seek to innovate along new social-technological trajectories in order to minimize

[10] Special thanks to design-build expert, Gavin Baxter (http://www.shedlightly.com/), for inspiration in this idea.

perceived compromises among stakeholders. This innovation can take place as part of a co-evolutionary process, in collaboration with stakeholders. For example, a clear articulation of options might change interpretation of desires, therefore opening discussion of further options. Moreover, designers can also help de-couple value sets from specific manifest forms, by demonstrating a range of schemes that theoretically accomplish similar goals. Testing options against evaluative criteria, illustrating the feasibility of phased implementation, and assessing their possible implications over the long term (inclusive of the range of diverse human experiences), differentiates scenario planning from an exploration of the 'designscape' (see Basin Layer II).

Strategies for the mobilization of proposed schemes are central to this stage of examination. As such, part of the innovation in this Basin Layer includes creative navigation or redefinition of political-economic channels. Here, the evaluation of solutions do become multi-level (Geels & Schot, 2007), as scenarios would necessarily articulate all players and plays involved in the dissemination of a new scheme. What's more, where barriers exist along these channels, power dynamics may be revealed, and opportunity for social innovation arises. In this regard, engagement with political-economic systems through specific design projects may subsequently result in indirect shifts within these systems. For example, if there is enough impetus within a community or special interest group to implement a given project, for which there may exist political obstacles, the causes and dynamics of these obstacles may be exposed, and potentially mitigated. Here again, one witnesses the relationship between structure and process (Giddens, 1984), only while in Basin Layer II the reflexive interaction discussed is between form and behaviour, in this Basin Layer it is between form and institutionalized systems.

Scenario planning can be used to present incremental stages of development along multiple trajectories, in order to break down processes of transition into manageable steps. Within this, however, a co-evolutionary approach can and should still be maintained; and, this with a view to what Stewart Brand (1999) refers to as the 'long now'. In other words, scenarios can represent a range of plausible pathways, the steps of which might later shuffle, or the middle phases of which might be missing entirely in the beginning. To say that circumstances are unpredictable and emergent is not to say that one cannot plan in advance; rather, one should pack a collection of tools to draw upon as needed. An adaptive, co-evolutionary approach means that designers imagine the future by moving through the conditions of the present. Solutions are developed in response to contexts, rather than the imposition of an imagined future state, or the repetition of past states. Decision processes remain flexible, confirmation of choices made only when necessary. As such, scenarios might present the long term view that is necessary for initial orientation, however, as emergent factors are revealed, pathways inevitably adjust. Designers' response to subtle shifts in habits of mind and ways of life will render each new design choice contemporary and progressive. Designs drawn from an authentic engagement with people and places are almost guaranteed to be novel, contemporary, and adaptive. Moreover, what is also developing in generative design practice is the notion that one can specifically encourage emergence by design (Brown, 2012). Rather than suggesting that emergence is an inevitable part of complexity, generative design implies that emergence is desirable. For example, encouraging emergence might involve permitting broad participation in the development and management of urban spaces, this consequently breeding community resilience. It might also involve establishing baseline parameters along which design schematics develop, maintaining space for surprise along this schematic unfolding: "Reflexive law, as it is called, is less rule-bound and recognizes that as long as certain basic procedural and

organizational norms are respected, participants can arrive at positive outcomes and self-correct" (Westley et al., 2011, p.769). In other words, one might plant seeds, write code, or set up a platform from which unexpected futures can blossom. While these kinds of adaptive approaches may seem overly prolonged in the face of immediate social-ecological pressures, the challenge is to become familiar enough with them to traverse their routes fluidly and intuitively.

As Alexander (1964) notes, the pace and scope of change in contemporary contexts is so rapid and extensive that the designer could not independently absorb and respond to all related systems' variables with which he or she is working, in order to make decisions that would be well-targeted on a macro scale. Strategic design thinking demands transdisciplinary collaboration. As an integrative practice, it represents a valid approach for the exploration of plausible future scenarios, and negotiation between interconnected variables, tested against evaluative criteria — this, inspired by the position that one can, in fact, move forward into what are, as of yet, unprecedented models. However, while design thinking implores that one enable creative agency to facilitate positive change for the future (Mau, 2004), complexity thinking cautions against any aim for absolute control in doing so. Furthermore, without rigorous analyses of the contexts in which one is designing, redesigns of current models may ultimately prove to be ungrounded or lacking in depth. For this reason, one requires effective ways of feeding knowledge products into design processes, throughout. On these grounds, Basin Layer I returns into view.

