Let's Get Divorced: Pragmatic and Critical Constructive Design Research

Jodi Forlizzi, Carnegie Mellon University, forlizzi@cs.cmu.edu

Ilpo Koskinen, Hong Kong Polytechnic School of Design, ilpo.koskinen@polyu.edu.hk

Paul Hekkert, Technical University Delft, P.P.M.Hekkert@TUDelft.nl

John Zimmerman, Carnegie Mellon University, johnz@cs.cmu.edu

Abstract

Over the last two decades, constructive design research (CDR) — also known as Research through Design — has become an accepted mode of scholarly inquiry within the design research community. CDR is a broad term encompassing almost any kind of research that uses design action as a mode of inquiry. It has been described as having three distinct genres: lab, field, and showroom. The lab and field genres typically take a pragmatic stance, making things as a way of investigating what preferred futures might be. In contrast, research done following the showroom approach (more commonly known as critical design (CD), speculative design, or design fictions) offers a polemic and sometimes also a critique of the current state embodied in an artifact. Recently, we have observed a growing conflict within the design research community between pragmatic and critical researchers. To help reduce this conflict, we call for a divorce between CD and pragmatic CDR. We clarify how CDR and CD exist along a continuum. We conclude with suggestions for the design research community, about how each unique research approach can be used singly or in combination, and how they can push the boundaries of academic design research in new collaboration with different disciplines.

constructive design research, pragmatic constructive design research, research through design, critical design, speculative design

Over the last two decades, constructive design research (CDR) — also known as Research through Design — has become an accepted and popular mode of scholarly inquiry within the design research community and in human-computer interaction (HCI) [Koskinen et al, 2011; Zimmerman and Forlizzi, 2014]. CDR is a broad term encompassing almost any kind of scholarly research that uses design action as a mode of inquiry; researchers make things as a way of producing valuable new knowledge. CDR values both thinking and making. We believe CDR has become popular because 1) it addresses challenges that cannot easily be approached with scientific or engineering inquiry, and 2) researchers trained in design find CDR to be a 'natural' way to conduct research. Koskinen et al., [2011] note three distinct genres: lab, field, and showroom.

The lab and field genres typically take a pragmatic stance, making things as a way of investigating preferred futures. Research done following the lab approach often involves a behavioral theory or design philosophy meant to improve design (e.g., using ethics to drive aesthetic choices for interaction [Ross and Wensveen, 2010]). Researchers make things operationalizing the selected theory or philosophy, then conduct studies to see if the artifact produces the outcome they intend. Research done following the field approach usually begins

with fieldwork investigating a target audience, problematic situation, or context. Researchers make things designed to bring about a specific change, and they place these objects back in the field to assess if they have the desired impact (e.g., studying people's TV watching behavior and suggesting interventions to make it a more social experience [Hassenzahl et al., 2013]). Research done following the showroom approach typically functions as a critique of the current state of the world. Known more commonly as critical design (CD) [Dunne, 2008], and more recently as speculative design and design fictions, this type of research works to generate a debate about values and hidden issues that researchers feel are both critical and missing [Dunne and Raby, 2013; Bardzell and Bardzell, 2013].

We claim that CDR is being damaged due to increasing and unnecessary conflict based on a misunderstanding of its aims. Interestingly, this conflict does not come from design studies researchers, nor has it come from engineers and behavioral scientists working in HCI. The source of the conflict is internal, taking place within the groups of researchers engaged in CDR. The conflict exists between a pragmatic push for relevance and a critical push back for more freedom in what design research can and should be. Those reviewing CDR papers all too frequently adopt the wrong lens. Reviewers look for pragmatic relevance from work that should be judged based on the quality of polemic it produces, and critical reviewers dismiss work for being too applied and not taking intellectual risks. Discussions of research approaches have also been contested. Pragmatic CDR researchers have pushed for more rigor in the hope of increasing the impact of pragmatic contributions and CD researchers have pushed back, noting that a forced scientific evaluation would significantly limit the kinds of research designers can do [Zimmerman et al., 2010; Gaver, 2012].

The conflict is familiar to those in design schools, where a product designer's pragmatic, problem-solving lens can conflict with the artistic lens of fashion and furniture designers. This conflict feels similar to the conflict in the sixties between radical designers and contemporary, apolitical designers, who were content to advance designs without connecting advances to utopic political foundations [Branzi, 2010]. These previous conflicts have generated a culture in which both arguments co-exist and create fruitful competition rather than polarize discourse and discontent.

