

Aspects of Research through Design

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Abstract

Research through design is, by nature, embedded in the design process. In other words, while its main concern is to inform a research question, it also must be concerned with the end product of the design. As such, designers/researchers become concerned with the same type of “wicked problems” the professional designers are, especially when using research through design. Moreover, they also add a new layer of complexity that is inherent to research. Since the approach is quickly gaining in popularity, it is necessary to develop a base of knowledge about it. Thus, this paper’s aim is to present a review of texts about research through design to demystify this approach and provide a deeper understanding for future work in the field. The gathered views on the subject are then classified into one of five sets of aspects: ontological aspects, epistemological aspects, expected contributions, methodological aspects, and limits.

Keywords

Research through design, methodology, design

Research through design (RtD) is an approach to scientific inquiry that takes advantage of the unique insights gained through design practice to provide a better understanding of complex and future-oriented issues in the design field. RtD is not a new approach. The term itself is two decades old (Frayling, 1993). In recent years, it has mainly been used and discussed in the human-computer interaction field (HCI), where it helped scientists and engineers to accept that design research approaches can provide novel, valid, and relevant input within the field of HCI. Today, RtD is an increasingly recognized approach to research in any design discipline. The approach acknowledges and embraces professional practice’s contributions to knowledge making it especially attractive in disciplines where designers/researchers are still practicing. This paper will voluntarily explore publication from different disciplines and aimed at audiences in an attempt to reconcile, albeit at a higher level, the basis of RtD across the design fields. Before going any further, we believe it necessary to situate “research through design” within the academic discussion of research and design. In other words, understanding how RtD relates to other types of design research.

Context of the present paper

From Frayling Onwards

Sir Christopher John Frayling is an important figure of art and design education of our time. He was mainly interested in film studies and held important positions in more than one British College dedicated to art and design.

Amongst his influential writings, Frayling introduced, in the Royal College of Art Research Papers (1993), the idea of three different forms of interactions between research and design or art: research *for* art and design, research *into* art and design, research *through* art and design.

Spawned from his reflections, the many different combinations of research and design have been discussed by many different authors. Amongst them, Alain Findeli, then professor at Université de Montréal, redefined the three forms of design research as follows (2004):

- **“Research for design”** aims at helping, guiding and developing design practice. Those researches document the processes and concerns of professional designers and treat designers and their practice as the object of their study.
- **“Research into design”** is mainly found in universities and research centres contributing to a scientific discipline studying design. It documents objects, phenomena and history of design.
- **“Research through design”** is the closest to the actual design practice, recasting the design aspect of creation as research. Designer/researchers who use RtD actually create new products, experimenting with new materials, processes, etc.

Findeli’s proposition was significant because it formalized the academic merit of RtD. This definition is often cited in literature and is the foundation for much work in the field. Consequently, it is adopted for the purposes of this research paper.

The Problem with RtD

Where “research for design” and “research into design” rely strongly on the research traditions of other disciplines and, as such, promptly create consensus, “research through design” is still debated and discussed since “no agreed upon research model existed for [...] designers to make research contributions other than the development and evaluation of new design methods” (Zimmerman, Forlizzi, & Evenson, 2007, p. 493). This situation makes it harder for designers/researchers to thoroughly understand the current state of the approach through the ramification of publications. Therefore, an aggregation of the different views is needed.

The Many Faces of Research through Design

Some authors (amongst others: Chow, 2010; Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011) wrote papers or books introducing new approaches or comparing RtD with other similar types of research, namely: *constructive design research*, *practice-led research* and *project-grounded research*. Although the authors make good points in distinguishing them, they share their most basic considerations and views towards practice and knowledge.

