



# Pragmatism and Design Thinking

**Peter Dalsgaard**

*Centre for Advanced Visualization and Interaction (CAVI) & Centre for Participatory IT (PIT)  
Aarhus University, Aarhus, Denmark*

This article examines the philosophical position of pragmatism as a conceptual scaffold for design thinking. A number of existing contributions to design have drawn upon concepts from pragmatism. The article continues this line of thought by a wider examination of how central concepts in design thinking resonate with the pragmatist philosophy of John Dewey. The argument put forward here is that there is a large degree of convergence between the pragmatist perspective and design thinking. Pragmatism offers well-developed and coherent articulations of concerns that are central to design thinking and the pragmatist perspective can be of value on both a theoretical and practical level. On a theoretical level, it can inform and inspire the development of the discourse on design. On a practical level, pragmatist concepts can be operationalized to inform and guide concrete design projects and help us understand and orchestrate the design process.

**Keywords** – Design Theory, Design Thinking, Interaction Design, Pragmatism.

**Relevance to Design Practice** – The article contributes to the development and articulation of design thinking and the discourse of design. It provides a conceptual frame for addressing central issues in design on the basis of a well-established school of thought, pragmatism. It outlines the implications of this perspective in practice.

**Citation:** Dalsgaard, P. (2014). Pragmatism and design thinking. *International Journal of Design*, 8(1), 143-155.

## Introduction

“Even on a cursory inspection, just what design thinking is supposed to be is not well understood, either by the public or those who claim to practice it” (Kimbell, 2011, p. 286).

The concept of design thinking has been the center of much attention in recent years, with researchers and practitioners from a range of fields contributing to discussions of what constitutes designerly ways of knowing and doing, and how such insights might inform and inspire domains beyond traditional design disciplines. However, as emphasized by Kimbell (*ibid*), this mounting interest has not led to a clear understanding of design thinking. Indeed, it may have resulted in a blurred picture as stakeholders with disparate perspectives and agendas take part in the discussion. In this article, I will argue that the discourse of design, and by extension the practice of design, can be developed by drawing upon central understandings and concepts from an established and well-developed theoretical position, namely pragmatist philosophy. One of the benefits of this move is that pragmatism offers a set of coherent concepts and articulations for addressing key issues in design. This can scaffold a clearer discussion of design thinking in addition to enriching our understanding of design.

My core field of research is interaction design. Although practitioners and researchers within interaction design have distinct topics of interest pertaining to the nature of interactive technologies, the field shares a number of similarities with other design disciplines. Most prominently, it is a field characterized by theoretical polyvocality and flux. The theoretical positions employed in interaction design address a diversity of research topics and offer different perspectives on the design process, on

the use situation and on the role of theory itself. Researchers and practitioners often have to act as theoretical bricoleurs (Louridas, 1999), assembling and making use of parts of this heterogeneous pool of knowledge to best fit the given situation and object of concern. In her account of theoretical positions in interaction design, Rogers (2004) argues that it can be beneficial to ‘import’ existing theoretical positions into the field since they “have the potential for being developed into a more extensive design language that can be used in both research and design... Designers and researchers need to engage in more dialogue, identifying areas of conceptual richness and design articulation” (p. 135). Several recent academic works have contributed to the discourse of design. Some address general characteristics of a designerly approach (e.g., Brown, 2009; Buxton, 2007; Cross, 2007, 2011), while others focus on more specific areas of concern. For instance, Bardzell and Bardzell’s (2008) proposal for the development of a discipline of interaction criticism echoes the concern for developing design articulations, drawing on and furthering work by Löwgren and Stolterman (2004), Bertelsen and Pold (2004) and McCarthy and Wright (2007). A common denominator among these works is that they contribute to the ongoing examination and articulation of practices, approaches and ways of understanding

**Received** October 28, 2011; **Accepted** September 17, 2013; **Published** April 30, 2014.

**Copyright:** © 2014 Dalsgaard. Copyright for this article is retained by the author, with first publication rights granted to the *International Journal of Design*. All journal content, except where otherwise noted, is licensed under a *Creative Commons Attribution-NonCommercial-NoDerivs 2.5 License*. By virtue of their appearance in this open-access journal, articles are free to use, with proper attribution, in educational and other non-commercial settings.

**\*Corresponding Author:** dalsgaard@cavi.au.dk



that are central to design. This area has been described as *designerly inquiry*, *designerly approaches*, *design thinking* and more. In this article, I employ the term *design thinking* in an inclusive sense to denote the ways of framing, approaching and addressing challenges that characterize design. This usage is in line with that of e.g., Buchanan (1992) and Cross (2011).

## Contributions

The examination of pragmatism in this article can be seen as a response to the abovementioned calls for articulating central issues and aspects of design. The primary contributions of the article are thus a selective reading and discussion of pragmatism in relation to issues central to design thinking, an examination of the convergence and overlaps between the two fields, and the development of the argument that pragmatism can serve as conceptual scaffolding for developing design thinking, which in turn has implications for design practice. Briefly, the pragmatist perspective can be of value for design thinking in at least four respects. First, the examination of distinct issues in design thinking may be informed and enriched by drawing upon how these issues have been articulated and explored in pragmatism (for instance, recurring themes in design thinking such as the theory-practice relation and the role of experiments have been extensively discussed in pragmatism). Second, the coherent conceptual framework offered by pragmatism may inspire and inform studies into how issues in design thinking are related (for instance, the pragmatist perspective on the interrelations between experimentation and technology may inspire examination of the relations between experiments, tools, techniques and materials in design). Third, these understandings may in turn enrich the practice of design since the pragmatist perspective can lead to (and to some extent already has resulted in) specific approaches to design challenges (for instance, the pragmatist concept of inquiry has inspired specific approaches to understanding and developing interfaces, as will be expanded on in the section *Implications of a pragmatist perspective on design*). Fourth, pragmatist concepts have been employed in a number of fields spanning education to the arts. As such, they may yield new and fresh perspectives for design thinking through discussions of how concepts treated in design thinking unfold in other spheres of human activity and experience. For instance, Dewey's treatment of art and aesthetics have inspired recent contributions to understanding aesthetics in interaction design such as (McCarthy & Wright, 2007; Petersen, Iversen, Krogh, & Ludvigsen, 2004), which in turn have resulted in new approaches in design practice.

**Peter Dalsgaard** is Associate Professor of Interaction Design at Aarhus University. His work explores theories of design and the nature of design processes, in particular as they pertain to innovation, creativity and participatory design. In a range of projects at the Centre for Advanced Visualization and Interaction ([www.cavi.au.dk](http://www.cavi.au.dk)) and the Participatory Information Technology Centre ([www.pit.au.dk](http://www.pit.au.dk)), he has explored the intersection between digital technologies and the physical environment with a particular focus on the design process. Pragmatist philosophy is a central theoretical source for his work. In a number of publications he has explored how the pragmatist perspective can yield insights into the design and use of interactive systems and environments.

## Structure of the Article

The main argument of the article is that pragmatism can inform and inspire (and to some extent already has informed and inspired) the discourse and practice of design. In order to do so, the article has in three main parts. First, I present a selection of *central issues in design thinking* regarding theory, practice, emergence, interaction, situatedness, experimentation, intervention, transformation and the role of technology. Then, I describe key tenets of pragmatist philosophy and examine *central issues in pragmatism*. In doing so, I treat similar themes and concerns as in the previous section. This leads to the third and final section in which I discuss the *convergence of issues in pragmatism and design thinking* and the *implications of a pragmatist perspective on design*. This final section argues that pragmatism offers a coherent repertoire of insights and conceptualizations that can be of benefit to the development of the discourse of design. In this discussion, I point to examples of how the pragmatist perspective can contribute to design practice. I conclude the paper by summarizing key arguments and outlining how the pragmatist perspective may be further explored and developed to benefit the discourse on design thinking.