To help transform this conflict into a productive situation, we call for a divorce between CD and pragmatic CDR. Explicitly differentiating these two types of CDR will reduce the internal conflict among design researchers. We also propose that we place these two types of design research on different ends of a continuum, showing how design research efforts can encompass varying combinations of these two approaches. We feel that this placement will allow each research approach to be strong and unique and to have its own criteria for evaluation.

To facilitate this goal, we provide a brief history of each approach, focusing on aspects of key projects. We articulate the knowledge outcomes from each approach, and what we see to be the strengths and weaknesses of each. We show how a design research effort can encompass varying combinations of these two approaches. We conclude with suggestions for the design research community about how to grow CD and CDR as unique research approaches and to continue to push the boundaries of academic design research in collaboration with new disciplines.

Constructive Design Research: The pragmatic side

CDR uses design action as a mode of inquiry. Researchers following this approach employ processes from design practice. When working on the pragmatic side of CDR, researchers make artifacts in order to codify understanding of the current state and to suggest how a design solution will yield a preferred future state. This approach has been described as distinct from scientific inquiry and engineering inquiry, because 1) it addresses a subjective question of what is 'preferred,' and 2) it allows designers to create new knowledge while they undertake processes inherent to design [Zimmerman, Forlizzi, and Evenson, 2007]. The pragmatic side of CDR operationalizes theory or philosophy that discusses design as focused on achieving a preferred state [Simon, 1969]. It takes into account the idea that many societal problems cannot be approached from the reductive methods of science and engineering and would best be approached with design thinking [Rittel and Webber, 1973]. It describes design as a reflective process utilizing abductive reasoning to reframe problematic situations as a way of making an advance [Schön, 1984; Kolko, 2010; Dorst, 2011].

Over the last two decades, this research approach has gained increasing acceptance in the design research community, making a new type of knowledge contribution that does not fit within the traditional definition of design studies [Koskinen et al., 2011]. It has also gained acceptance in the human-computer interaction research community, which brings together engineers, behavioral scientists, and design researchers.

Lab

Researchers following CDR's lab genre typically hold design workshops to investigate a behavioral theory or a philosophical idea. Design activities in the workshops reveal underlying patterns in how a theory, philosophy, or design quality might best be embodied in an interactive product. Researchers then produce several versions of the same artifact and typically run controlled studies to assess their insights about the artifact.

The lab genre emerged in design schools in the Netherlands because these schools integrated experimental psychologists and designers into faculty and student bodies. This genre blends the controlled experimental approach to research found in psychology with design action and insight. One example of the lab genre can be seen in the research of Stephan Wensveen, who built an alarm clock that was meant to understand emotion expressed through action and interaction with the clock (Figure 1) [Wensveen, Overbeeke, and Djajadiningrat, 2002].

