

# THE VALUE OF DESIGN RESEARCH

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## BEYOND THE SCIENCE OF DESIGN: CRITERIA FOR "UMBRELLA" DESIGN THEORIES

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### ABSTRACT

In this paper, we propose a set of criteria that can be used to formulate or evaluate theories of design. The theories may already exist, or they may be theories that attempt to extend beyond the scope of existing design theories, without calling into question their more specialized validity. Our criteria are:

1. The theory should have more than a trivial application to design practice.
2. The theory should use propositions as a way of describing, explaining and predicting actual and existing aspects of designing and design success (however defined).
3. Where appropriate, the new theory should accept propositions and language contained in other design theories.
4. The theory should accommodate or at least acknowledge generative activity.

*Keywords: Design theory, criteria, generative activity*

### 1 INTRODUCTION

The questions that motivated this work began with the concept of science of design, which has as its main object of study the design phenomena, whether process or artifact. At the same time, as pointed out for example by Cross (1999; 2007), it is problematic to frame science of design both in the traditional sciences as well as in the humanities. In this context, the academic design research community has long struggled with different (and sometimes contradictory) definitions and interpretations of "design", "theory," "design science," and other related terms (e.g., Krippendorf 2006; Love 2005; Jonas 2007; Joseph 2010). The first key term is the word "theory, which is employed in at least 2 ways:

- as a generalized understanding of phenomena that is systematic in such a way that it can produce hypotheses that are testable through repeatable observations (typically used in science)
- as a useful lens for producing valid interpretations of the object of study (typically used in the humanities)

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Since it has more specific criteria to meet, the definition of theory in the sciences can be understood as a subset of the larger definition of theory in the humanities. We consider a scientific theory to be a general description of a phenomenon, conceptualized in such a way as to generate hypotheses that can be tested through disproving the null hypothesis. In the humanities, on the other hand, a theory is a lens or perspective on the object of study, conceived in such a way as to provide a valid interpretation (or "way of looking at it") that is not already well established. The scientific lens is one such perspective, but it is one of many. A quick review of the table of contents of Rivkin and Ryans's (1998) *Literary Theory: An Anthology* provides a list of more than a dozen such perspectives. However, it should be noted that neither the scientific nor the humanities approach is entirely satisfactory for design, which must accommodate generativity as a central concern (e.g. Gaver 2012 and many others). As a result of these reflections, we propose that a design theory should address one or more, and preferably all, of the criteria presented in this article.

## 2 METHOD

Our method for developing these criteria was an extended discussion and debate among a group of 6 researchers (the authors) from 4 countries. We met weekly over a period of 3 months, and during that time, we pursued a trajectory that began with reading and understanding existing proposals for criteria that should be met by a theory of design (e.g. Chakrabarti & Blessing 2014; Gregor & Jones 2007), continued with producing a master list of roughly 50 factors that would ideally be included in a theory (Figure 3), and finally consolidating those factors into the criteria that we propose in this paper. We are conscious, however, that this essay does not exhaust the topic, which has been discussed for at least the last 50 years (e.g. Cross 1999; Friedman 2003; Joseph 2010). That said, our discussions did revisit basic concepts such as the term "design practice."

## 3 DESIGN PRACTICE

One of the most basic and fundamental definitions given to the word design, as practice, refers to an activity where for a given and existing situation "A" one aims to attain a desired and more satisfactory situation "B" (Simon 1969). This simple definition brings several implications. Firstly, it associates design with a process that leads to a particular way of thinking which involves the construction of possible future worlds. It also implies working with uncertainty, taking risks, and building several possible paths in a non-linear way. In this sense, design practice is essentially a generative activity. However, designers create, through a complex and systemic activity, more than material objects – design can also be viewed as a discipline that adjusts, improves, and

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invents/ discovers/ constructs knowledge, with the goal of producing something useful that didn't previously exist. The word useful, here, has to be perceived in a large sense, not necessarily only related to technical-material aspects. To design the conditions for a memorable experience or think about meanings associated with a new artifact can be useful in a specific context. Artifact in this paper is understood in a large sense – it could be a product, a system, a service, an environment, or even an experience.