Hierarchy of Engagement

While the above interpretation of strategic design thinking is intended as an iterative approach, a similar concept can also be extended hierarchically (in the same way that it can be explored historically). The purpose of doing so is to demonstrate that strategic design thinking is, in fact, still valuable, even as complexity and resilience thinking begin to push conventional approaches to 'planning' toward more adaptive processes. In fact, it might be posited that strategic design thinking is invaluable in the search for "untried beginnings" (Westley et al., 2011), or new social-technological regimes that could theoretically sustain contemporary ways of life within known planetary parameters:[11] "we will need to harness human creativity and innovation potential to tip the interlinked social and ecological systems in the direction of greater resilience and sustainability" (Westley et al., 2011, p.762-763). When working within uncertain circumstances, one need not forego planning altogether, rather, adjust the nature of that planning to be immersive, responsive, as well as generative. Creative agency should not be relinquished entirely, only reoriented through deep reflection on contextual factors. The metaphor of paddling a river comes to mind. Paddlers craft the vessels by which they relate to the river. The river pushes the vessels and the paddlers push back with their oars, not to change the direction of the current, only to affect their position within it. In order to avoid capsizing, expert paddlers must scan the waters, understand its undulations, and anticipate how to move effectively amidst them. Westley et al. (2006) similarly describe 'flow', as it relates to social innovation, as agents nurturing and kneading the environmental conditions that might lead to a system tipping point, and the ability to accomplish this requiring immersion in that system: "The flow can find you only if you are in the stream" (p.194).

The Hierarchy of Engagement (see Figure II) considers the possible links between creative agency, accountability, and discernment. Here we return to the opening philosophical proposition:

[11] See Rockström et al. 2009 for an overview of the concept of planetary boundaries.

that one might take accountability for one's presence in a system through active engagement with it. On the assumption that one can never remove oneself entirely from the earth's biosphere systems, disengaging on the grounds that one has no ultimate control is akin to what Mau (2010) critiques as acting without awareness: "It is becoming increasingly clear we have to take responsibility for designing things that were left to accident in the past"(p.20). If a design-like ordering of one's experiences in a continually modulating environment is habitual and constant (Cross, 2007; Berger, 2009), it would seem as though a stance of absolute disengagement is only tenable in relation to very select social-ecological interactions. Moreover, a position of disengagement should not be mistaken with one of intentional non-intervention. The choice to avoid intervention still expresses creative discernment, requiring an understanding of plausible options and their implications. As such, while a creative agent's intervening actions may be quiet, the strategic design processes that inform them can be lively. In complex scenarios, wherein decision stakes and systems uncertainties are high, it may be advisable to spend time as witness to the circumstances at hand before acting. If one positions strategic design thinking as a way of knowing and way of being, then one can also come to know the system in which one is operating through processes of design agency (by the same right that processes of scientific observation can be considered to be intervening) (Midgley, 2000). At the same time, a desire for directional transformation suggests a need to be proactive, to some extent. With this Hierarchy of Engagement, we set out to explore the idea that the nature of creative agency can change as one becomes familiar with and comfortable in the settings in which one is working. In the first level, 'Consumers'' only acts of agency might be to accept or reject that which is presented to them. In the second level, 'Coordinators' are able to organize and influence the experience of others within a system, on a small scale. 'Makers' possess the technical know-how for self-reliance within the existing social-technological regime, however, depend on predictable, repeatable formulas to generate anticipated results. For example, they are masters of the 'simple' and 'complicated' fields described by Westley et al. (2006).[12] Subsequently, 'Inventors', after repeating the same tried and tested routines multiple times in the previous level, might discover means of radically altering the formulas to new ends. The final level, 'Player', represents the most contextually embedded and personally empowered position in the hierarchy. After engaging with one's own ability to recreate, Players willingly relinquish a certain degree of their creative agency, and capacity to manipulate matter, rather to co-create with the larger system, and its emergent factors.