Even within those papers using the term “research through design”, there is a lack of consensus on how it should be discussed and what issues need to be explored. For example, the works of Wolfgang Jonas on “Research through DESIGN through research” (2006, 2007b) addresses issues, approaches and audiences that have little to do with the work discussed by Zimmerman (2007, 2010), Bowers (2012) or Koskinen et al. (2011). In fact one might notice that Jonas does not cite publications from these other authors (and vice versa). Nevertheless, Jonas talks of “a generic structure of learning / designing, which has been derived from practice” (2006, p. 7) while Koskinen et al. write about research in which “construction [...] takes center place and becomes the key means in constructing knowledge” (2011, p. 5). Bowers goes by Frayling’s claim that the artefacts embody the design thinking (although he remarks that “this thinking is typically of a very varied, multi-faceted, heterogeneous sort” (2012, p. 70). As for Zimmerman, he described RtD as the “process of iteratively designing artifacts as a creative way of investigating what a potential future might be” (2010, p. 312).

In their own ways, these authors are all concerned with an underlying shared goal: establishing aspects of research done through the design process and its resulting product. In fact, we found, as it will be discussed in this paper, no vital contradiction between the authors’ claims. Since our goal here is to federate views and conclusions on all fundamental aspects of RtD, it is natural to consider all these publications together and on levelled grounds.

Hence, all these slightly different approaches will be used under one and the same appellation in this paper: ‘research through design’.

Methodology

To fulfil this objective, a literature review was done.

First, a general research was conducted through publication databases searches. Then, the articles and books were analysed to extract information about different aspects of RtD.

Initial selection of articles and books

A series of databases were used to gather publications discussing RtD.

Table 1 shows the keywords entered and the databases used; the number of returned articles and books appears at their intersection of the line and column, and the number of articles and books *kept* for the current research appears at the bottom of the column.

The keywords used are both English and French and were searched as part of the ‘title’, ‘subject’ and ‘keyword’. The use of hyphens did not change the results of the searches; for example, a search for “research through design” returned the same array of publications as a search for “research-through-design”.

The publications were then filtered by three inclusion criteria:

- The publication must discuss RtD (or any of its other name) as their main subject, excluding a lot of publications on research using RtD;
- The publication must be concerned with design;
- The publication must be in French or English.

It should also be noted that the French keywords brought up many publications that were rejected. This can be attributed to the relative prevalence of each of the words used. For example, “recherche projet” brings up many results that were *research projects*, in the broadest sense of the term.

After the filter and removal of duplicates, we added other readings to complement the content of each publication kept, either taking from their references or from the discussed subject (such as epistemological criteria of action research and grounded theory).

Table 1: Databases, keywords and results

Databases	Research through design	Constructive design research	Practice-led research	Project-grounded research	Research by design	Recherche par projet	Recherche-projet
Business Source Premier (EBSCO)	0	0	9	0	650	2	1
CPI.Q (Gale)	0	1	4	0	2536	0	713
Current Contents Connect (ISI)	8	0	14	0	6	0	0
Erudit	1	0	0	2	484	0	247
FRANCIS (ProQuest)	0	0	1	0	0	0	5
Primo Central (Ex Libris)	316	10	271	7	0	247	109
Web of Science (ISI)	24	0	20	1	21	0	0
TOTAL KEPT	10	2	7	1	11	2	2

Extraction of information

The analysis of the selected publications led to information on different aspects of RtD. The following particular subjects were present in the literature and were selected as pertinent categories for organizing and providing a framework for the literature review.

- **Ontological aspects:** what is the “nature of reality” (Creswell, 2003, p. 21)? What reality can be perceived using RtD?

- **Epistemological aspect:** what makes an observation valid? “How we know what we know” (Creswell, 2003, p. 21)?
- **Expected contributions:** what type of results can be expected from RtD? What kind of help can RtD contribute to knowledge, practice or other disciplines?
- **Methodological aspect:** what “process of research” (Creswell, 2003, p. 21) is associated with RtD?
- **Limits:** what issues commonly come up in RtD and what can’t it do?