These initial reflections about the role of knowledge in design lead to a second important concept of design as a kind of learning activity that is at once constructive, evolutionary, and exploratory. Through several evaluations and decision-making processes one can associate design with the construction of new knowledge, where learning is an essential factor. Beyond learning, design, as practice, could be considered as a special method for knowledge construction (e.g. Hatchuel et al. 2001). Explicit knowledge is generated and becomes tangible for all actors involved in this process. People involved are changed by it; they are no longer the same as they were at the beginning of the process. This learning of new knowledge also produces new meanings and other intangible factors.

A third implication is that design more often than not deals with complexity. Further, complexity, as defined by Morin (2005, p.35), always involves uncertainty; it

"includes not only amounts of units and interactions that challenge our calculation possibilities: it also comprises uncertainties, indeterminations, and random phenomena. Complexity, in a certain sense, is always related to an accident."<sup>1</sup>

Since design activity is itself complex, it goes through moments where construction is fully controlled, partly controlled, and totally indeterminate (Dorst 2003). In this sense, the design activity has an exploratory character. One searches through the novel, conducting research of diverse natures. Sometimes one follows the logic of a systematic and structured search where the goal is to generate knowledge that will be useful to the project. Other moments are more intuitive and less controlled, so that unexpected elements appear (Schön 1983). Several research strategies that are naturally employed by designers in their practice had their origins in science or social science. Thus, it is common to conduct surveys, statistical data analysis, or ethnographic-inspired research. However, it is more difficult to associate the activity of design with a scientific task of an academic nature. In

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<sup>1</sup> Free translation of the original in Portuguese

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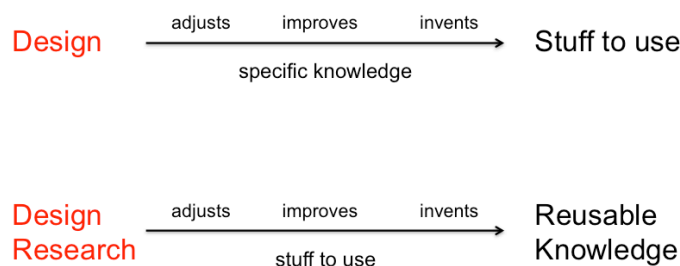
science, one searches for general principles that can explain phenomena, typically using either inductive or deductive logic. Design on the other hand, tends to proceed using abductive reasoning. The academic community should validate knowledge in science, even if this knowledge should not necessarily be considered as true or false, but rather based on a stronger case or a weaker one. However, if one considers that design isn't science, the question remains: is it possible for design to nonetheless be considered a scholarly activity?

## 4 RESEARCH AND SCHOLARLY ACTIVITY

The word "research" is a second ill-defined key concept, broadly used by the design academy. It is used in at least 2 ways (figure 1), as:

- a search for knowledge that is related to design practice and is intended primarily for use in creating a satisfactory outcome (i.e. "stuff") in a specific project (e.g. Boradkar 2010). A design project is typically situational and the standards of validity are quite fluid, depending on the requirements of the case. Often the evaluation of the validity of both the data collection and analysis is carried out by the design team itself: sometimes in consultation with the client.
- a search that is intended primarily to generate new knowledge having design phenomena as the main object of investigation. It could be considered scientific research or scholarly research. Scientific research is subject to relatively strict standards that are typically understood as being able to generate hypotheses that can be validated by disproving the null hypothesis. A scholarly activity seeks to understand design as a larger human, interpersonal, and cultural phenomenon. This meaning is subject to relatively strict standards of validity, but not in the same sense as scientific testing.