[12] Simple tasks calling for easy replication of a recipe to achieve a good result; and, complicated tasks almost certainly guaranteeing an expected outcome with the use of a detailed blueprint and expert knowledge (Westley et al., 2006).

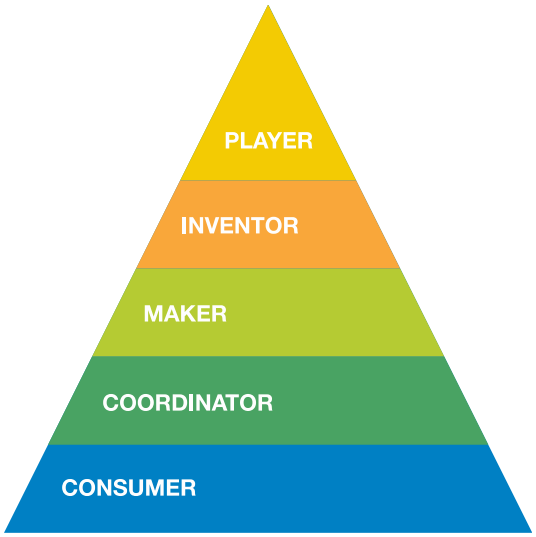

Figure II: Hierarchy of Engagement

Conclusion

In developing a multi-layered view of strategic design thinking, our aim here is to demonstrate how designers might articulate these layers further within their processes to reflect an adaptive approach to systems transformation, similar to those expressed in social innovation and resilience literature. At the end of this discussion, wherein we have teased out the many faces of design, we will conclude by again pointing out that these Basin Layers do not operate progressively, rather simultaneously, and are also co-dependent. For example, without the semiconscious habit of design-like reordering, one might not discover one's capacity for creative agency, adaptive response hovering in a reactionary position. Without the sense of empowerment afforded by creative agency, one might not recognize one's ability to take responsibility for one's place within a system. Subsequently, if one neglects to seek out one's 'fit' in a system through immersive engagement with it, creative agency might become over-expressed through behaviour patterns of domination and control. Moreover, in a process of adaptive transformation, one may find oneself holding ground in each of these Basin Layers concurrently, or moving between them iteratively. Depending on the circumstances in which one is operating, one may find it is easier to make changes within certain Basin Layers than others. For example, a regime may be supportive of technological innovation and move quickly through product research and development, however, with these new developments still founded in outmoded ways of thinking about social organization. Or, a community might embrace sustainability values, without yet possessing the know-how to translate its operational systems to zero waste models. Or finally, a group may be equipped with both fresh perspectives and know-how, but lack mobility within the political channels necessary to implement such changes. The multi-layered view examined here is intended to help identify the most effective points of entry into processes of systems transformation using strategic design practice.

Works Cited

Aaltonen, M. (2007). *The third lens: Multi-ontology sensemaking and strategic decision-making.* Burlington, VT: Ashgate.

Alexander, C. (1964). *Notes on the synthesis of form.* Cambridge, MA: Harvard University Press.

Allen, R. (Ed.). (2006). *The Penguin Complete English Dictionary.* London, UK: Penguin Books.

Arthur, B. (2009). *The nature of technology: What it is and how it evolves.* New York, NY: Free Press.

Batty, M. (2013). *The new science of cities.* Cambridge, MA: MIT Press.

Benyus, J. (1997). *Biomimicry: Innovation inspired by nature, 1st Edition.* New York, NY: Morrow.

Berger, W. (2009). *Glimmer: How design can transform your business, your life, and maybe even the world.* Toronto, ON: Random House Canada.

Bettencourt, L. (2013). The origins of scaling in cities. *Science, 340,* 1438-1441.

Brand, S. (1999). *The clock of the long now: Time and responsibility, 1st Edition.* New York, NY: Basic Books.