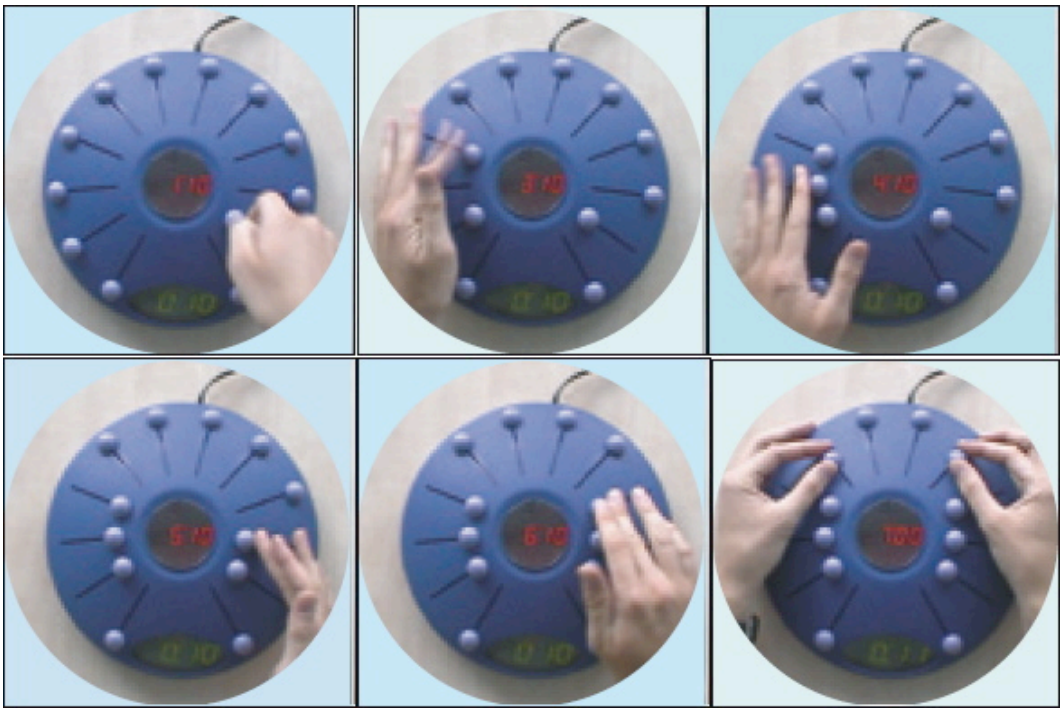

Figure 1. Lab research in the form of an alarm clock that recognizes the emotions of its user from rich interaction. [Wensveen, Overbeeke, and Djajadiningrat, 2002].

CDR lab research advances the discipline by providing new ways for designers to embody important qualities in new designs. The resulting artifacts work as both exemplars and as evidence. The empirical evaluations of the artifacts provide evidence of how people react to the new qualities and reveal complications in moving from theory to thing. In many cases, researchers create frameworks that detail how the theory under investigation can most easily be operationalized in a design. The resulting knowledge aids other design researchers and design practitioners by providing details on how they might draw these new qualities into their work. When reviewing lab-based work, reviewers should assess the impact and advancement to the field of design research. The designs are not intended to be early versions of commercial products. The work should not be assessed based on perceptions of how well the designs might perform in the market.

Field

When following the field genre, researchers typically select a target audience or context and then conduct fieldwork with the aim of discovering opportunities for new products or services to improve people's lives. Through a synthesis of the data, researchers reframe the problematic situation and draw out insights, opportunities, and concerns. They make new artifacts meant to achieve a preferred future and place them back into the environments of the field study in order to assess their impact. The field genre emerged from participatory design and from action research. It mixes design action with sociology, anthropology, psychology, and engineering.

The project on Families, Control, and the Smart Home provides an example of the field genre. Researchers conducted extensive fieldwork investigating the challenges faced by dual-income

parents. The researchers reframed several aspects of smart homes [Davidoff et al., 2006]. First, they focused on home as less of a place and more a set of responsibilities and social roles. Second, they recast the goal of the smart home technology as "making families feel in control of their lives," in contrast to typical smart home research that focused on control. The team addressed the anxiety many dual-income parents felt about forgetting to collect their children at the end of the workday, a problem made more acute when parents took over each others' routines. The team developed a system that learned a family's pick-up and drop-off routines. It used these inferences to issue alerts when there was a child that likely needed a pickup and no parent appeared to be heading in the correct direction (Figure 2) [Davidoff et al., 2011].

CDR field research views the reframing of a problem or design opportunity as the main research contribution. This focus on reframing subtly changes how researchers engage in the fieldwork that informs their designs. Instead of working like an ethnographer to develop a detailed understanding of the present, CDR field researchers work to develop a "good enough" understanding of the present that drive imagination of a preferred future [Odom et al., 2012]. CDR field research always has some kind of investigation of the present to support an articulation of the future, and occasionally the research stops at this point, with no resulting artifact. In most cases, however, the artifact made following the fieldwork functions as an exemplar of the problem/solution framing. Artifacts get evaluated in terms of how well they address or advance the reframing. Like CDR lab research, researchers following a field approach often produce frameworks to help researchers and practitioners work with the new problem framing. Artifacts made following a field process are almost never intended to be commercially viable; however, they are meant to inform the design of viable products that embody the reframing.

Figure 2. Field research on families and smart homes. The Person-Place-Time-View interface shows a prediction of where and when every family member will be and which parent is responsible for different child pickups and drop-offs.

Lab and Field: Shared pragmatics

Lab and field share a pragmatic perspective. These approaches attempt to make a specific and explicit change in the world by producing knowledge researchers and practitioners can apply in future work. They draw on disciplines including psychology, sociology, anthropology, and engineering, but they also make a designerly contribution. They use theories of human behavior, but the research typically does not advance these theories by refining or refuting them. Assessment mainly revolves around relevance, but includes novelty, rigor, and validity. Relevance connects with the intended impact the work is attempting to have on the world. Novelty requires that the work offers new insights or even a complete reframing. Rigor connects with execution of research methods as well as design craft. Validity relates to both the overall design of the research study, including the selection of the methods, and in providing a description of the design process that others could reproduce.