## Central Issues in Design Thinking

In *Designerly Ways of Knowing*, Cross (2007) argues that “design practice does indeed have its own strong and appropriate intellectual culture... we must avoid swamping our design research with different cultures imported either from the sciences or the arts” (p. 55). According to Cross, this tradition of designerly knowing, thinking, and acting constitutes a third paradigm of inquiry besides science and the arts. As such, it should be understood and treated on its own terms, rather than through the lenses of the other paradigms. The major challenge in addressing this field as a researcher is that it is only marginally articulated, whereas other paradigms have well-developed vocabularies. In addition to further examinations by Cross (2011), a number of writers have since touched upon the need for formulating what constitutes designerly inquiry, including Ludvigsen (2006), Buxton (2007), and Stolterman (2008), who states that “... design disciplines such as interaction design have to develop and foster their own designerly approach for education and practice” (p. 63). Wolf, Rode, Sussman, and Kellogg (2006) make the case that the lack of theoretical development within design should not be mistaken for a lack of structure. On the contrary, Wolf et al. argue that good design is in fact characterized by discipline and rigor and that design has its own cohesive structure and logic. An explication of these dimensions of design will enable designers to better enter into discussion with other paradigms of inquiry. In the following, I will outline a selection of the most salient, recurring issues treated in recent contributions to the field. The objective for doing so is to establish a basis for the latter parts of the article in which I will discuss how pragmatism can inform design.



**Theory-practice and reflection-action are intertwined in design.** Designers are often faced with challenges or problems, which cannot be exhaustively analyzed in advance to the point that the designer can lay out a clear-cut plan for how to solve them. The concept of *wicked problems* from Rittel and Webber (1973) is widely used in design to denote such problems, which cannot be solved through traditional analytical problem solving. Although Rittel and Webber addressed social policy problems in their seminal paper, the characterization of wicked problems can be extended to those facing designers, as noted in numerous contributions to the field, e.g., (Hallnäs & Redström, 2006; Stolterman, 2008; Zimmerman, Forlizzi, & Evenson, 2007). To address wicked problems, designers move through iterative phases of thinking and doing, or *action* and *reflection* in the widely used terminology of Schön (1983, 1987). Designers' actions yield input for ongoing reflection and their reflections in turn shape ongoing actions to resolve design problems or open up new design opportunities. Designers draw on theories and preconceptions to scaffold their inquiries into design problems and these theories and preconceptions can be transformed, enriched or discarded over the course of time on the basis of how well they scaffold design practice. Theory and practice are thus closely interrelated in design, as discussed by e.g., Buchanan (1992), who states that "Designers are exploring concrete integrations of knowledge that will combine theory with practice for new productive purposes" (p. 6).

**Design is characterized by emergence and interaction.**

In design processes, problems and solutions co-evolve as the designer acts not only to resolve known issues, but also to explore the nature of the problem. Indeed, one of the first major challenges in many design projects is that of exploring and articulating what constitutes the design problem, or framing and naming the problem in the terminology of Schön (1983, 1987). Throughout the process, the design space—i.e., the arena in which the designer acts—undergoes changes. This ongoing development is influenced by reciprocal interaction between designers, stakeholders and the various components of the design space. As phenomena in the design space interact and evolve, new opportunities and constraints for design emerge. Among others, Cross (2011) has explored these features, stating that "... designing utilizes aspects of emergence; relevant features emerge in tentative solution concepts, and can be recognized as having properties that suggest how the developing solution-concept might be matched to the also developing problem-concept" (p. 11).

**Design is situated and systemic.** Hallnäs and Redström (2006) describe the fundamental concern in design as overcoming a "*hermeneutical gap*" between the existing situation and the product of the design process and between designers' current understandings and the crystallization of ideas and concepts embodied by the product itself. The gap is hermeneutical because it is the interaction designer's interpretation that bridges the gap from the initial problem setting to the outcome of the design process. This notion is analogous to the oft-quoted "dialectics between tradition and transcendence", as coined by Ehn (1988).

This demands an understanding not only of the characteristics of interactive systems, but also of the *design situation* (in order for designers to plan and carry out their work) and of the *use situation* (in order for designers to grasp the potential changes brought about when the result of the design process is introduced into the use domain). In discussing the systemic nature of design, Stolterman (2008) characterizes designerly inquiry as a deliberately iterative process of moving between the whole and the parts: "[...] a rational designer works on many alternative designs in parallel in an iterative way, while going back and forth between the whole and the details. This way of doing design is not a choice. It is at the core of what it means to act in a rational, disciplined, designerly way" (p. 61).

**Design is experimental.** Since design problems are seldom fully defined and the properties of the design space emerge and evolve, designers must adopt an experimental approach in order to explore how to move towards a satisfying solution or product. Design experiments can take many forms, including sketching (described by Buxton (2007) as the quintessential design activity), mockups (Ehn & Kyng, 1991), prototyping (Floyd, 1984) and scenarios (Carroll, 1999). The design process can be understood as a learning process in which the designer develops an increasing understanding of the use domain through studies, experiments and interventions. Furthermore, this learning process extends to the use domain as people are exposed to and reflect upon the design process. This knowledge is eventually manifested in the product of design. The work of the designer is often scaffolded by the use of more or less congruent theories and guidelines that provide insights into the design situation and the use situation, with the designer moving between these two throughout the process.

**Design is an interventionist and transformative discipline.**

Design seeks to alter the current state of affairs through the introduction of something new, be it services, products or technologies. In the words of Löwgren and Stolterman (2004), the designer is ultimately more committed towards the transformation of the use domain than towards theoretical coherence and consistency: "A researcher is interested in reality whereas a designer is interested in what reality could become" (p. 31). Even in design research, elements of intervention are essential according to Brandt and Binder (2007): "[...] any experiment, which is worth considering as a contribution to research inquiries, must somehow involve an intervention with the world" (p. 12).

**Designers employ tools and techniques that are essential to their work.**

In his studies of how designers work, Gedenryd (1998) has explored how competent designers develop so-called *situating strategies* to accomplish intended changes in the world, meaning that they explore and utilize the full range of resources available in the design situation—their own knowledge and embodied skills, other people in the situation, physical resources such as tools, materials and surroundings, etc. It appears to be a common trait across many design disciplines that design ability goes beyond intramental (i.e., "in the head") activities and extends into competent use of tools and techniques such as the aforementioned activities of sketching, prototyping and scenario

development. Designers draw on these resources to understand the present situation, to envision and explore potential futures and to expose potential future users to their concepts to evaluate which course to take in the design process.

This set of issues in design thinking—the theory-practice relation, emergence, interaction, situation, inquiry, transformation, and technology—do not represent an exhaustive account of the ongoing debates in the field, but they have been and continue to be central topics for discussion. My motivation for selecting these issues is that if we follow Rogers' (2004) proposal to 'import' theoretical positions to inform the development of the discourse of the field, then the imported theories should of course contribute to our understanding of said issues. In the following section, I discuss core concepts of pragmatism that resonate with these issues in design thinking.

## Central Issues in Pragmatism

Pragmatism denotes a shared body of assumptions and perspectives that originated in the United States around the end of the nineteenth century. Major early contributors to pragmatism include Charles Sanders Peirce (1839-1914), William James (1842-1910), and later John Dewey (1859-1952) and George Herbert Mead (1863-1931). Pragmatism is often construed as one school of thought, but there have been a number of different and to some extent incongruent interpretations of even fundamental assumptions in the field from the very beginning. To establish my own position and develop a clear line of argument, I will draw on the work of Dewey. With the scope and focus of the paper in mind, I will not go into detailed accounts of differences and incongruities between Deweyan pragmatism and other strands (for this, see e.g., Shalin (1986)). Dewey (1916/2004) is widely recognized as one of the most prominent philosophers of the past century. His most influential legacy is arguably his work on education. Dewey treated a number of other issues on the basis of his pragmatist principles, including democracy, psychology, morals and ethics, logic, experience and art.