In either case, the scope or ultimate purpose of the activity might be relatively constrained (e.g. an "adjustment" to existing stuff or existing reusable knowledge), or relatively dramatic (e.g. an "invention" of new stuff or new reusable knowledge – although some may argue, depending on their philosophical position, that "discovery" is more appropriate than "invention" in the case of knowledge).



*Figure 1. The difference between design and design research (source: authors).*

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The first definition – knowledge for a specific project – is strongly related to design as practice. One accepts the idea that this kind of research could be categorized as research *in* design. The word “in” means that this research is built into a specific process. In the 1990s, the influence of learning by doing in design was positioned by Christopher Frayling in his work about the research in the arts, media and design (Frayling 1993). He proposed three different approaches: research about design, research for design, and research through design. This idea has evolved in different ways and has been interpreted by many authors: while some emphasize the role of practice and implicit results in the artifact, others declare the importance of making a contribution to the academic field in the traditional way of disseminating the knowledge through writing and publishing about the reflection that happens in the design process.

The goal of either scientific or scholarly design research is also the assembly of new knowledge. This knowledge will have been subject to assembly, close scrutiny, and quite stringent standards of validation, since the intention is to apply it to other situations. Design as a practical activity is situational; design as a scholarly activity is less so. Situational refers to a specific design problem and the actors involved in solving it, even if it is also difficult to define design activity as a traditional problem-solving task. As has been widely discussed, the wicked feature of the design problem (Rittel and Webber 1973), is that it is ill-determined and ill-structured; these are also qualities of design as a process, and help to determine what one understands as a situational problem. Each design is highly related to a specific context where it is placed, including the lived experience of the actors involved in the process. The design rarely has as one of its objectives to be reproduced in other situations.

However, it is evident that if one considers the design process as a permanent learning process, each experience could be applicable in future situations. On the other hand, scholarly design research does attempt to investigate design phenomena, trying to identify patterns, construct theories, develop methods, or even in some cases create new technologies. One could categorize this research as Scholarly Design Research. The strategies employed are, usually, different from research in design. Scholarly design research should work with the same level of rigor used in traditional sciences or humanities. Nigel Cross has tried to resolve these difficulties by separating these two concepts: Science of Design and Design as Discipline. Referring to Grant (1979), he proposes, “design as an activity may be the subject of scientific investigation” (Grant 1979 cited in Cross 2001). Reflecting about Design and Science, Cross proposes the idea that the study of design:

Includes the study of how designers work and think, the establishment of appropriate structures for the design process,

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the development and application of new design methods, techniques and procedures, and reflection on the nature and extent of design knowledge and its application to design problems. (Cross, 1984, p. 53)

The proximity of design and design research (figure 1) suggest the close relationship between common practice and academic research in design. Frequently, scholarly researchers will promote, participate in, or simply observe a specific design, trying to produce knowledge that can be applied to other, similar situations. Usually, this kind of research is categorized as "Research Through Design". On the other hand, a scholarly researcher could develop not just reusable knowledge, but also, more specifically, theories, methods, and tools that could help designers to do projects.

## 5 RECURRING THEMES

Several issues were discussed on repeated occasions by the co-authors of this essay. These issues could be considered as the main guides in our proposition to define criteria that a design theory must meet. Thus, recurrently we have discussed: (i) the relationship between design as practice and design as scholarly investigation; (ii) the design research position relative to other research fields; (iii) what a theory (in general) has to attempt to be considered as a theory; and (iv) trends in the design research field.

The first issue addresses the difficulty of separating design practices from design research, as seen above. It indicates that design research is often intrinsically linked to practice. A theory in design usually has practice as its object of observation, or alternatively, it influences the practice with its propositions.

The second issue inquires where design research is positioned in relationship to the other research areas, and to what extent design research has a specific field of investigation. Some authors propose design research as a component of a large and general group called "science", as originally advocated by Simon (1969). Social science is also often considered under this umbrella. Other authors understand design as part of scholarly research in the humanities, where the goal is not to "prove" a single case but instead to multiply valid interpretations. An alternative notion considers design research as a particular and specific way of investigation, related to and at the same time separate from the sciences and the humanities (figure 2).