Aspects of Research through Design

This literature review examined a relatively low number of articles and books. Hence, certain authors appear frequently in this text. Their contributions have however been distributed in the different aspects to provide a clear overview of RtD from each angle.

Ontological Aspects

Every research approach has its specific strengths and weaknesses (Creswell, 2003). These strength and weaknesses are often derived from the ontological standpoint of the approach, in other words: what is the nature of reality that can be perceived through this approach. In this section we will discuss the reality observed through the construction of designed artefacts.

Adaptation: towards a concern of the real

Research in design is not concerned with the “true”, but with the “real”. Wolfgang Jonas (2006) proposed a model of knowing in design inquiry that provides insights on how designers actually transition their focus from the true to the real. In the model, Jonas sets three steps:

1. **Analysis:** how things *are* currently (the truth);
2. **Projection:** how things *could be* (the ideal); and
3. **Synthesis:** how things *will be* (the real).

Where design could be perceived as following the processual steps of evolution (variation – selection – re-stabilization), the theory of autopoiesis proposes that a transformation is “the result of internally generated change” (Jonas, 2007b, p. 1366). Adaptation and selection are not triggered by outside forces but by the “co-evolution of independent systems” (Jonas, 2007b, p. 1367). The co-existence and interaction of the independent systems better define the role of each of them (Morgan, 1986, cited by Jonas, 2007b). This facilitates change towards a more significant and/or efficient accomplishment of the role. In other words, the adaptation, created by the design, is a change of states, towards a preferred one in which the role of the designed artefact will be more significantly or efficiently fulfilled.

This statement applies to other levels of reflection as well:

- First, contributions of RtD, as design theories, should, in themselves, spawn from the co-evolution of design practice and design research and lead towards a better fulfilment of their respective roles.
- Then, the design-research relationship set in place by the RtD approach must also be understood from the above statement. In the case of RtD, “research is guided through design process logic and design is supported/driven by phases of scientific research and inquiry” (Jonas, 2007b, p. 1378).

The Real that *Will Be*

Knowing that design provides adaptation to individual systems, we can better understand that “changing existing situations into preferred ones” (Simon, 1996, p. 111) or “improving ‘quality of life’” (Jonas, 2007b, p. 1363) is intrinsic to both the research objectives and the design goals of RtD.

Consequently, it “provides an opportunity for the research community to engage in discourse on what the preferred state might be” (Zimmerman, Stolterman, & Forlizzi, 2010, p. 310), bringing the ethical consideration of creation and design to the forefront. This is a fundamental aspect of the critical design approach that produces, often by using RtD, artefacts “that encourage complex and meaningful reflection on inhabitation of a ubiquitous, dematerializing, and intelligent environment” (Dunne, 2006, p. 147, cited by Bardzell et al., 2012, p. 288).

The “real” by which RtD is concerned therefore transcends inquiries to describe ‘how something is’ and focuses on ‘how it *will be*’ as well as ‘what this future preferred state should be’.

Epistemological Aspects

Building on our clearer understanding of the reality perceptible to RtD, we can now establish what we can learn from this reality and how.

Jonas (2007a) suggests that we turn to grounded theory and action research for inspiration on the epistemological aspects of design through research.

The following paragraphs will cover literature concerned with the learning and validity aspects of RtD.

How Do We Learn in RtD?

Using Schön and Wilke’s works, Wolfgang Jonas writes:

‘Design through research’ assumes that ‘exclusively scientific research is unable fully to recognise the implications of acting in a space of imagination and projection. The ‘knowledge base position’ needs to be complemented by the ‘unknowledge base position’ or by the competencies to deal with not-knowing (2007a, p. 202).

This competency resides in the design process which provides unequalled insight into the future: the real that ‘will be’.

This is why the RtD approach requires the researcher to also be a practitioner; because “knowledge of design allows the interpretation of research information in context” (Hanington, 2003, p. 17).