Critical Design: Definition, history, and examples

CD — by which we mean design research known as critical design, speculative design, or design fictions — is a type of design research that involves making artifacts that are intended to reveal hidden values and generate debate. It draws on traditions from art and the humanities, and it often uses strategies such as hyperbole or irony to communicate a point that is disconnected from the artifact that has been designed.

CD has several origins, but the name “critical design” comes from the book Design Noir [Dunne and Raby, 2001]. One specific purpose of CD has been to separate design from its tight connection to commercial practice. While design discourse has also discussed a need for this separation, CD represents a research-based attempt to revise the meaning and purpose of design from within.

Design Noir provides a nice example of CD research, telling the story of Placebo project, which explored how people relate to electromagnetic radiation (EMR) around them [Dunne and Raby, 2002]. Researchers designed a series of simple, non-functional prototypes people might use detect EMR and thus protect themselves from its invisible force. (Figure 3a). These functioned as placebos — the prototypes did not protect people, but they did create debate around EMR and cultural attitudes towards it.

Figure 3. Examples of CD: a) EMR Probes [Dunne and Raby, 2002]; b) Slogan Bench [Gaver, 2002]; c) Datacatchers [Gaver et al, 2016].

In our analysis of examples, we view the Presence Project as a turning point for CD. The Interaction Research Studio at the Royal College of Art's work on Presence shows a transition towards design research. The group's designs featured technological components, both in early projects like the Slogan Bench (Figure 3b) [Gaver et al, 2001] and continuing to recent work like Datacatchers (Figure 3c) [Gaver et al, 2016]. The Presence Project showed how design research can reject a scientific approach and still be systematic. This is consistent with later publications that described the aims and premises of CD as aesthetic accountability rather than as scientific [Dunne and Raby, 2001; 2013; Blythe, 2014].

Dunne's research explorations often took the form of concepts provoking thought about where scientific advances might lead society. This work developed a powerful advocate in Paola Antonelli, the design curator of New York's Museum of Modern Art. The exhibition Design and the Elastic Mind at MoMa brought CD to the attention of the art world. At this time, the methodology behind critical design also shifted. Instead of critique, it turned to the exploring various types of possible futures. Design became speculation, and its criticism was now implied rather than direct. In recent publications, Dunne and Raby have likened design to literature, aligning their CD work with the notion of design fiction [Dunne and Raby, 2013].

The Interaction Research Studio continued its work when it moved to Goldsmiths College, designing artifacts to provoke thought and debate about new futures for technology. The approach for this work followed from the Placebo project in Design Noir.

CD promotes design as a powerful force for change in the world, one that is distinctly separate from market-driven change. CD makes these arguments through design artifacts rather than philosophical discourse. It has a theoretical foundation, as Dunne's PhD thesis clearly shows [Dunne, 1999].

Bardzell and Bardzell [2013] recently noted a problem with CD in the relationship between designing and discourse. They argue that the criticality of CD lies more in the discourse than in the design artifacts produced. Without the artifacts, critical design would not exist; however, a reliance on writing keeps the approach going and growing. Unlike art, whose artifacts function as vehicles for thinking, CD has become well known for its attitude, published papers, and presentations within academic and scholarly settings.

CD brought practices from art and the humanities into design, and produced a discourse centered around design artifacts. This approach stands in opposition to commercial design practice. CD and CDR treat the integration of social science and engineering differently in their approaches to work (see [Bernabi and Power, 2016] for one exposition of CD). CD artifacts are often built with an avant-gardist aesthetic to set them apart from commercial products, which gives this form of research an implicit, political critique. References are used in CD to build up designs, rather than to evaluate them critically or to contextualize the designs systematically.

We believe that CD research would benefit from further documentation and from more discussion of its unspoken assumptions and their implications to design research, and by extension, design education. We believe that the main differences between pragmatic CDR and CD lie in these assumptions. CDR appears more open and flexible in its assumptions than CD, which rejects science and prioritizes artistic expression. In doing so, it reduces the many alternatives for seeing design as a source of knowledge. For example, it devalues interpretive social science in design, while we see it in the lab and field genres. Finally, CD prioritizes the

avant-garde aesthetic at the cost of more contemporary alternatives. Most of these limitations are not logical necessities, but instead seem to be more historical traditions of CD.