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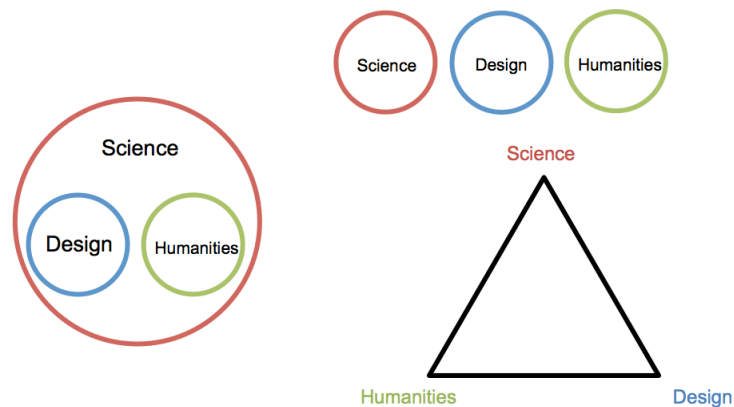
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*Figure 2: Three different models of how Design Research may be related to Science and the Humanities (source: authors).*

The third theme is a reflection on what criteria a theory must meet. Both in science and in the humanities, a theory must allow room and dialogue with other valid theories. A theory will always seek a greater understanding of a studied phenomenon, since that is what differentiates it from practice. This greater understanding of a particular object of study is what allows a theory to be broadly applicable in many similar situations. A theory must always create a space for new observations. These new observations may lead to questioning the theory itself. In general, following on Booth et al. (1995), new theories should be contestable, defensible and substantive. That is to say, a proposed theory should suggest a new way of seeing things that is not already well established (i.e. be contestable). It should be possible to produce evidence to validate it that would be acceptable to a reasonable expert (i.e. be defensible). Finally, it should be significant enough to be worth proposing and producing evidence to validate (i.e. be substantive).

A theory is a model of current understanding with the potential to inform future understanding. As Given (2008) puts it, a theory is:

...normally used to denote a model or set of concepts and propositions that pertains to some actual phenomena; a theory can provide understanding of these phenomena or form the basis for action with respect to them (Given 2008, p. 870).

Our fourth theme concerned the new trends in design as a practice. A design theory must be able to apply to the evolution of design. Conversely, new design practices can lead to new theories of design. Finally, we addressed the actual objects of study at a more granular level. We proposed approximately 50 factors (figure 3), ranging from "uncertainty" to "iteration". This was an exploratory exercise – undoubtedly there are many other possible objects of investigation.

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However, even in this incomplete list it is possible to see the more traditional views and concepts, probably still valid, that link Design to dimensions such as "Art" and "Technology" or to a "Compositional" practice that privileges "Style" and "Aesthetics". However, we also recognize cognition, perception, sociability, and the roles of the designer and user, and there are the human factors, economic factors, and the influence or participation of other disciplines, among many other aspects to investigate.

Uncertainty	Validity	Sociability
Situation / context / environment	Meaning	Interaction
Problem solving	Falsifiability	Inputs / (requirements)
Ideals / ideology	Satisfying	Goal / intention / objective
Experience of the user	Rhetoric	Education
Emotion	Artifact	Economic factors
Culture	Composition	Design methods / planning
Communication	Cognition	Style / aesthetic
Expressivity of designer	Perception	Games
(opinion, belief, preference)	Creativity	Semiotics
Designer	Reasoning	Process
User	Innovation	Technology
Generation	(novelty)	Arts
Evaluation	Accommodation of the theories	The other disciplines
Representation	Reflection / reflexivity	Knowledge
(draw, prototype, model)	Structure / form	Abstraction
Constraints	Behavior	Iteration
Refutability	Function	

Figure 3. Factors associated with a theory of design (source: authors).