To do this, RtD favours a constant realignment of the construction of artefacts, based on trial and error, to better tackle complex design problems (Toeters, ten Bhömer, Bottenberg, Tomico, & Brinks, 2013).

The advantages of researching, or learning, through construction is also discussed in education. Constructionism, an instructional method promoted by Seymour Papert (1983), sets the learner (in Papert’s discussion: a child) in a dialog with its environment and with the construction. Papert goes as far as calling this, very appropriately, “learning by design” (Papert, 1983, cited by Lebrun, 2002, p. 28). This perspective on learning is also applicable to RtD; in which researchers learn about the object of their inquiry through the constant evolution of the artefact, i.e. it “allows for creating a dialog with the material” (Toeters et al., 2013, p. 116).

This dialog and constant realignment, however, generates issues in insuring validity in its results. A proper structuration of the trial and error process, possibly based on the traditional scientific method (Gauch, 2003), using hypothesis, prediction, controlled experiments and

analysis cycle, could help solve this issue. This idea is, however, not supported by any literature found at the moment.

Besteliu and Doevendans (2001) also support this position, writing that knowledge is produced in the construction and, also, through the use of the product “as the knowledge generated through the design process itself and as knowledge codified in the designed product as it is built and used over time” (p. 45). This suggests that the research does not have to be confined to the construction of the product but can be expanded, and perhaps validated, by the study of the designed product’s users.

Validation Insights from Action Research

Action research and research through design are sometimes compared because of their fundamental similarities (Papas, O’Keefe, & Seltsikas, 2012). Much like for action research, validity in RtD cannot be evaluated by the reproducibility of the results since “[t]here can be no expectations that two designers given the same problem, or even given the same problem framing, will produce identical or even similar artefacts” (Zimmerman et al., 2007, p. 499).

Action research has its own validity criterion to make-up for replicability: *recoverability*. This means that the designer/researcher must make sure that “the process is recoverable by anyone interested in subjecting the research to critical scrutiny” (McNiff, 2013, p. 18).

In a compatible mindset, Michael A. R. Biggs and Daniela Büchler propose that “rigor in research is the strength of the chain of reasoning, and that has to be judged in the context of the question and the answer” (2007, p. 69). Therefore, if one would recover the RtD *process* and judge its chain of reasoning strong, then the process would be considered rigorous.

Now, rigor and validity may not be the same, but they are directly linked. Indeed, argue Biggs and Büchler, “[w]e say the process was rigorous, and therefore validates the claims of the outcome” (2007, p. 67). This would mean that a rigorous process leads to valid outcomes and therefore recovering the process and establishing its rigor would lead to granting validity to the outcomes of the research.

Owain Pedgley (2007) provides a list of best practice that could help ensure recoverability of the project. These best practices should then be used in RtD (all from Pedgley, 2007, p. 473).

- **Chronology:** “Describe work in the same sequence that it occurred, ideally as bullet-points”;
- **Clarity:** “Keep entries intelligible, insightful and honest”;
- **Focus:** “Keep entries succinct: they should not be a crafted essay”;
- **Record images:** “Record still and moving images of developing and completed physical models”;
- **Out of hours:** “Account for instances of ‘out of hours’ designing in the next day’s diary”;
- **Diary admin:** “Ensure that all diary sheets are numbered and dated”;
- **Modelling admin:** “Ensure that all modelling outputs are numbered and dated to aid cross-referencing (e.g. ‘LB1:22’ refers to log book 1, page 22)”.

Validation Insights from Grounded Theory

Contrarily to action research that puts the burden of validity on anyone who would challenge it, grounded theory prefers to keep the responsibility of demonstrating validity on the researcher. Although “grounded theory was developed to provide a basis for predicting cause and effect relationships within the postpositivist paradigm” (Hall & Callery, 2001, p. 257), Bryant’s repositioned grounded theory, which is ontologically similar to research through design in that it considers reality as multiple and subject to redefinition, states that a rendering of an experiment

is “a *representation* of experience, not a replication of it” (2007, p. 51, emphasis from original text).