Strengths and weaknesses of Constructive Design Research

Since its inception, CDR has been legitimized as a type of research that is just as valuable but different than technical or human science research. CDR is different than research in technical fields or the human sciences because it is a type of activity that designers do naturally, and includes activities like making judgments or reframing problems and problematic situations. There is a strong connection to relevance as a quality with which to evaluate the research (other criteria include process, invention, and extensibility) [Zimmerman, Forlizzi, and Evenson, 2007]. As CDR has been legitimized, it has also becomes more accessible and even attractive to students and practitioners, beyond those in the design research community.

However, CDR is not without weaknesses. There is currently a range of strong and weak CDR efforts in the community worldwide. Additionally, CDR is often confused with design research in commercial practice. In fact, it is can be hard for anyone to distinguish if CDR is design research or design practice. This is partially due to the fact that knowledge outcomes from CDR are often recognized after the work is complete. Collectively, these weaknesses can lead to problems seeking research funding, which also stagnates the development of the field.

Additionally, there is a need to develop more criteria for the evaluation of CDR processes, outcomes, and contributions, and to develop means for disseminating and sharing this knowledge in the larger design community. In discussing how CDR produces knowledge, researchers note that CDR researchers too rarely build on the nascent theory produced by other CDR researchers, and that this might limit the impact of CDR over time [Zimmerman et al., 2010]. This will help to build evidence that the insights generated by CDR projects can be generalized, replicated and extended and made use of design practitioners developing products, services and systems in the industrial sector.

Strengths and weaknesses of Critical Design

The brand and cachet of CD is alluring, especially to those who are new to design research. CD connects to roots in art and in design thinking. CD’s demand for high aesthetic quality of artifacts also works as a strength; this makes outputs of CD easy to differentiate from design practice, something that cannot be said for CDR.

CD suffers by not clearly articulating the kind of knowledge it produces, and how this knowledge matters to anyone other than other CD researchers. Often, the outcomes of CD offer few connections to the larger design research and practice communities. This is partly because there is no consistent means of documenting these types of projects (although [Gaver and Bowers, 2012] offers a starting point), and partly because CD works more like art in its tendency to keep its references hidden. CD produces knowledge through sensitizing concepts and innovative methods; however, it is not always clear how other designers can take up and advance this knowledge. Finally, CD is at odds with any type of design that works towards social innovation, because it focuses on the designed artifact as an expression of the designer, rather than attempting to address the needs of other stakeholders.

Time to Divorce?

We feel the time has come to ask for a divorce between pragmatic CDR and CD. Conflict is counterproductive for any research community. Developing two sets of objectives, goals, and knowledge outcomes for each approach should reduce the number of inappropriately rejected papers, resulting in both more research output and in better quality research. A separation between these two different ways of making things to produce different design knowledge will allow each to grow and develop their own knowledge outcomes, standards for evaluation, and outstanding research contributions.

However, we do not see these approaches as being exclusive. Instead, we propose to place them on a continuum, to illustrate that any singular research effort can include aspects of both approaches (Figure 4). Most research falls near the ends of either poll, but some projects fall more squarely in the middle, working to critique the current state of the world and offer a pragmatic vision of preferred futures.

Similarities and Points of Conflict Between pragmatic CDR and CD

While CD and pragmatic CDR draw from different traditions, work with different intentions, and produce different kinds of artifacts, they share an overlap in much of the kinds of knowledge they produce and in the underlying structures that lead to better quality research. It is the ideology and purpose that differentiates the two approaches, and therefore, how design and research processes unfold within each. One research approach may follow the other, or they may be undertaken concurrently. For example, the work from TU/e mentioned in the CDR section [Wensveen, Overbeeke, and Djajadiningrat, 2002] started with probes, then ended with lab studies. The Datacatchers project started as a critical design effort, but ended with a systematic evaluation [Gaver et al, 2016]. We see Odom's work on the PhotoBox, investigating slow technology and interaction with people's growing collections of virtual possessions, as an example of work that unites these two distinct perspectives [Odom et al, 2014].

Pragmatic CDR and CD both produce knowledge in the form of the resulting artifact [Cross, 2001]. Knowledge in this form can be particularly valuable in transferring ideas to practice as design practitioners most often share knowledge with each other and teach through a discussion of exemplars. Early HCI research noted that the thing must proceed the theory of the thing, such as the mouse arriving before the usability research showing that it functioned as a great pointing device [Carroll and Kellogg, 1989].

Recent CDR research has discussed many different ways of formalizing this artifact knowledge. Researchers have discussed analyzing artifacts within a program using frameworks [Zimmerman and Forlizzi, 2014], design patterns [Zimmerman, 2009] and strong concepts [Höök and Löwgren, 2012] that rise above the details of patterns and function more as intermediary themes. More recent work by Dalsgaard and Dindler [2014] introduce the idea of bridging concepts that build on observations of new interaction techniques that emerge across several designs both within and outside of a research team's portfolio. These are different from design patterns in that they are linked by an underlying behavioral theory, which brings different interactions together.