Accepting the notion that a design theory must be attentive to the processes involved in design practice suggests the words "Methods" and "Problem Solving" – two topics widely studied by the scholarly design community since the 1960s. The use of a domain language (drawings, mockups, prototypes, ...) reminds us that often design theories will reflect on the "Representation" of something that does not yet exist. How could we represent the future? One must create something that gestures in the direction of a possible future, and in that creation a step is taken into a future that contains this new gesture. Thus, "Creativity", "Imagination", "Cognition", "Reasoning" and "Communication" are themes related in the process to the concept of "Representation."

Some more recent themes are "Experience", "Emotion", "Co-Design" and "Participatory Design." Again, the inter- and trans-disciplinary characteristic of design demands a conversation between diverse knowledge areas. Further, one way to characterize design is to say that it is the process of creating mediating artifacts. Another recurring theme in the discussions was design as "Rhetoric" or as a "Discourse." This theme often led to another issue, the "Political" aspect involved in design. Design should not be restricted in its attention to



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objects, communications, services, or experiences, but should continue its expansion into "Strategies" and "Policies." Strategies and Policies maintain a fairly close relationship to "Ideals," "Ideology," and even "Ethics." It can be observed that a Design Theory similarly maintains an ontologically close relationship with areas such as philosophy, sociology, and economics. Designers often argue that they are poorly understood by organizations and their role is not seen as relevant. Perhaps the reason for this misunderstanding is the fact that the design community itself has not carefully defined some basic concepts. For example, design is sometimes seen as the center of the world, capable of solving all the problems of society, through the plans of some "super designer". On the other hand, sometimes the designer is seen as a "simple" facilitator of processes. Well-defined boundaries often work as walls; however, very ill-defined boundaries can dilute the role of design in society. In this sense, the role of design in policy discussions is also an important theme for the formulation of theories of Design.

The word "Culture" is perhaps a little lost in this list, belying its importance. Culture can be interpreted in several ways, but here it is with the meaning of the "Artificial," or design as something that is made by people, which modifies nature to achieve certain outcomes. In some cases, the outcomes are related to goals, which in turn could be associated with decision-making processes. This is another concept that causes difficulties. It is known that the problem-space co-evolves with the solving-space (e.g., C-K theory). How can we make responsible decisions about something that has not yet been built? It is not just a process of analysis-synthesis, because the generative character of the design constantly reshapes goals to be achieved during the process of creating the new.

These aspects were extensively discussed, grouped and regrouped, sorted and associated, and this conversation led to the formulation of a set of "umbrella" criteria that a theory of design should try to meet. The criteria are not completely distinct: some are implied by others or inherent in others, but we felt it would be useful to explicitly unpack these implications using the logic by which we understood them.

### 6 CRITERIA FOR "UMBRELLA" DESIGN THEORIES

1. The theory should have more than a trivial application to design practice.

The theory might attach to the whole process or to part of the process, but it is important that a design theory deal with design, in the same way that a theory in physics deals with physical phenomena or a theory in medicine refers to health. To put it another way, the proper subject of

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a design theory is design. If the subject were to be something else, for instance the products of design, then there is no need for a special category of theories: those arising in other, non-generative disciplines will suffice.

However, since design naturally works with other fields, part of the application to design practice may include trans/inter/multi-disciplinarity.

For the sake of convenience, we list some of the parts of the process that might be useful to keep in mind:

1. What did you set out to do (the brief)?
  2. Who should be involved (stakeholders)?
  3. How did you do it and communicate about it (the process)?
  4. What have you done (the project)?
  5. Where and when did you do it (time and place)?
  6. What was limiting you (constraints)?
  7. What does it mean (semiotics)?
2. The theory should use propositions as a way of describing, explaining and predicting actual and existing aspects of designing and design success (however defined).