The weight of validity, then, falls back onto the researcher’s ability to use what is being observed: theoretical sensitivity.

Theoretical sensitivity is defined as “the investigator’s ability to use personal and professional experiences and the literature to see the research situation and data in new ways and exploit the potential of the data for developing theory (Strauss & Corbin, 1990, cited by Hall & Callery, 2001, p. 263) and should be demonstrated in a RtD publication or report.

Validation Insights from Design

Finally, Findeli suggest the simplest yet most elegant validity criterion of RtD: the designer/researcher is using the project as her or his field for data collection and the validity of the choice of this field comes with the success of the design project (Findeli, 2003 cited by Cournoyer, 2011). Simply put: in accord with Biggs and Bütchler’s proposition that the rigor of the process validates the outcome (2007), if the project works and the artefact produced is acceptable, then knowledge produced through the process is also valid.

Expected Contributions

Having established that RtD deal with the reality that ‘will be’ and that we learn from it through the dialog and constant realignment of the project, the designer/researcher must now determine what exactly she or he wants to know by the means of her or his specific RtD.

Nigel Cross (1999, p. 6) proposed that design research falls into one of three main categories:

- “Design epistemology – study of designerly ways of knowing”
- “Design praxiology – study of the practices and processes of design”
- “Design phenomenology – study of the form and configuration of artefacts”

Although Cross does not discuss which of these categories is possible through each of the types of design research as described by Findeli (2004), design praxiology is the most discussed in RtD literature.

Floet (2001) also argues that “[l]earning to design has two components: practicing the ‘techniques’ of design on the one hand and the development of ‘an attitude’ to designing on the other hand” (p. 360), effectively suggesting that knowledge gained through practice can be of both technical and affective natures.

Reflexive Practice, a Design Praxiology Framework

As suggested by a number of authors (amongst others: Nimkulrat, 2012; Zimmerman et al., 2007), Schön’s works on reflexive practice (Schön, 1983) can improve design methodology. According to Schön, there are many different contributions that can spawn from reflexive practice’s professional knowledge constants (described below, as synthesised by Chiapello (2012, p. 73)). Here is a list of these possible contributions, arranged by constants:

- **Means:** Tools that can be used by the practitioner to articulate his thoughts;
- **Language:** Means of communications (oral or not) and terms used by a professional community;
- **Repertoire:** Inspirational solutions and experiments that were either performed by the practitioner or that are known to her or him;
- **Appreciative system:** System of values or criteria by which the practitioner judges a solution or work accomplished;
- **Global theories:** Theory that can guide the practitioner in her or his actions, reflection or understanding of a situation;

- **Role:** The role a practitioner sees herself or himself as occupying in a project and which has an influence on the type of solutions or scope of action she or he is allowed to take. Reflexive action can also occur in two different timeframes (Schön, 1983). Reflection-in-action happens during practice, for example, when a decision or an action is made and relies more heavily on tacit (non-explicit) knowledge. Reflection-on-action happens later, as the practitioner thinks about what she or he has done or decided.

Evaluating Contributions

Discussing interaction design specifically, Zimmerman and his collaborators, propose a set of four criteria to evaluate the contribution of a research (2007, pp. 499-500):

- **Process:** The research contributes to the “rigor applied to the methods and the rationale for the selection of specific methods”;
- **Invention:** The research situates its contributions in the current state of knowledge and provides “significant advancement”;
- **Relevance:** The research contributions lead to, or support, a preferred state of the world. Also, the research must explain why the state is preferred.
- **Extensibility:** The research contribution must be usable as a basis for new research, i.e. it must be “described and documented in a way that the community can leverage the knowledge derived from the work”.

Methodological Aspects

The next logical step to having established what the designer/researcher wants to know is to establish how she or he will gather the necessary data to extract that knowledge from.