Additionally, work by Brandt and Binder [2007] discusses the importance of a research program. This is a larger project that encompasses individual design cases and design experiments. A program works well when it links findings and insights from cases and experiments. A program

forms a larger argument and connects the research being done to larger questions or concern within a research community.

In its part, CD has seen debate as a key mechanism for extracting knowledge out of projects. This notion came originally from Dunne and Raby [2001], who encouraged designers to point out alternative ways of seeing things and found its clearest formulation in the Material Beliefs project [Beaver et al., 2009]. Some recent work leverages long-term field studies and brings CD closer to fieldwork in CDR [Odom et al. 2014]. Other work has created a bridge by discussing how design researchers might document a research program in the form of an annotated portfolio [Gaver and Bowers, 2012]. The structure that a program provides benefits both pragmatic CDR and CD research by creating environments where tacit knowledge learned in a specific design case has the opportunity to become more explicit in future cases.

Points of Conflict

Design researchers working in pragmatic CDR and CD increasingly seem to find themselves caught up in non-productive issues in advancing their work. These issues include impact and peer review of new research, efforts to formalize research approaches and establish research priorities, and efforts to obtain funding.

Some pragmatic CDR researchers complain their work lacks the impact they desire. They note that the engineering and behavioral science researchers in the HCI community almost never build on the knowledge CDR researchers produce. Impact can also be hindered through the peer review of design research publications [Zimmerman et al, 2010; Gaver, 2017]. Too much of the discussion on what it is that makes a good CDR or CD contribution takes place in private, and this make the review process feel random and arbitrary. Advances in the field that take place in the actions of individual reviewers or in the private discussions of program committees where academic papers are accepted or rejected are generally not shared with the larger design research community. A recent article bemoaning the lack of “real design papers” at CHI, an HCI conference that has given rise to much CDR activity, points to a potentially unintended outcome of this conflict [Gaver and Höök, 2017].

Pragmatic CDR has created a set of quality criteria to guide the design research community in formalizing what constitutes a good CDR project [Zimmerman, Stolterman, and Forlizzi, 2010]. The goal is to create high-quality contributions that are on par with the best contributions from other research traditions, thus legitimizing design research beyond the discipline of design. Other work has set forth criteria that describe a high-quality pragmatic CDR contribution, including process, invention, relevance, and extensibility [Zimmerman, Forlizzi and Evenson, 2007].

These criteria can be used by others in planning and executing their own CDR efforts to guide them in creating quality contributions. However, these are not meant to be applied to CD cases, which puts premium on novel perspectives rather than findings. It is clear that the criteria developed to describe a good pragmatic CDR contribution do not fit CD. While process and relevance may be viable criteria for both pragmatic CDR and CD, concepts and artifacts developed in CD are rarely meant to be generalizable. Rather, they are like pieces of conceptual art – meant to expose unconsidered assumptions and ideological commitments in existing practices.

Finally, when applying for grants from government agencies or from industry, design research is often met with some suspicion in terms of the methodology, with concerns that the insights gained will not generalize or scale to larger populations. In trying to address these challenges to make the work more impactful and fundable, some pragmatic CDR researchers have pushed for increased rigor, increased relevance, and the development of theory as an outcome of CDR [Zimmerman, Forlizzi and Evenson, 2007; Zimmerman, Stolterman, and Forlizzi, 2010]. Not surprisingly, some CD researchers have pushed back. They note that applying a scientific lens to CDR research will diminish the breadth of design research. They resist the creation of any "official" standards for evaluating CDR research, even though they note the lack of evaluation standards may be the cause of substandard research, and naïve design, being published.

Discussion

We have described the origins, practices, goals, and knowledge outcomes of two types of constructive design research that are currently locked in a non-productive conflict. We believe that now is the time for the broader design research community to divorce the practices and knowledge outcomes of pragmatic CDR and CD. We see three main activities in this effort: 1) developing "individual brands" for CD and pragmatic CDR; 2) increasing the quality of these efforts without narrowing the space of investigation; and 3) developing approaches to teach about DR in both professional and academic settings.