A theory that presents itself using propositional language is going to be easier to understand and relate to other theories than one that does not use propositions. That the substance of those propositions is description, explanation, and prediction will make them more useful as a means of strengthening the case for the validity of the theory. By its nature, a proposition is open to discussion and experimentation, observation and interpretation. It is in this way distinguished from an axiom, imperative, or even description.

By specifying not only "designing," but also "design success," we are suggesting that a theory should contain within its formulation some indication of what criteria might be used to distinguish among design solutions in a terrain that involves success and failure. Such criteria would also serve to help establish the natural application area of the theory. For instance, many design theories that take a more technical approach do not explicitly deal with human satisfaction as an evaluation criterion. It would therefore be inappropriate to expect these kinds of theories to align well with situations where human satisfaction is a primary factor – unless they have been augmented with additional attention to the human behavioral and social.

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3. Where appropriate, the new theory should accept propositions and language contained in other design theories.

In some disciplines, it is normal for one theory to compete with another, since each theory suggests a way of understanding phenomena that may be mutually exclusive of other ways of understanding them. For instance, the earth either revolves around the sun, or else the sun revolves around the earth. One theory precludes the other, and once one is established, there are a variety of implications that arise, both for having accepted it and also for having rejected others.

However, in other disciplines, particularly in the humanities and social sciences, it is possible for theories to co-exist, since the point is not to establish a single truth, but instead to produce multiple valid ways of understanding that can be applied to various objects of study. This multiplicity of understanding is characteristic of design, where the standard approach is not to suggest that there is one best design and the designer's job is to find it. Instead, the designer typically recognizes that there is a wide range of possible ways to move from the current situation to a set of possible preferred situations. Designers and clients then choose among the preferred situations, depending on a variety of factors and the relative weight of those factors.

In addition to the paradigm of acknowledging and accepting the co-existence of multiple theories, this criterion also proposes re-using language from previous work. Two reasons exist to preserve language where possible. First, it is just good manners. Second is that a discipline can easily get bogged down in a proliferation of terms that relate to the same ideas, or conversely a paucity of terms that results in the same one being used differently by each scholar.

4. The theory should accommodate or at least acknowledge generative activity.

Design is a scholarly field that falls in the category shared by others such as computer science, engineering, math, and chemistry, where the primary purpose is not to analyze and describe, but instead to analyze and create. A theory that does not acknowledge in some way the generative nature of the area might therefore be a good theory, but it is going to be missing an important aspect of the object of study.

However, at this point it is not necessary to spell out, except as examples, the kinds of generative processes that might be relevant. Some possible examples are the cognitive processes of creativity (such as expansion, combination, and analogy), intuition, synthesis, and the logic of abduction.

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## 7 CONCLUSIONS

The ideas contained in this essay were formulated by six researchers, from different design areas and countries. The researchers are linked to design research, but also have training and experience in the Humanities, Engineering, Architecture, and Computer Science. The manner used to propose the essay was not completely structured. Each meeting decided the next step or else changed the path using some main references in the design literature. Sometimes the authors sought to build a consensus; at other times a divergence remained.

Brainstorming sessions, drawings, and semantic maps were constructed, and the expression "if then" was often invoked. That manner of research is very similar to the design process itself. In this sense, it could be proposed that design research has some peculiarities in regard to other sciences. Openness, ill-structured, wicked problems, and non-linearity are expressions common to describe the design process and probably also to describe design research. It is acceptable that this reality is not a problem but a very positive aspect.

Even accepting this proposal, Design Research has to be done with the same rigueur that characterizes traditional science or humanities. That was why we have attempted to propose a small set of criteria for a design "umbrella" theory. We have not proposed a new general design theory; in fact, this was one of the points of disagreement among the group. While some believed it to be possible to construct a General Design Theory, others believed that it is not necessarily a useful focus of Design Research. For them, Design Research can avoid a trivial connection to practice by being oriented to the development of theories that are more directly applicable to specific and situational cases. In the end, the proposal of this essay was much less ambitious: simply the formulation of some criteria. It is hoped that this discussion will continue and new criteria could be suggested or even these ones criticized and improved.