In their critique of research through design, John Zimmerman and his collaborators mention that “there is a need for serious development of RtD into a proper research methodology that can produce relevant and rigorous theory” (2010, p. 316).

As described in this section, the methodological aspect of RtD has however been discussed from different angles that are coherent with the approach’s ontological and epistemological position described earlier.

The methodological aspects covered in this section cover the expected steps of the research all the way down to tools suggestions for data collection.

Flow of the Research through Design

Ditte Amund Basballe and Kim Halskov distinguish three dynamics that appear in sequence during a RtD project (2012):

- **Coupling:** The initial step that “unites research and design interests” (Basballe & Halskov, 2012, p. 65). During coupling, the basic frame and constraints of the project to serve both level of interests.
- **Interweaving:** At this point research interests and design interests influence each other and the project as processes, methods and validation are established.
- **Decoupling:** Decoupling appears at later points of the project when the designer/researcher must focus on one of the interest set (design or research). For example, decoupling appears during the production phase since it focuses on the design process, but is also appears during the final evaluation and inquiry when the research interests become the focus of the work.

From One to the Many

Having understood how the workflow will progress through the project, we must now establish *what* should be observed. Although we know that RtD takes place within a design project, we will discuss the different types of projects that could be tackled in RtD.

Bowers promotes the use of many artefacts of the same studio or designer for a RtD. This series of linked designs, once combined, constitutes what he calls a 'portfolio', which presents a set of seven interwoven features (constitution, relationship, communication, perspective, mutual informing, shaping and materiality) that can be used for analysis or any other form of research inquiry, making the portfolio an 'annotated portfolio' (Bowers, 2012, pp. 71-72).

In a somewhat opposed trail of thought, Alex Wilkie and his collaborators (2010) propose that the creation of one artefact (or maybe of a portfolio, the authors do not discuss the issue) might not need to be jealously developed far from sight. They suggest that RtD projects have "two underlying dimensions of 'looseness' and 'openness'" (Wilkie et al., 2010, p. 99).

Looseness refers to the number of outcomes targeted or allowed by the project and the designers/researchers. Openness, on the other hand, relates to how 'secret' the project is. An opened project can allow public participation, media attention, etc.

A loose project could accommodate interdisciplinary teams working on a single project, which effectively transforms the designed artefact into a boundary object (Star & Griesemer, 1989).

The DRM

Blessing and Chakrabarti's (2009) Design Research Methodology (abbreviated DRM) provides a comprehensive 4-stage plan to use design practice in research.

1. **Research clarification:** In this stage, the researcher finds other researches or publication to clarify both the investigation to perform as well as the criteria to measure the success of the design.
2. **Descriptive study I:** The first descriptive study aims at better understanding the situation as it appears in standard design practice and the problematization of the current situation.
3. **Prescriptive study:** This study is the fully-documented, knowledge-based design project (or, more often, projects). Based on the information found in the previous stages and the established criteria of success and validity, the researcher plans and conducts the projects. The objective of this study is to gather data on the research subject.
4. **Descriptive study II:** The final stage of the DRM involves a thorough investigation of the impacts of the methodology used in the prescriptive study. The main objects of this phase are (1) the evaluation design methodologies investigated in the prescriptive study are, from a design practice applicability standpoint and (2) the evaluation of the results of the prescriptive study's project, using the measurable success criteria established earlier.

Note that the DRM also distinguishes between seven types of research, based on the current state of knowledge and their goals, that uses the above phases differently and sometimes uses only the 2 or 3 first phases. It is also important to note that this approach to methodology is intended to support studies with clearly measurable outcomes, which can prove to be a problem with less empirically-based investigations.

Documentation and the Process Reflection Tool

One of the main RtD methodology concerns resides in a "more rigorous documentation of progress and evolution of RtD projects" (Zimmerman et al., 2010, p. 316). This section does not

provide a prescriptive method of documentation, but proposes some of the methods discussed in the literature.