To reiterate, my motivation for examining Deweyan pragmatism is to point to the convergences between pragmatism and design thinking with the objective of informing and contributing to the development of the discourse of design and design practice. For this reason, the article focuses on a selective reading and discussion of concepts central to this undertaking. To make clear the relations and relevance of pragmatism to design thinking, I examine the following Deweyan concepts: *the theory-practice relationship, emergence and interaction, situation, inquiry, transformation, technology and experience*. These concepts are interconnected, as will become clear in their exposition. I have selected these concepts on the grounds that (1) they constitute core aspects of Dewey's position, (2) they are interrelated and form a cohesive conceptual frame, and (3) they resonate with the list of key themes of interaction design thinking presented in the previous section and can enrich our understanding of these themes. It is necessary to present the concepts in some detail to support the argument that pragmatism offers a coherent frame for addressing central concerns in design.

**Theory and practice.** Pragmatism is so labeled due to the "pragmatic maxim", sometimes also referred to as the "primacy of practice" principle, a foundational proposition stating that the meaning of our conceptualizations of the world—ideas, theories, assumptions etc.—should be evaluated on the basis of their consequences and implications in practice. Or, in fewer words, our experience in practice takes precedence over doctrines. The pragmatic maxim merges theory and practice in the sense that theories stem from practice—they do not exist in a separate and impermeable sphere of abstraction—and in that the value of theories rely on the ways they help us grasp and act in the world. In this light, theories are instruments for practice and must continuously be evaluated on this basis. Theories that are meaningful in present practice may not be so under alternative and future circumstances, and the notion of transcendental truth outside of what we can explore in practice is meaningless. Although theories are tentative, not all theories are equally valid. On the contrary, theories are formed in relation to specific situations and circumstances and must be evaluated by how they help us grasp the world and act in it.

**Emergence and interaction.** Pragmatism can be construed as a philosophy of flux in the sense that it regards the world as *emergent* and never fully finalized. The existence of the external world is very real and the basic premise of our existence. However, this neither means that the external world is fixed and stable, nor that it will ever be so. On the contrary, Shalin, a contemporary pragmatist sociologist, vividly describes it as "brimming with indeterminacy, pregnant with possibilities, waiting to be completed and operationalized." (Shalin, 1986, p. 10) Coupled with the pragmatic maxim, the notion of emergence implies an experimental view of the world: We cannot rely solely on given conceptualizations for they will likely change their meaning in time. We can, however, establish temporary stability in a given situation. In other words, the world and phenomena in it are emergent and it is in our nature to make sense of it in practice and form transient constructs in the attempt to attain stability. Pragmatism thus presents a highly situated perspective on human activity in which our reciprocal capabilities of action and reflection form the basis for sense making. We often seek to reify sense-making. Sometimes it is done through the formation of habits and recognition of patterns of experience, sometimes it is shared in communication and sometimes it is externalized implicitly or explicitly in documents, artifacts, technologies, practices or social structures and constructs. Just as we ourselves are situated and draw on our repertoire of habits and experiences, so are other phenomena around us situated, most notably other human agents, but also technologies and spaces that have been shaped as tools and instruments for coping with the emergent phenomena of the world. According to Dewey, this process of interaction is inherent to our being in the world: "Interaction is a universal trait of natural existence" (Boydston, 1981-1990, vol 4, p. 195). Interaction makes it become possible to examine the properties of self, others, surroundings, artifacts and social constructs: "Everything that exists in as far as it is known and knowable is in interaction with other things" (Boydston, 1981-1990, vol. 1, p. 138). Our

interaction with these components is reciprocal and dialogical. It is not only the subject who brings with them a history of interactions. The other components in a situation—people, things and places—all influence how events unfold in practice.

**Situation.** All human activity is *situated*. This may seem a commonsense statement, but Deweyan pragmatism follows this assumption further than most by stating that neither the subject nor phenomena in the world can be understood outside of a situation. For this reason, human thought and action as well as objects and events must always be understood in the larger frame of the situation. A situation is constituted by a subject and the surrounding environment, including other people, artifacts, physico-spatial surroundings and as social constructs such as norms and rules. A crucial consequence of this proposition is that the situation does not exist outside of the subject, neither does the subject exist outside of the situation; the two are implicitly and reciprocally co-constitutive:

What is designated by the word 'situation' is not a single object or event or set of events. For we never experience nor form judgments about objects and events in isolation, but only in connection with a contextual whole. This latter is what is called a 'situation'. (Dewey, 1998, pp. 66-67)

Situations may be perceived as more or less stable and comprehensible. To the extent that there is a fit between the components in a situation, that is, subject, artifacts, socio-cultural constructs and physico-spatial surroundings, a situation can be experienced as stable. In Deweyan terminology, this is a *determinate situation*. An *indeterminate situation* is one in which the assemblage of components is somehow mal-aligned, or in the words of Dewey, a situation in which “its constituents do not hang together” (p. 109). Situations can be very dynamic in nature. Since the world is inherently in flux, few, if any, situations remain determinate over the course of time due to the changes in the constitutive components of a situation. We may experience indeterminate and challenging situations as being *problematic* and seek to transform them into determinate situations. The terms indeterminate and problematic are not interchangeable for it is only when the subject articulates or relates to the indeterminacy of the situation that it becomes problematic: “The indeterminate situation becomes problematic in the very process of being subjected to inquiry” (Dewey, 1998, p. 111)

**Inquiry.** Inquiry is the mode of thinking and doing by which the subject approaches the indeterminate situation in order to transform it. In Dewey's (1938) words, “Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituents distinctions and relations as to convert the elements of the original situation into a unified whole” (p. 108). Our initial comprehension of a situation is based on past experiences that have formed our knowledge and habits. It is on this backdrop that situations may appear problematic when our habitual response does not lead to the expected outcome; in that respect, the indeterminacy of a situation is what gives rise to thought. Thus, a perceived conflict or tension is a qualification for initiating the process of inquiry although it does not always have this effect. The process of inquiry unfolds in the following

manner: at the outset, the subject recognizes the problematic nature of the indeterminate situation. This motivates the subject to transform the situation. The subject then tries to identify the elements of the situation that causes indeterminacy. This can be seen as a tentative articulation of what constitutes the problem as well as the framing of the boundaries or parameters for the inquiry. Having some idea of the problem space, the subject then forms conceptualizations—ideas, theories and hypotheses—of how to transform the situation. The final and critical part of the process is to try out these conceptualizations in practice to see if they can move the indeterminate situation towards resolution. To the extent that the conceptualizations prove to move the situation towards determinacy, they are transformed from hypotheses into facts of existence. If they fail to do so, they are inadequate and the subject must form and try out new hypotheses, although informed by the failure of previous assumptions. This description outlines the process of inquiry in the most general of ways. Due to the composite nature of situations, it is rare that problematic situations are resolved in such a straightforward manner. Often, the resolution of a problematic situation is an ongoing, iterative process that cycles between problem framing and articulation, hypothesis generation and practical evaluation. Addressing one component of the situation may cause other components to change in unforeseen ways, necessitating a reformulation and reframing of the problem. The resolution of a problematic situation may come about through the transformation of one, more or all of its constituent components. If a situation is resolved in such a way that the components now appear in a structured and fulfilling way to the subject, it is labeled a *consummatory experience* in Deweyan terminology; if the pieces do not fit together and/or the subject abandons the process of inquiry, it is labeled an *inchoate experience*.