Bromwich, D. (2008). Moral Imagination. *Raritan, 27* (4), 4-33.

Brown, T. (2009). *Change By Design: How Design Thinking Transforms Organizations and Inspires Innovation.* New York, NY: Harper Collins Publishers.

Brown, T. & Wyatt, J. (2010). Design thinking for social innovation. *Stanford Social Innovation Review, Winter,* 30-35.

Brown, T. (2012). From blueprint to genetic code: The merits of an evolutionary approach to design. *Rotman Magazine, Spring,* 17-21.

Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues, 8*(2), 5-21.

Chaisson, E.J. (2001). *Cosmic evolution: The rise of complexity in nature.* Cambridge, MA: Harvard University Press.

Christian, D. (2004). *Maps of time: An introduction to big history.* Berkeley, CA: University of California Press.

Cross, N. (2007). *Designerly ways of knowing.* Basel, SW: Birkhäuser; London, UK: Springer.

Diamond, J. (1995). The evolution of human inventiveness. In M.P. Murphy & L.A.J. O'Neil (Eds.), *What is life? The next fifty years: speculations on the future of biology* (pp. 41-55). Cambridge, MA: Cambridge University Press.

Di Cicco, P.G. (2007). *Municipal mind: manifestos for the creative city.* Toronto, ON: Mansfield Press Inc.

Dubberly, H. (2014). A systems literacy manifesto [Conference Lecture]. Systemic design: Emerging contexts for systems perspectives in design. Oslo School of Architecture.

Duke, Pratt School of Engineering. (n.d.). *Duke smart home program: Smart technology for sustainable living.* Retrieved from http://smarthome.duke.edu/

Edmonson, A. (1986). *A fuller explanation: The synergetic geometry of R. Buckminster Fuller* [NetLibrary version]. Retrieved from http://www.bfi.org/about-bucky/resources/books

Elliot, C. & Elliot, B. (1991). From the patient's point of view: Medical ethics and the moral imagination. *Journal of Medical Ethics, 17,* 173-178.

Folke, C. (2006). Resilience: The emergence of a perspective for social-ecological systems analyses. *Global Environmental Change, 16*, 253-267.

Fuller, B. (1969). *Utopia or oblivion.* New York, NY: Bantum Books.

Funtowicz, S.O. & Ravetz, J.R. (1993). Science for the post-normal age. *Futures, 25*(7),739-755.

Gamble, J.A.A. (2008). *A developmental evaluation primer.* Montreal, QC: J.W. McConnell Family Foundation.

Geels, F.W. & Schot, J. (2007). Typology of sociotechnical transition pathways. *Research Policy, 36,* 399-417.

Giampietro, M. (2004). Science for governance: The crash of reductionism against the complexity of reality. In M. Giampietro, *Multi-scale integrated analysis of agroecosystems* (pp.3-13). Boca Raton, FL: CRC Press LLC.

Giddens, A. (1984). *The constitution of society: Outline of the theory of structuration*. Cambridge, UK: Polity Press.

Gunderson, L.H. & Holling, C.S. (2002). *Panarchy: Understanding transformations in human and natural systems.* Washington, D.C. Island Press.

Himelfarb, A. (2013). The Means Test: How We Measure Success [Blog Entry]. Retrieved from atafhimelfarb.wordpresscom/2013/01/03/the-mean-test/

Hobbs, R. J., Higgs, E., & Harris, J.A. (2009). Novel ecosystems: implications for conservation and restoration. *Trends in Ecology & Evolution, 24*(11), 599-605.

IDEO. (n.d.). *Human-centred design toolkit.* Retrieved from http://www.ideo.com/work/human-centered-design-toolkit/

IwB. (n.d.). *Our tools.* Retrieved from http://institutewithoutboundaries.ca/what-we-do/tools/

Johnson, S. (2010). *Where good ideas come from: The natural history of innovation*. New York, NY: Riverhead Books.

Kearns, P. & Kearney, J. (2006). *Turning the World Right-Side Up.* Halifax, NS: Fernwood Publishing.