With minor efforts, the design community can develop a distinct brand for individual forms of constructive design research. For example, CD could be branded in a way that anchors it in design and makes it distinct from art, maybe by building on Dunne and Raby's repeated efforts to draw this line [see Dunne, 2007]. Pragmatic CDR could be branded in a way that makes it distinct from design practice. The design research community should always strive to increase the quality of its efforts without narrowing the space of investigation. Much could be accomplished with some simple efforts such as documenting investigations in detail, better articulating aspects of the process that in hindsight were found to be critical to the progression of the research, and being aware of and using others' design theories and frameworks when available. These activities are also important when designing things that do not yet exist, when there is little understanding of how future products, services, systems, and environments will situate in the world, and for larger societal problems, which may have many alternate solutions.

A final effort is for the design research community to develop approaches for teaching novice researchers about CD and pragmatic CDR, the strengths and weaknesses of each approach, and when and how to apply each in a research setting. In both CD and CDR, the goal is to grow the research approach and to extend the boundaries of academic design research to new efforts and contexts. The field needs the diversity of many approaches, and this divorce will help our community grow and become more impactful.

Conclusion

Through history, influence, and approach, pragmatic CDR and CD have grown into separate, unique constructive design research approaches. Our goal in this paper, through examining the history, practice, goals, knowledge outcomes, and strengths and weaknesses of each approach, is to increase awareness and influence of all design research contributions. We call for a divorce of pragmatic CDR and CD. We hope that in the future, CD and CDR will be as commonly known and as viable as other historic movements in our discipline.

References

Bardzell, J., & Bardzell, S. (2013, April). What is critical about critical design?. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 3297-3306). ACM.

Beaver, J., Kerridge, T., & Pennington, S. (Eds.), (2009). Material beliefs. London: Goldsmiths, Interaction Research Studio. □materialbeliefs.com/□. Retrieved 05.03.2010.

Bernabei, R., & Power, J. (2016, July). Living Designs. In Conference on Biomimetic and Biohybrid Systems (pp. 40-47). Springer International Publishing.

Blythe, M. (2014, April). Research through design fiction: narrative in real and imaginary abstracts. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 703-712). ACM.

Brandt, E., & Binder, T. (2007). Experimental design research: genealogy, intervention, argument. International Association of Societies of Design Research, Hong Kong.

Branzi, A. (2010). Design come profesione di massa [Design as a mass profession]. In L. di Lucchio & A. Penati (Eds.), Vitamins for design (Vol. 7, Iss. 42-43, pp. 32-43). Rome, Italy: Disegno industriale.

Cross, N. (2006). Designerly Ways of Knowing (pp. 1-13). Springer London.

Dalsgaard, P., & Dindler, C. (2014, April). Between theory and practice: bridging concepts in HCI research. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 1635-1644). ACM.

Davidoff, S., Ziebart, B. D., Zimmerman, J., & Dey, A. K. (2011, May). Learning patterns of pick-ups and drop-offs to support busy family coordination. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 1175-1184). ACM.

Davidoff, S., Lee, M. K., Yiu, C., Zimmerman, J., & Dey, A. K. (2006, September). Principles of smart home control. In International Conference on Ubiquitous Computing (pp. 19-34). Springer Berlin Heidelberg.

Dorst, K. (2011). The core of 'design thinking' and its application. Design studies, 32(6), 521-532.

Dunne, A. (2008). Hertzian tales: Electronic products, aesthetic experience, and critical design.

Dunne, A. (2007). Frequently asked questions. Design Interactions Yearbook 2007. London: Royal College of Art.

Dunne, A. (1999). Hertzian tales. PhD Thesis, Royal College of Art.

Dunne, A., & Raby, F. (2013). Speculative everything: design, fiction, and social dreaming. MIT Press.

Dunne, A., & Raby, F. (2002). Placebo. http://www.nomads.usp.br/pesquisas/design/objetos_interativos/arquivos/restrito/DUNNE_the%20placebo%20project.pdf, accessed January, 2017.

Dunne, A., & Raby, F. (2001). Design noir: The secret life of electronic objects. Springer Science & Business Media.

Gaver, W. (2012, May). What should we expect from research through design?. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 937-946). ACM.

Gaver, B., & Bowers, J. (2012). Annotated portfolios. interactions, 19(4), 40-49.

Gaver, W., Boucher, A., Jarvis, N., Cameron, D., Hauenstein, M., Pennington, S., Bowers, J., Pike, J., Beitra, R., and Ovalle, L. (2016). The Datacatcher: Batch Deployment and Documentation of 130 Location-Aware, Mobile Devices That Put Sociopolitically Relevant Big Data in People's Hands. Proceedings of CHI16. New York, NY: ACM Press, 1597-1607.