**Transformation.** Transformation is the motivation for situated inquiry, turning indeterminate situations into determinate ones: “Situations are an intimate, interconnected functional relation involving the inquirer and the environment. The resolution of a problematic situation may involve transforming the inquirer, the environment, and often both. The emphasis is on transformation. (Boydston, 1981-1990, vol. 10, p. 33)” Since the situation is constituted of subject, physico-spatial surroundings, others, artifacts and social constructs, it may be transformed through changes in one, more or all of these components and their relations. For instance, the subject may gain a better understanding of the situation through inquiry to the extent that they no longer experience it as problematic; in this respect, it is the expanded horizon of the subject that is the main reason that the situation is no longer indeterminate. But it might as well be the case that the subject subjugates the other components in the situation to fit their intentions and thus resolves the situation. Regarding the first instance, the transformation of the inquirer, Dewey (1916/2004) states that “The self is not something ready-made, but something in continuous formation through choice of action” (p. 235). In the present, I bear with me a personal history of past experiences and formed habits that guide my current experiences and actions, but my ongoing interactions in situations will change and expand upon my habits and repertoire of experiences.

**Technology.** Dewey's definition of technology is more inclusive than the general conception of the term in that he treats technology broadly as the use of instruments or means to reach an intended outcome. Technology is thus central to the transformation of a situation through inquiry. Technology has a dual nature in this regard, since it is at the same time constitutive of experience and a means of altering experience; it frames our understanding of the situation and at the same time facilitates our reconstruction of it. It supports our thinking and learning through doing and as such plays a role in constituting our selves. Technology justifies and proves itself to be meaningful if it works in the way that we hypothesized it to do. Technologies are themselves situated and part of a larger context. Instruments gain meaning through use and some evolve over the course of time, potentially in complex and specialized forms. Complex and specialized technologies allow for different ways of experiencing the world, expanding what we can understand and achieve. This inclusive definition of technology covers physical tools as well as semantic constructs. Most importantly, Dewey describes *language* as a meta-instrument, a "tool of tools" in the sense that it is the primary instrument for establishing meaning. Language is instrumental in the sense that it is not primarily concerned with correct representation, but with managing and controlling the conditions of the situation and steering it towards transformation. Inquiry, then, can be understood as a technological activity, where artifacts and other technological constructs serve as situated tools for experience and interaction. Instruments gain meaning for us through this use and are integrated into our habits and repertoires of knowledge and experience. This applies to everyone's use of technology and the social is inherently intertwined with the technological since technology frames and supports social interaction.

## Discussion: A Pragmatist Perspective on Design

In this final section, I examine the convergence of issues in pragmatism and design thinking and discuss the implications of a pragmatist perspective on design. The main argument is that pragmatism can serve as conceptual scaffolding for developing the discourse of design and by extension the practice of design. This has already happened to some extent through existing contributions to design. The reasoning behind this line of argument is in itself inspired by the pragmatist understanding of theory and practice: theory and practice exist in a reciprocal relationship and theoretical conceptualizations have consequences in practice. On the one hand, theories spring from and must be judged on the basis of practice; on the other hand, the theories and conceptual frameworks that designers bring with them explicitly and implicitly shape practice. At times, the influence of theory in practice is clear, such as when a theoretical concept leads to the development of a specific method or technique. At other times, the influence can be less clear—although still influential—when theories and ways of thinking become part of a designer's repertoire and shape the way they understand and act in design situations.

## The Convergence of Pragmatism and Design Thinking

In the previous sections, there is a clear convergence between themes and concepts outlining design thinking and the core concepts of Deweyan pragmatism. Thus far, I have refrained from weaving these overlapping strands together in order to lay them out clearly and succinctly in their own right. However, it should shine through that there are numerous overlaps. A number of works that draw on pragmatism, including Schön (1983, 1987) and Buchanan (1992), have had considerable impact on design thinking and have served as inspiration for my further examination of pragmatist philosophy presented in this article. Schön's work has inspired the development of design education and provided valuable articulations to support research into the design process. Contributions that draw on pragmatist aesthetics have been influential in shaping recent discussions concerning experience-oriented aspects of use and interaction in design. Such contributions emphasize the potential of pragmatist concepts in both design and use situations. In the following, I continue this line of thought by addressing the convergence of themes and concepts between the pragmatist perspective and design thinking.

First and foremost, pragmatism emphasizes the *primacy of situated practice* and the existential condition of being placed in a *world of emerging and unfolding phenomena*, a "world brimming with indeterminacy, pregnant with possibilities" (Shalin, 1986, p. 10). This is a fundamental condition that simultaneously challenges us and inspires us to consider what we might do to change the situations we find ourselves in. As a paradigm of inquiry, pragmatism presents a situated world view that rests on the pragmatic maxim, asserting that practice is the essential test bed in which conceptualizations prove their value. The world of practice is emergent, in the making, through the ongoing interactions between subjects and surrounding environments. This resonates with the understanding that design is a situated and systemic activity in which the designer must engage with the design situation both to get an initial understanding of the challenge they are facing and in the ongoing design process in which various components of the situation "talk back" to the designer in the conversational metaphor of Schön (1983, 1987).

At its core, *design is an interventionist discipline* that seeks to bring about change by developing and staging artifacts and environments that alter how we perceive and act in these volatile conditions. This is evident in e.g., Brandt and Binder (2007) and Binder and Redström (2006), which emphasize intervention as a key component in designerly inquiry. As such, pragmatism and design coincide on a fundamental level; one might say that pragmatism is very amenable to designerly thinking in that it offers articulations and insights regarding the notions of *situation, emergence, and interaction* that can be employed in understanding the design and users of interactive artifacts. The interventionist and transformative agenda of design resonates with the pragmatist tenet that practice-based action takes precedence over doctrines. As stated by Harrison, Back, and Tatar (2006) "Scientific investigation does not and would not employ methods that are at variance with underlying principles. Designers have no problem

doing just that if it solves the problem at hand” (p. 269). This is well aligned with Deweyan pragmatism insofar as it regards ideas and theories as tools for action; it is by putting them to work in practice that we can know their value and meaning. By implication, pragmatism moves beyond the theory-practice dichotomy and proposes instead an understanding of knowledge as an active phenomenon formed through *experimental action*. Rorty (1991a), a present-day pragmatist, states that we should not “... view knowledge as a matter of getting reality right, but as a matter of acquiring habits of action for coping with reality” (p. 1). The pragmatist perspective emphasizes participation and stresses that knowing is formed in and through interaction with the situation. This transformative relationship is directed towards understanding and acting in response to the situation and though we draw on past experience and knowledge, this repertoire is challenged through inquiry and may evolve or be expanded in the process. Such a view clearly echoes many of the descriptions of how designers act and learn in the face of challenging situations and as such pragmatism can help ground and inform studies of ongoing designerly inquiries.

However, it is not only designers, but also users who face a world that is “pregnant with possibilities” (Shalin, 1986, p. 10). The pragmatist conceptualization of inquiry can offer insights concerning both *how designers approach and explore design challenges*, and *how users make sense of and employ the products of design*. The pragmatist perspective implies a systemic understanding of situations and prompts us to consider users as resourceful actors who, just as designers, draw on interactive artifacts and systems to make sense of and transform their situation. The perspective also underscores that these technologies are likely not the only resources that people draw on and that they may move from being at the center of users’ attention towards the periphery and vice-versa, depending on how a situation unfolds. In this respect, a pragmatist perspective prompts designers to consider how the conditions for use will change and how the products we design are part of larger, dynamic assemblies of technologies.

*Experimentation* is another confluent theme in design and Deweyan pragmatism. In a pragmatist perspective, experimentation, reflection and action are intertwined as hypotheses and conceptualizations are informed by, directed at, and tried out in practice. This intentionality (i.e., directedness towards the enviroing conditions) goes beyond immediate action; it also frames the evaluation of the hypothesis-action-transformation constellation. In pragmatism, evaluation of experiments is not based on immutable criteria. Experimentation affects not only things outside of an experimenting subject, such as a designer or a user. It changes the whole situation including the subject. As a consequence, the subject may gain richer understandings of the situation and rethink the evaluation criteria. This mirrors the common description of design as an iterative process in which designers move towards a better understanding of the problem through loops of interventions and experiments (e.g., Löwgren & Stolterman, 2004). In the design situation, experiments are essential as they form the basis for shaping and evaluating potential future situations and act as catalysts for knowledge and learning.