Kelley, T. & Littman, J. (2000). *The art of innovation: Lessons in creativity from IDEO, America's leading design firm.* New York, NY: Currency/Doubleday.

Kitcher, P. (2011). *Science in a democratic society.* Amherst, NY: Prometheus Books.

Klanten, R., Bourquin, N., Tissot, T., & Ehmann, S. (Eds.). (2008). *Data flow: Visualizing information in graphic design.* Berlin, DE: Gestalten.

Klein, G., Moon, B., & Hoff man, R. (2006). Making sense of sensemaking 1: Alternative perspectives.

Intelligent Systems, 21(4), 70-73.

Kolko, J. (2007). The tenuous relationship between design and innovation. *Artifact, 1*(3), 224-231.

Kolko, J. (2010). Abductive thinking and sensemaking: The drivers of design synthesis. *Design issues, 26*(1), 15-28.

Kolko, J. (2011). *Exposing the magic of design: A practitioner's guide to the methods and theory of Synthesis (human technology interaction).* New York, NY; Oxford, UK: Oxford University Press.

Kolko, J. (2012). *Wicked problems: problems worth solving: A handbook and a call to action.* Austin, TX: AC4D. Retrieved from https://www.wickedproblems.com/

Lappé, F.M. (2011). *EcoMind.* New York, NY: Nation Books.

Lapum, J., Ruttonsha, P., Church, K., Yau, T., & Matthews David, A. (2012). Employing the arts in research as an analytical tool and dissemination method – Interpreting experience through the aesthetic. *Qualitative Inquiry, 18*(1), 100-115. DOI 10.1177/1077800411427852

Lyster, C. (2006). Landscapes of Exchange: Re-articulating site. In C.Waldheim. *The landscape urbanism reader* (pp.219-237). New York, NY: Princeton Architectural Press.

Martin, R.L. & Christensen, K. (2013). *Rotman on design: The best on design thinking from Rotman magazine.* Toronto, ON: Rotman UTP Publishing.

Mau, B., Leonard, J., & the Institute without Boundaries. (2004). *Massive change*. New York, NY: Phaidon.

Mau, B. (2010). Design and the Welfare of All Life. In L. Tilder, & B. Blostein, (Eds.), *Design Ecologies: Essays on the nature of design* (pp.10-25). New York, NY: Princeton Architectural Press.

McDonough, W. & Partners. (1992). The Hannover principles: Design for sustainability. Prepared for EXPO 2000, The World's Fair. Charlottesville, VA: William McDonough Architects.

McDonough, W. & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things.* New York, NY: North Point Press.

McDonough, W. & Braungart, M. (2013). *The upcycle: Beyond sustainability — designing for abundance, 1st Edition.* New York, NY: North Point Press.

Midgley, G. (2000). *Systemic intervention: Philosophy, methodology, and practice.* New York, NY: Kluwer Academic/Plenum Publishers.

Midgley, G. (2003). Science as systemic intervention: Some implications of systems thinking and complexity for the philosophy of science. *Systemic Practice and Action Research, 16*(2), 77-97.

Page, S.E. (2007). *The difference: How the power of diversity creates better groups, firms, schools, and societies.* Princeton, NJ: Princeton University Press.

Papanek, V. (1971). *Design for the real world: Human ecology and social change.* New York, NY: Pantheon.

Peterson, G.D., Cumming, G.S., & Carpenter, S.R. (2003). Scenario planning: A tool for conservation in an uncertain world. *Conservation biology, 17*(2), 358-366.

Quilley, S. (2011). Open Source Economics: Looking for meaning in a throwaway world [Video File]. *Innovation in Action Speaker Series, SiG@Waterloo.* Retrieved from http://sig.uwaterloo.ca/feature/stephen-quilley-2011-innovators-in-action-speaker-series

Register, R. (2006). *Ecocities: Rebuilding cities in balance with nature, revised edition.* Gabriola Island, BC: New Society Publishers.