Gaver, B., & Höök, K. (2017). In search of the elusive CHI design paper. interactions, 24(2), 22-23.

Gaver, W. H., Hooker, B., Dunne, A., and Farringdon, P. (2001). The Presence Project. London, UK: RCA CRD Projects Series.

Hassenzahl, M., Eckoldt, K., Diefenbach, S., Laschke, M., Lenz, E., & Kim, J. (2013). Designing moments of meaning and pleasure. Experience design and happiness. International Journal of Design, 7(3), 21-31.

Höök, K., & Löwgren, J. (2012). Strong concepts: Intermediate-level knowledge in interaction design research. ACM Transactions on Computer-Human Interaction (TOCHI), 19(3), 23.

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

Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2011). Design research through practice: From the lab, field, and showroom. Elsevier.

Odom, W. T., Sellen, A. J., Banks, R., Kirk, D. S., Regan, T., Selby, M., ... & Zimmerman, J. (2014, April). Designing for slowness, anticipation and re-visitation: a long term field study of the photobox. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 1961-1970). ACM.

Odom, W., Zimmerman, J., Davidoff, S., Forlizzi, J., Dey, A. K., & Lee, M. K. (2012, June). A fieldwork of the future with user enactments. In Proceedings of the Designing Interactive Systems Conference (pp. 338-347). ACM.

Rittel, H. W., & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy sciences, 4(2), 155-169.

Ross, P. R., & Wensveen, S. A. (2010). Designing behavior in interaction: Using aesthetic experience as a mechanism for design. International Journal of Design, 4(2).

Schon, D. A. (1984). The reflective practitioner: How professionals think in action (Vol. 5126). Basic books.

Simon, H. A. (1969). The Sciences of the Artificial. Cambridge, MA.

Wensveen, S., Overbeeke, K., & Djajadiningrat, T. (2002, June). Push me, shove me and I show you how you feel: recognising mood from emotionally rich interaction. In Proceedings of the 4th conference on Designing interactive systems: processes, practices, methods, and techniques (pp. 335-340). ACM.

Zimmerman, J. (2009, April). Designing for the self: making products that help people become the person they desire to be. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 395-404). ACM.

Zimmerman, J. and Forlizzi, J. (2014). Research through Design in HCI. In J.S. Olson and W.A. Kellogg, eds. Ways of Knowing in HCI (Vol. 2). New York, NY: Springer.

Zimmerman, J., Stolterman, E., & Forlizzi, J. (2010, August). An analysis and critique of Research through Design: towards a formalization of a research approach. In Proceedings of the 8th ACM Conference on Designing Interactive Systems (pp. 310-319). ACM.

Zimmerman, J., Forlizzi, J., & Evenson, S. (2007, April). Research through design as a method for interaction design research in HCI. In Proceedings of the SIGCHI conference on Human factors in computing systems (pp. 493-502). ACM.

Author Biographies

Jodi Forlizzi

Jodi Forlizzi is a Professor of Human-Computer Interaction in the School of Computer Science at Carnegie Mellon University and a Co-founder of Pratter.us, a healthcare startup. She designs and researches systems ranging from peripheral displays to social and assistive robots. Her current research interests include designing educational games that are engaging and effective, designing services that adapt to people’s needs, and designing for healthcare.

Ilpo Koskinen

Ilpo Koskinen has been working as a professor in industrial design since 1999 mostly in Helsinki, but also in Denmark, Australia, and Hong Kong. His main research interests have been mobile multimedia, design in cities, and the methodology of design research. His recent work expands his earlier work on constructive design research into social design. His mission is to expand design by making research that communicates to designers.

Paul Hekkert

Paul Hekkert is full Professor of Form Theory at Delft University of Technology. Paul conducts research on the ways products impact human experience and behavior, and leads the international project UMA (Unified Model of Aesthetics). He is co-editor of Product experience (2008) and published Vision in Design: A guidebook for innovators (2011), a book that describes an approach to design and innovation. Paul is co-founder and chairman of the Design and Emotion society and captain of science of the Dutch Top Sector for the Creative Industries.

John Zimmerman

John Zimmerman is a Professor of Human-Computer Interaction in the School of Computer Science at Carnegie Mellon University. He teaches courses on interaction design, service design, HCI, and innovation. His research investigates four areas: (i) interaction with intelligent systems, (ii) service innovation, (iii) crossing the digital-physical divide, and (iv) research through design as a scholarly approach to inquiry.