*Technology* plays an essential role in design experiments, both in regards to facilitating experiments and externalizing design concepts (in the shape of e.g., mock-ups, prototypes, and scenarios). A pragmatist perspective on technology emphasizes the reciprocal nature of our relation to technology as designers and users. Technology frames our understanding of the situation and serves as means for transforming it. Bringing this conception of technology to the table can add to our understanding of design practice. Many design methods rely on the use of technologies, e.g., sketching and prototyping, and a pragmatist perspective can add to analyses of why we rely upon such techniques, how they unfold in practice, what the outcome is and how this outcome informs and shapes the design process. Looking beyond the scope of the specific design project, it may also scaffold examinations of how these technologically mediated design methods are integrated into designers’ habits and repertoires of knowledge and experience over the course of time. For those interested in pursuing this theme, Dewey’s concept of technology is treated in strands of philosophy of technology, in particular in the work of Hickman (Hickman, 1992, 2001). However, the uptake of these works, and to some extent of philosophy of technology in general, is limited within design. This can seem paradoxical when one considers the calls for common foundations within the field.

## Implications of a Pragmatist Perspective on Design

One of the pertinent questions when introducing theoretical frameworks to the field of design is how the framework can be brought to bear on practical design problems in real-life projects, or as it is often put, *what are the implications for design?* While existing contributions address concrete implications of pragmatism on design to some degree, many of them focus on other aspects of design, e.g., how to educate designers or how to understand people’s experience of the products of design. This work is highly valuable for shaping the discourse of design and qualifying the work of designers; an understanding of the convergence of pragmatism and design thinking can serve the same purpose. The pragmatist perspective can have—and has already had—important implications for shaping design thinking and design as a discipline. However, the pragmatist perspective can be developed so that it can also directly inform design in practice. Following an account of existing contributions, I will therefore show how pragmatist concepts can be operationalized to guide specific design projects, exemplified through two cases. Finally, I round off with pointers to future examination and development of the pragmatist perspective in design.

### *Existing pragmatist contributions to design*

Since pragmatism is a well-developed theoretical position, it offers a rich body of work to draw upon. Dewey never brought his concepts to bear directly on design himself and his works have had most influence in domains such as education, aesthetics and psychology. However, the influence of his work is clear in a number of design contributions. Some of these reference Dewey explicitly, whereas other contributions bear marks of his legacy intermixed with other theoretical positions. A noteworthy aspect

of adopting and employing a pragmatist perspective is that it can enrich our understanding of several key aspects of design. Past contributions have thus explored pragmatist perspectives on topics such as design education, design processes and experience-oriented aspects of design and use, albeit often on overarching or formative levels.

**Design education:** Donald Schön is arguably the most widely recognized proponent of pragmatist principles in design. Schön's exploration of designers as competent practitioners in *The Reflective Practitioner* (Schön, 1983) and *Educating the Reflective Practitioner* (Schön, 1987) has been highly influential in understanding the design process and the competencies of skillful designers and in shaping design education. Key parts of Schön's work can be understood as the application of pragmatist principles on the field of design, particularly with respect to the reciprocal relations between reflection and action, the experimental and iterative transformation of practice, and to the formation and ongoing development of habits and knowledge. These insights are a continuation of Dewey's theories of learning as an interactive and experiential process, and the very notion of project-based learning, which is prominent in contemporary design education, stems from this part of Dewey's oeuvre (Knoll, 1997).

**The design process:** Recalling the definition of situation as an assemblage of subject, context, socio-cultural constructs and technologies, pragmatism prompts a systemic understanding of the design situation in which all of these components can—and likely will—influence the design process. The design problem is not given, it is developed through the first stages of designerly inquiry; this, too, is an understanding revitalized in design by Schön's notions of *framing* and *naming* (Schön, 1983, 1987). Pragmatism frames designerly inquiry as an experimental process in which the designer draws on all of the resources at hand, as well as develops their own understanding of the situation in order to transform it. Pragmatism thus clearly lends backing to the iterative model of design processes promoted by e.g., Löwgren & Stolterman (2004). In his article "Wicked Problems in Design Thinking", Buchanan (1992) draws explicitly on Dewey's work on experimental inquiry. More recently, Östman (2005), Melles (2008) and Dalsgaard (2009) have sought to revitalize pragmatism in design. The pragmatist legacy is also clear in Gedenryd's book *How Designers Work* (Gedenryd, 1998), which emphasizes the crucial importance of the tools and resources that competent designers draw on in their work. Another central tenet from pragmatism that is now a core part of design thinking is the ongoing exchange between thought and action, which are intrinsically interrelated. Designers act on the basis of their preexisting understanding of the design situation, not only to achieve a predetermined objective, but also to get a better understanding of the situation. Indeed, designers often fall back on methods and techniques that serve to kick start the process of understanding through doing and then gradually come to understand the situation through our actions. A prime example of the intertwined nature of thinking and doing in design through the use of tools and resources is found in Buxton's work on sketching (2007). Recently, pragmatist concepts have also been applied to examine the nature of constraints in design projects and the ways in which designers can manipulate constraints to drive

design projects (Biskjær & Dalsgaard, 2012), as well as the role of instruments and physical artifacts in collaborative design projects (Hansen & Dalsgaard, 2012).

**The experience of design and use:** Dewey's conceptualization of the experience of art can add to understanding of the properties of interactive artifacts and how they are perceived and employed. In *Art as Experience* (Dewey, 1934/2005), Dewey makes a clear distinction between an "art object"—a product—and a "work of art"—a process. A work of art—or a work of design—in its finest form is a heightened state of experience. This experience emerges in the process of making (as artists and designers do) or in the process of encountering the artifact (as an engaged audience or group of users do). Pragmatism thus emphasizes the notion that things and events gain meaning and significance through interaction. Even though these concepts were formulated in the early part of the 20th century, they seem as relevant as ever. On the one hand, because the proliferation of digital technologies foster ongoing interactions between people and an interactive systems, or assemblies of people and systems and on the other due to a growing interest in how people can come to shape technologies, both in specific strands of design such as participatory design, and in more general trends such as Web 2.0. Recent years have seen an increasing interest in the notion of user experience, especially concerning interactive products and services. In this domain, Dewey's pragmatist aesthetics has served as inspiration for a number of contributions related to experience and interaction. The most expansive treatment of the topic is McCarthy and Wright's *Technology as Experience* (McCarthy & Wright, 2004) in which the authors build explicitly on Dewey and Russian scholar Bakhtin to develop an understanding of how technology is experienced from a so-called *felt life* perspective. A Deweyan understanding of experience has also featured explicitly in a number of papers in the interaction design research community, among these Forlizzi and Battarbee (2004) and Jacucci, Jacucci, Wagner and Psik (2005). In particular, the pragmatist understanding of aesthetic experience has informed discussions within the field, e.g., Löwgren (2007) and Petersen et al. (2004), who explicitly define their subject matter as "*Aesthetic Interaction—A Pragmatist's Aesthetics of Interactive Systems*".

## Employing Pragmatist Concepts to Guide and Inform Specific Design Cases

In her account of theoretical positions in interaction design, Rogers (2004) distinguishes between early theoretical developments inspired primarily by cognitive science and recent theoretical positions inspired by a wider range of traditions including activity theory, situated action and distributed cognition and ethnomethodology. According to Rogers, one of the key distinctions between the early and recent developments is the role of theory. In early developments, theory serves as informative, predictive and prescriptive with regards to systems design. In recent developments, theory serves to provide descriptive accounts, to generate rich insights to inform the design process, to explain user behavior, to provide analytic frameworks and to articulate design issues. In many respects, pragmatism falls in the latter category. This does not mean that a pragmatist perspective

cannot yield specific considerations or approaches for design. One way to operationalize the pragmatist framework to directly inform design is through “*bridging concepts*” (Dalsgaard & Dindler, 2014). Bridging concepts are akin to Höök & Löwgren’s notion of “strong concepts” (Höök & Löwgren, 2012) in that they are a form of generative and solution-oriented knowledge that exists in the space between abstract theories (e.g., pragmatism) and specific instances of design (e.g., a concrete design project or a specific challenge in a project). The term bridging concept is employed because the specific intent behind them is to bridge the gap between general theories and particular design challenges. Bridging concepts can thus be developed from theory with the intent of informing design in practice, while still being general enough to be appropriated and applied in different projects and domains.