Rockström, J., W. Steffen, K. Noone, Å. Persson, F. S. Chapin, III, E. Lambin, T. M. Lenton, M. Scheffer, C. Folke, H. Schellnhuber, B. Nykvist, C. A. De Wit, T. Hughes, S. van der Leeuw, H. Rodhe, S. Sörlin, P. K. Snyder, R. Costanza, U. Svedin, M. Falkenmark, L. Karlberg, R. W. Corell, V. J. Fabry, J. Hansen, B. Walker, D. Liverman, K. Richardson, P. Crutzen, and J. Foley. (2009). Planetary boundaries: exploring the safe operating space for humanity. *Ecology and Society, 14*(2), 32. Retrieved from http://www.ecologyandsociety.org/vol14/iss2/art32

Rittel, H. & Webber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*, 155–169.

Sevaldson, B. (2011). GIGA-Mapping: Visualization for Complexity and Systems Thinking in Design. *Nordic Design Research Conference, 4, Making Design Matter.* Retrieved from http://www.nordes.org/opj/index.php/n13/article/view/104/88

Steffen, W., Crutzen, P.J., & McNeil, J.R. (2007). The Anthropocene: Are humans now overwhelming the great forces of nature? *Ambio, 36(8),* 614-621.

Stirling, A. (2010). Keep it complex. *Nature*, *468*(23), 1029-1031.

Stolterman, E. (2014). *Improving design without destroying it* [Video File]. Retrieved from http://ingbrief.wordpress.com/2014/11/03/20141021-erik-stolterman-improving-design-without-destroying-it-web-video/

Swimme, B.T. & Tucker, M.E. (2011). *Journey of the universe.* New Haven, London: Yale University Press.

Tomalty, R. (2009). The ecology of cities: Urban planners are starting to see cities as complex systems that ought to be conceptualized in a way that mimics natural processes. *Alternatives Journal, 35*(4), 18-21.

U.S Green Building Council. (n.d.). *LEED.* Retrived from http://www.usgbc.org/leed

Varela, F.J. Thompson, E.T. & Rosch, E. *The embodied mind: cognitive science and human experience.* Cambridge, MA; London, UK: MIT Press.

Verbeek, P. (2005). *What things do: philosophical reflections on technology, agency and design.* University Park, PA: Pennsylvania State University Press.

Walker, B. & Salt, D. (2006). *Resilience thinking: Sustaining ecosystems and people in a changing world.* Washington, DC: Island Press.

Walker, B., Holling, C.S., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society, 9*(2).

Westley, F., Patton, M.Q., & Zimmerman, B. (2006). *Getting to maybe: How the world is changed* [NetLibrary version]. Retrieved from www.torontopubliclibrary.ca

Westley, F. & Antadze, N. (2009). Making a difference: Strategies for scaling social innovation for greater impact. *The Innovation Journal, 15*(2), 1-18. Retrieved from http://sig.uwaterloo.ca/research-publications

Westley, F., Olsson, P., Folke, C., Homer-Dixon, T., Vredenburg, H., Loorbach, D., Thompson, J., Nilsson, M., Lambin, E., Sendzimir, J., Banerjee, B., Galaz, V., & van der Leeuw, S. (2011). Tipping toward sustainability: Emerging pathways of transformation. *Ambio, 40*, 762–780.

Westley, F. & McGowan, K. (2013). At the root of change: The history of social innovation [Conference Paper]. *Nesta's Social Frontiers: The next edge of social innovations research*. London, UK.

Westley, F. & McGowan, K. (2014). Design thinking, wicked problems, messy plans. In C. Reed & N.M. Lister, *Projective ecologies* (pp.290-311). New York, NY: Actar Publishers.

Whitesides, G. (2010, February). *Toward a science of simplicity* [Video File]. Retrieved from http://www.ted.com/talks/george_whitesides_toward_a_science_of_simplicity?language=en#t-715568

Zec, P. (2009). *Universal design: Best practice.* Essen, DE: Red Dot.

Zhang, T., Francesca, G. & Margolis, J.D. (2014). Does 'could' lead to good?: Toward a theory of moral insight [Working Paper]. *Harvard Business School, 14-118,* 1-51. Retrieved from http://hbswk.hbs.edu/item/7472.html