## 8 REFERENCES

- Booth, W.C., Colomb, G.G. & Williams, J.M., 2008. *The Craft of Research*, Third Edition (Chicago Guides to Writing, Editing, and Publishing).
- Chakrabarti, A. & Blessing, L., 2014. *An Anthology of Theories and Models of Design*. L. T. M. B. Amaresh Chakrabarti, ed., London: Springer.
- Cross, N., 1999. Design Research: A Disciplined Conversation. *Design Issues*, 15(2), pp.5-10.
- Cross, N., 2006. *Designerly ways of knowing* Springer L., London: Springer London.

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## *Beyond the Science of Design: Criteria for "UMBRELLA" Design Theories*

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- Dorst, K., 2003. The Problem of Design Problems E. Edmonds & N. Cross, eds. *Design*, 4, pp.135-147.
- Fallan, K., 2011. *Designing Things: A Critical Introduction to the Culture of Objects*. *Design and Culture*, 3(2), pp.263-265.
- Frayling, C., 1993. *Research in Art and Design*. Royal College of Art Research Papers, 1(1), pp.1-5.
- Friedman, K., 2003. Theory construction in design research: criteria: approaches, and methods J. Shackleton & D. Durling, eds. *Design Studies*, 24(6), pp.507-522.
- Gaver, W., 2012. What Should We Expect From Research Through Design? *Chi*, pp.937-946.
- Given, L.M., 2008. *The Sage Encyclopedia of Qualitative Research Methods* L. M. & Kristie S. Given, ed., Sage Publications, Inc.
- Grant, D., 1979. *Design Methodology and Design Methods Design Methods and Theories* Vol 13, No 1
- Gregor, S. & Jones, D., 2007. The Anatomy of a Design Theory. *Journal of the Association for Information Systems*, 8(5), pp.313-335.
- Hatchuel, A., Le Masson, P. & Weil, B., 2001. From R&D to R-I-D: Design strategies and the management of "innovation fields." In 8th International Product Development Management Conference. pp. 1-16.
- Jonas, W., 2007. Design Research and its Meaning to the Methodological Development of the Discipline. In R. Michel, ed. *Design Research Now*. Birkhäuser, pp. 187-206.
- Joseph, F., 2010. *Mnemotechne of Design — Ontology and Design Research Theories* Mnemotechne of Design. Auckland University of Technology.
- Krippendorff, K., 2006. *The Semantic Turn; A New Foundation for Design*. Boca Raton, London, New York: Taylor & Francis, CRC Press.
- Love, T., 2005. A unified basis for design research and theory. in *International Design Congress - IASDR 2005: New Design Paradigms*, Douliou, Taiwan, 2005. International Association of Societies of Design Research, Taiwan.
- Morin, Edgar., 2005. *Introdução ao Pensamento Complexo*. Porto Alegre: Sulina.
- Owen, C., 2007. Design Thinking: Notes on Its Nature and Use. *Design Research Quarterly*, 2(1), pp.16-27.
- Rittel, H.W.J. & Webber, M.M., 1973. Dilemmas in a general theory of planning. *Policy Sciences*, 4(2), pp.155-169.
- Rivkin, Julie. Ryan, Michael., 2004 *Literary theory :an anthology* Malden, MA : Blackwell Pub.
- Schön, D.A., 1983. *The Reflective Practitioner: how professionals think in action*, Basic Books.
- Thompson, S.C., 2011. *Rational design theory : a decision-based foundation for studying design methods*. Georgia Institute of Technology.

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Venable, J.R., 2006. The Role of Theory and Theorising in Design Science Research. In Design Science Research in Information Systems and Technology. pp. pp. 1-18.