I offer two examples of how bridging concepts can inform specific design projects, namely the concepts of *inquisitive use* and *peepholes*, in the development of the interactive installations *Balder’s Funeral Pyre* and *Silence and Whispers*.

### *Inquisitive Use as Bridging Concept in the Balder’s Funeral Pyre Project*

The first case, *Balder’s Funeral Pyre* was an interactive installation developed for a centre for children’s literature. It was designed at the Centre for Advanced Visualization and Interaction (CAVI), Aarhus University, with the participation of the author throughout the design process. In Scandinavian mythology, the death of the god Balder marks a crucial narrative turn. Balder is slain and his body is placed upon a burning ship that is set off to sea. These events mark the beginning of the end of the mythological world, culminating in an apocalyptic battle. The installation was developed to foster children’s interest in literature by evoking specific moods and ambiances, instilling user curiosity and conveying narrative elements without retelling the myth word by word. This approach to knowledge mediation aimed to encourage children to read and explore stories from this universe themselves.

In the design of *Balder’s Funeral Pyre*, the bridging concept of *inquisitive use* was developed to guide the design process. Inquisitive use, which is introduced in (Dalsgaard, 2008), draws on the Deweyan concepts of *situation*, *inquiry* and the potential of *conflict* in order to examine how interactive installation can be designed to encourage inquiry. Inquisitive use denotes a special way of interacting with a system that is instigated when users encounter a conflict in form of a problematic situation that challenges their preconceptions and leads them to explore and potentially affect and alter the situation. Through iterations of inquisitive, experimental actions and feedback from other components in the situation, the user-situation transaction unfolds until the situation is transformed, see Figure 1.

In the *Balder’s Funeral Pyre* project, inquisitive use was employed as a bridging concept to gain an understanding of how users might perceive of an evocative installation and how the installation could be designed to inspire (rather than enforce) explorative and contemplative use. One specific example of how this played out in practice was during the prototype test phases.



**Figure 1. Model of inquisitive use in which an experience of conflict in the situation triggers interaction, leading to a process of inquiry.**

Several prototypes were developed and tested with children, the primary user group. They all shared the same basic setup, a long, narrow corridor in which the walls were rear-projected with interactive visualizations of fire. Audio mixes of crackling fire, creaking wood and crashing waves formed a responsive soundscape. The audio and visuals were coupled with pressure sensors in the floor, which enabled visitors to interact with the fire. When no one was in the corridor, the flames would simmer near the floor, but when someone entered, a fire would shoot up in front of them. As visitors proceeded down the corridor, the growing fire appeared to envelop them. The most popular prototype on test had drastic fiery explosions that responded instantly to children’s movements and interaction. This encouraged playful interaction from the children who would run down the corridor, playing and hooting; this version was recognizable to the children as something out of a computer game or an action movie, according to their responses. However, informed by the concept of inquisitive use, the design team ended up selecting a different and less popular prototype as the template for the final installation. This prototype was more subtle and ultimately more demanding. It only revealed itself fully to the user through a longer duration of engagement and inquiry, which interaction-wise was done by introducing delays and visualizing slowly emerging fires around users. This presented the children with a conflict or tension, in that they experienced it as something new, potentially frightening and definitely extraordinary, which prompted them to behave in an unfamiliar and somewhat counter-intuitive way.



**Figure 2. Designers discuss and evaluate prototypes of Balder’s Funeral Pyre.**

The decision to implement this version meant that not all children would experience the same thing. Some were too frightened and hurried through the corridor. Others were too impatient and moved along before the installation revealed itself to them, making for *inchoate experiences*. The children who remained in the installation long enough to watch events unfold, however, were for the most part very affected by it and

experienced it as a *consummatory resolution* to their exhibition visit thus far. The bridging concept of inquisitive use was thus employed actively by the design team to inspire how the interaction should occur, to guide concrete design decisions and to evaluate prototypes.

### *Peepholes as bridging concept in the Silence and Whispers Project*

The second case, *Silence and Whispers*, was a prototype installation for conveying and collecting place-specific stories from the Suomenlinna islands, a UNESCO world heritage site with a rich history in Helsinki, Finland. The installation was distributed in a series of corridors and caves. As visitors entered the caves, they would hear audio fragments of sinister stories and legends from Suomenlinna through a series of speakers connected to the system. The stories, collected from resident islanders, told of events and myths not presented in official documents of the islands. To hear more snippets and combine them into coherent stories, visitors had to venture into the underground and explore the installation. An intended expansion of the project would allow visitors to share their own stories about the place, which would then be fragmented and become part of the evolving installation. The installation is described in more detail in (Dalsgaard & Dindler, 2009).

In the *Silence and Whispers* installation, the bridging concept of *peepholes* was employed to guide and inform the design process. Peepholes, which are explored in more detail in Dalsgaard and Dindler (2009), build on the Deweyan concepts of *situation*, *inquiry*, *transformation* and *technology*, as well as concepts from Borgman (1995) and Berleant (1991), and refer to aspects of interactive systems and installations that use the conflict between what is hidden and what is revealed to instill engagement through curiosity and inquiry. Since it is a bridging concept, peepholes can be developed in range of modalities, e.g., visual, spatial or auditory, depending on the particular design situation. In the case of *Silence and Whispers*, the peepholes concept was instantiated primarily through auditory and spatial means. Visitors heard fragments and whispers and could only glimpse part of the ‘system’ through the entrances. They had to venture into the caves and corridors to gain access to other parts of the content.



**Figure 3.** A visitor explores the caves of *Silence and Whispers*.

The pragmatist concepts combined in peepholes guided the development of the installation in several ways. The Deweyan conception of situation as the frame of interaction inspired the development of an installation that was more than a singular interface, but rather an assemblage of technologies in a distributed spatial setting. The pragmatist concept of technology also clearly guided the design. Firstly, the reciprocal nature of technology in a Deweyan perspective inspired the designers to both frame and give access to particular experiences through technology as well as offering visitors means to shape the installation themselves through recording and distributing their stories. Secondly, digital peepholes hold a particular potential for interaction and transformation through loops of feedback, since they can respond to the actions of users to gradually present more of the underlying content. As was the case with the bridging concept of inquisitive use, peepholes clearly draw on a Deweyan understanding of inquiry as a mode of experience that is prompted by conflict—here in the case of tensions between what is revealed and what is hidden—and which can lead to consummatory experiences through an experimental approach to interacting with the installation.

As the two cases show, bridging concepts developed from pragmatism can guide design in practice, both by inspiring specific design strategies and supporting concrete design decisions. The bridging concepts are, however, intentionally developed to be at a certain level of abstraction so that they can be employed in a range of projects. For example, peepholes can be instantiated through visual and embodied interaction, such as O’Shea’s (2007) *Out of Bounds* installation, through tangible installations, such as Cassinelli and Ishikawa’s (2005) *The Khronos Projector*, and more. Bridging concepts thus offer designers a theory-driven set of insights that they can appropriate and further concretize in specific projects.

## Conclusions and Future Work

The main argument presented in this article is that Deweyan pragmatism offers a set of concepts that can contribute to the efforts to articulate designerly inquiry and thinking, as well as a framework for understanding the relations between these concepts. I have done this by discussing central issues in design thinking and pragmatism to establish the convergence between them. The proposition is supported by the fact that several existing influential contributions to design build on pragmatism. These understandings can enrich both the discourse on design and design practice, exemplified here through two cases in which bridging concepts developed from pragmatist theory have informed and guided real-life design projects. It may be argued that the issues addressed here only comprise a subset of the issues at stake in design thinking and there are a number of themes in design which may not be informed by existing pragmatist contributions to the same extent. However, judging on the basis of the convergences discussed in this article, I contend that the pragmatist position is a well-suited candidate for those who seek to draw on established theoretical positions in the ongoing effort to explore and articulate design inquiry and thinking.