Owain Pedgley (2007) provided key elements of a good documentation methodology:

- **Solo effort:** Since the designer/researcher will undoubtedly be alone at certain part of the project, a good method will take into consideration that documentation might be a solo effort;
- **Endurance:** documentation must be able to account for months if not years of design/research work;
- **Subject delimitation:** As not all aspects of a project can be accounted for, a focused area of data must be established as the subject to prevent data overflow;
- **Mobility:** Because the design process does not necessarily stop when the designer/researcher leaves the studio, the documentation method must be mobile.

In an attempt to minimize this type of issue, Peter Dalsgaard and Kim Halskov (2012) introduced the Process Reflection Tool (PRT), a web-based system designed specifically for documenting the design process of a project.

The tool allows designers/researchers to enter details about any event (and sub-event) in the process or take informal notes on conversation, decision or other significant step of the project. Those events and notes are organised according to their timestamp to visually show the evolution of the project.

There are some important challenges to the use of the PRT, such as the immediate capture of information, the perceived importance of entering data by the designers and some difficulty on determining what and how to document events. The authors argue, however, that the use of the tool supports better cooperation between actor of a project, invite discussions on the research agenda and help keep better records of events in long-term projects (Dalsgaard & Halskov, 2012, pp. 434-436).

In line with the looseness dimension described above, Mithra Zahedi's doctoral thesis discusses the use of multidisciplinary cooperation on RtD projects (2011). She promotes the use of triangulation in data collection (as per Van der Maren, 1996), joining observation of the designers work and interviews with them.

Limits of RtD

Even the most informed and prepared designer/researcher cannot exceed the limits or ignore the challenges of RtD. This section is probably the least internally coherent since the limits are not necessarily linked to one another. It does, however, provide a list of possible issues that should always be kept in mind while planning and executing a RtD.

The Knowledge, Not the Product

Frayling (1993) made a point to distinguish RtD from researched art or design, advocating that, in the case of researched art or design, "the goal here is art rather than the knowledge and understanding" (Frayling, 1993, p. 5).

Research through design's goal should be the knowledge and understanding, but this knowledge and this understanding result from the making of an artefact that, as stated earlier, is embodied in the artefact created or designed.

Timeframe

"It has been argued that a comprehensive understanding of design decision making cannot be formed solely from time-restricted studies and the un-naturalistic interactions that they involve"

(Dorst, 1995, cited by Pedgley, 2007, p. 467). The timeframe of the study is especially important to RtD since smaller timeframes tend to lead to less leveragability in the results. To provide useful results, then, the research project must allow for the natural unwrapping of design project to take place.

Conclusion

The aggregated views on RtD draws a coherent research philosophy ranging across many years of articles and books about the design discipline.

The reality described by RtD is the one that 'will be', the preferred state. It is one that comes naturally out of the interaction of the current state with its environment.

RtD implies creating an artefact that cannot be wholly described and that enables the designer/researcher to dialog with the situation and learn from it.

Research contributions can range across many aspects of design (including the designer, the process and the artefact itself) but design practice seems to be the main concern of designers/researchers using this approach. Reflexive practice (Schön, 1983) seems to be the most complete framework to categorise potential contributions.

RtD is very similar, *in appearance*, to a regular design project. Its goals, however, are different and the influence of the research inquiry is present at most steps of the project. Documentation of the process is a key concern for designers/researchers using this approach.

Finally, RtD can easily be defined by what it is not. First, the artefact is not the goal of RtD; knowledge and understanding is. Second, RtD is not able to provide predictability. Finally, it is riddled with issues that come with its heavy reliance on design.

Further Research

Possible further research should critically validate the portrait of RtD proposed in this paper against actual publications on performed RtD.

We also noticed that the rigor aspect of RtD is not thoroughly discussed. Questions like "could we enhance the rigor of RtD and how?" remain to be answered.

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