A number of interesting topics excluded here warrant further examination. Such future work could include in-depth studies of the pragmatist perspective in specific design cases, further development of pragmatist concepts of particular interest to particular areas of design and examination of relations between pragmatism and other strands of theory in the ongoing explication of designerly inquiry and thinking. With regards to the latter, it would be of value to establish dialogues between pragmatism and other theoretical positions that have influenced the field of design such as phenomenology and cultural-historical activity theory to examine affinities, departures and potential for further development. Although these positions emerged and developed in different contexts, and even on different continents, there are numerous shared conceptual concerns. For example, phenomenology, which through the work of Winograd and Flores (1987) and Dourish (2001) among others has inspired the discourse of design, shares the anti-Cartesian and anti-dualistic standpoint of pragmatism and foregrounds subjective experience. However, the two positions also differ on a number of accounts, such as the implications of experience and the awareness of being, as explored by e.g., Rorty (1991b, pp. 18-20). Similarly, pragmatism and activity theory, influential in the field of interaction design through the work of Kaptelinin and Nardi (2006) and Bertelsen and Bødker (2002) among others, foreground practice and the crucial role of instruments in human activity, while there are arguably incongruences with regards to their conceptions of the intentional and goal-oriented nature of activity. Indeed, there are even shared concerns and conceptualizations between the three positions, e.g., with regards to the concept of breakdown (Koschmann, Kuutti, & Hickman, 1998). It is unfortunately beyond the scope of this article to offer more than an invitation to pursue these threads in future work, but hopefully it suggests that this could be a worthwhile endeavor.

Going beyond the line of argument that pragmatism can bridge disparate concerns in design by scaffolding our understanding of both design and use, it would also be worthwhile to examine if and how the perspective can enrich our understanding of design theory and research. A number of recent contributions have explored and developed the notion of *research through design* (e.g., Koskinen, Binder, & Redström, 2009; Zimmerman, Stolterman & Forlizzi, 2010) in which researchers engage in design in order to develop new understandings. This approach, which too blurs the line between the roles of researcher and designer, rings true with pragmatism. Dewey himself shunned what he labeled 'the spectator theory of knowledge', the idea that knowing comes from passive observation of phenomena outside of the subject. Much of his work on education is a response to this view. One of the primary catalysts of knowing is active engagement in indeterminate situations that at the same time offer researchers a test bed for hypotheses and prompt new ways of seeing and doing. It follows from a pragmatist perspective that theories of design must continuously be put to the test in practice to ascertain their value, both with regards to how they can yield insights for researchers into the design process and with regards to how they may inform and develop design practice. While

these relations between design research and pragmatism have not been explored in depth, there are clearly affinities that warrant further studies. Finally, and on a higher level yet, the notion of developing a discourse or "linguaging" (Krippendorff, 2006) of design itself invites further discussions, both with regards to what such efforts could and should encompass and with regards to the general implications of developing a shared language.

## Acknowledgments

This work builds on an examination of pragmatism that began in 2006. Since then, many people have challenged, informed and inspired it. In particular, I'd like to thank my colleagues in the departments of Aesthetics and Communication and Computer Science (Martin Brynskov, Susanne Bødker, Jonas Fritsch, Tony Gjerlufsen, Ole Iversen, and Clemens Klokmoose) for many fruitful discussions. Also warm thanks to co-authors of previous publications exploring pragmatist concepts (Michael Mose Biskjaer, Christian Dindler, Kim Halskov and Nicolai Brodersen Hansen). The research has taken place within the frames of the Centre for Advanced Visualization and Interaction, (CAVI, <http://www.cavi.au.dk>) and the Participatory Information Technology Centre (PIT, <http://www.pit.au.dk>).

## References

1. Bardzell, J., & Bardzell, S. (2008). Interaction Criticism: A Proposal and Framework for a New Discipline of HCI. In *Proceedings of the CHI Conference on Human Factors in Computing Systems* (pp. 2463-2472). New York, NY: ACM Press.
2. Berleant, A. (1991). *Art and engagement*. Philadelphia, PA: Temple University Press.
3. Bertelsen, O. B., & Bødker, S. (2002). Activity theory. In J. M. Carroll (Ed.), *HCI models, theories and frameworks: Toward an interdisciplinary science* (pp. 291-324). San Francisco, CA: Morgan Kaufmann.
4. Bertelsen, O. W., & Pold, S. (2004). *Criticism as an approach to interface aesthetics*. In R. Raisoamo (Ed.), *Proceedings of the 3rd Nordic Conference on Human-computer Interaction* (pp. 23-32). New York, NY: ACM Press.
5. Binder, T. and Redström, J. (2006). Exemplary Design Research. In Friedman, K., Love, T. and Corte-Real, E. (Eds.) *Proceedings of Design Research Society Wonderground International Conference 2006*.
6. Biskjaer, M. M. & Dalsgaard, P. (2012). Toward a constraint-oriented pragmatist understanding of design creativity. In A. Duffy, T. Taura, & Y. Nagai (Eds.), *Proceedings of the 2nd International Conference on Design Creativity* (pp. 65-74). Scotland, UK: the Design Society.
7. Borgman, A. (1995). *The depth of design*. Chicago, IL: University of Chicago Press.
8. Boydston, J. A. (Ed.). (1981-1990). *Later works of John Dewey: 1925-1953* (Vols. 1-16). Carbondale, IL: Southern Illinois University Press.

9. Brandt, E., & Binder, T. (2007). Experimental design research: Genealogy, intervention, argument. In *Proceedings of the 2nd Conference of International Association of Design Research*. Hong Kong, China: International Association of Design Research.
10. Brown, T. (2009). *Change by design: How design thinking transforms organizations and inspires innovation*. New York, NY: HarperBusiness.
11. Buchanan, R. (1992). Wicked problems in design thinking. *Design Issues*, 8(2), 5-21.
12. Buxton, B. (2007). *Sketching user experiences: Getting the design right and the right design*. San Francisco, CA: Morgan Kaufmann.
13. Carroll, J. M. (1999). Five reasons for scenario-based design. In *Proceedings of the 32nd Hawaii International Conference on System Sciences* (Vol. 3, p. 3051). New York, NY: ACM Press.
14. Cassinelli, A., & Ishikawa, M. (2005). Khronos projector. In *Proceedings of the 32nd International Conference and Exhibition on Computer Graphics and Interactive Techniques* (Article No. 10). New York, NY: ACM Press.
15. Cross, N. (2007). *Designerly ways of knowing*. Basel, Switzerland: Birkhäuser.
16. Cross, N. (2011). *Design thinking: Understanding how designers think and work*, Oxford, UK: Berg.
17. Dalsgaard, P. (2008). Designing for inquisitive use. In J. van der Schijff & G. Marsden (Eds.), *Proceedings of the 7th ACM Conference on Designing Interactive Systems* (pp. 21-30). New York, NY: ACM Press.
18. Dalsgaard, P. (2009), *Designing engaging interactive environments: A pragmatist perspective*. Aarhus, Denmark: Aarhus University.
19. Dalsgaard, P., & Dindler, C. (2009). Peepholes as means of engagement in interaction design. In *Proceedings of the 3rd International Conference of Nordic Design Research* (pp. 1-10). Oslo, Norway: The Oslo School of Architecture and Design.
20. Dalsgaard, P. & Dindler, C. (2014). Between Theory and Practice: Bridging Concepts in HCI Research. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 2014*. New York, NY: ACM Press.
21. Dewey, J. (1938a). *Logic: The theory of inquiry*. New York, NY: Holt, Rinehart and Winston.
22. Dewey, J. (1938b). *Experience and education*. New York, NY: Collier Books.
23. Dewey, J. (1998). In L. Hickman, & T. Alexander (Eds.), *The essential Dewey: Ethics, logic, psychology*. Bloomington, IN: Indiana University Press.
24. Dewey, J. (2004). *Democracy and education*. New Delhi, India: Cosmo Publications. (Original work published 1916)
25. Dewey, J. (2005). *Art as experience*. New York, NY: Perigee. (Original work published 1934)
26. Dourish, P. (2001), *Where the action is: The foundations of embodied interaction*, Cambridge, MA: MIT Press.
27. Ehn, P., & Kyng, M. (1991). Cardboard computers: Mocking-it-up or hands-on-the-future. In J. Greenbaum & M. Kyng (Eds.), *Design at work—Cooperative design of computer systems* (pp. 169-196). Hillsdale, NJ: Lawrence Erlbaum Associates.
28. Ehn, P. (1988). *Work-oriented design of computer artifacts*. Stockholm, Sweden: Arbetslivscentrum.
29. Floyd, C. (1984). A systematic look at prototyping. In R. Budde, K. Kuhlenkamp, L. Mathiassen, & H. Zullighoven (Eds.), *Approaches to prototyping* (pp. 1-18). Berlin, Germany: Springer Verlag
30. Forlizzi, J., & Battarbee, K. (2004). Understanding experience in interactive systems. In D. Benyon, P. Moody, D. Gruen, & I. McAra-McWilliam (Eds.), *Proceedings of the 5th Conference on Designing Interactive System* (pp. 261-268). New York, NY: ACM press.
31. Gedenryd, H. (1998), *How designers work: Making sense of authentic cognitive activities*. Lund, Sweden: Lund University Cognitive Studies.
32. Hallnäs, L., & Redström, J. (2006). *Interaction design: Foundations, experiments*. Borås, Sweden: University College of Borås.
33. Hansen, N. B., & Dalsgaard, P. (2012). The productive role of material design artefacts in participatory design events. In L. Malmberg & T. Peterson (Eds.), *Proceedings of the 7th Nordic Conference on Human-computer Interaction* (pp. 665-674). New York, NY: ACM press.
34. Harrison, S., Back, M., & Tatar, D. (2006). "It's just a method!": A pedagogical experiment in interdisciplinary design. In J. M. Carroll, S. Bødker, & J. Coughlin (Eds.), *Proceedings of the 6th ACM Conference on Design Interactive Systems* (pp. 261-270). New York, NY: ACM press.
35. Hickman, L. A. (1992). *John Dewey's pragmatic technology*. Bloomington, IN: Indiana University Press.
36. Hickman, L. A. (2001). *Philosophical tools for technological culture: Putting pragmatism to work*. Bloomington, IN: Indiana University Press.
37. Höök, K., & Löwgren, J. (2012). Strong concepts: Intermediate-level knowledge in interaction design research. *ACM Transactions on Computer-Human Interaction*, 19(3), No. 23.
38. Jacucci, C., Jacucci, G., Wagner, I., & Psik, T. (2005). A manifesto for the performative development of ubiquitous media. In O. W. Bertelsen, N. O. Bouvin, P. G. Krogh, M. Kyng (Eds.), *Proceedings of the 4th Decennial Conference on Critical Computing* (pp. 19-28). New York, NY: ACM press..
39. Kaptelinin, V., & Nardi, B. (2006). *Acting with technology: Activity theory and interaction design*. Cambridge, MA: MIT Press.
40. Kimbell, L. (2011). Rethinking design thinking: Part I. *Design and Culture*, 3(3), 285-306.

41. Knoll, M. (1997). The project method: Its vocational education origin and international development. *Journal of Industrial Teacher Education*, 34(3), 59-80.
42. Koschmann, T., Kuutti, K., & Hickman, L. (1998). The concept of breakdown in Heidegger, Leont'ev, and Dewey and its implications for education. *Mind, Culture, and Activity*, 5(1), 25-41.
43. Koskinen, I., Binder, T., & Redström, J. (2009). *Lab, field, gallery, and beyond*. *Artifact*, 2(1), 46-57.
44. Krippendorff, K. (2006). *The semantic turn: A new foundation for design*. Boca Raton, FL: Taylor and Francis CRC Press.
45. Louridas, P. (1999). Design as bricolage: Anthropology meets design thinking. *Design Studies*, 20(6), 517-535.
46. Ludvigsen, M. (2006). *Designing for social interaction: Physical, co-located social computing* (Doctoral dissertation). Aarhus, Denmark: Center for Interactive Spaces, ISIS Katrinebjerg.
47. Löwgren, J., & Stolterman, E. (2004). *Thoughtful interaction design*. Cambridge, MA: MIT Press.
48. Löwgren, J. (2007). Pliability as an experiential quality: Exploring the aesthetics of interaction design. *Artifact*, 1(2), 85-95.
49. McCarthy, J., & Wright, P. (2007). *Technology as experience*. Cambridge, MA: MIT Press.
50. Melles, G. (2008). An enlarged pragmatist inquiry paradigm for methodological pluralism in academic design research. *Artifact*, 2(1), 3-11.
51. O'Shea, C. (2007). *Out of bounds*. Revised January 15, 2012, from <http://www.chrisoshea.org/projects/out-of-bounds/>
52. Östman, L. E. (2005). *A pragmatist theory of design: The impact of the pragmatist philosophy of John Dewey on architecture and design* (Doctoral dissertation, Karlstad University).
53. Petersen, M. G., Iversen, O. S., Krogh, P. G., & Ludvigsen, M. (2004). Aesthetic interaction: A pragmatist's aesthetics of interactive systems. In D. Benyon, P. Moody, D. Gruen, & I. McAra-McWilliam (Eds.), *Proceedings of 5th Conference on Designing Interactive System* (pp. 269-276). New York, NY: ACM.
54. Rittel, H., & Webber, M. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences*, Vol. 4, 155-169.
55. Rogers, Y. (2004). New theoretical approaches for HCI. *Annual Review of Information Science and Technology*, 38(1), 87-143.
56. Rorty, R. (1991a). *Objectivity, relativism, and truth*. Cambridge, UK: Cambridge University Press.
57. Rorty, R. (1991b). *Essays on Heidegger and others: Philosophical papers*, Cambridge, UK: Cambridge University Press.
58. Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. London, UK: Temple Smith.
59. Schön, D. (1987). *Educating the reflective practitioner*. San Francisco, CA: Jossey-Bass.
60. Shalin, D. N. (1986). Pragmatism and social interactionism. *American Sociological Review*, 51(1), 9-29.
61. Stolterman, E. (2008). The nature of design practice and implications for interaction design research. *International Journal of Design*, 2(1), 55-65.
62. Winograd, T., & Flores, F. (1987). *Understanding computers and cognition: A new foundation for design*. Boston, MA: Addison-Wesley.
63. Wolf, T. V., Rode, J. A., Sussman, J., & Kellogg, W. A. (2006). Dispelling design as the black art of CHI. In R. Grinter, T. Rodden, P. Aoki, E. Cutrell, R. Jeffries, & G. Olson (Eds.), *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 521-530). New York, NY: ACM Press.
64. Zimmerman, J., Forlizzi, J., & Evenson, S. (2007). Research through design as a method for interaction design research in HCI. In M. B. Rosson, & D. Gilmore (Eds.), *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 493-502). New York, NY: ACM Press.
65. Zimmerman, J., Stolterman, E. & Forlizzi, J. (2010). An analysis and critique of research through design: Towards a formalization of a research approach. In O. W. Bertelsen, P. Krogh, K. Halkoy, & M. G. Petersen (Eds.), *Proceedings of the 8th ACM Conference on Designing Interactive Systems* (pp. 310-319). New York, NY: ACM Press.

Copyright of International Journal of Design is the property of International Journal of Design and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.