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Four Criteria for Design Theories

Abstract The goal of this paper is to demonstrate that the adoption of the four criteria we outline will strengthen future design theories and encourage existing design theories to expand or reconfigure in useful directions. We propose four criteria for design theory creation and evaluation. These are (1) the theory should have substantial design applications, and be applicable to any topic; (2) the theory should use propositions – if-then language – as a way of describing, explaining, and predicting actual and existing aspects of designing; (3) where appropriate, a new theory should accept and adopt propositions and language contained in other design theories; and (4) the theory should accommodate, or at least acknowledge, generative activity. We are not proposing a new general design theory – this paper outlines a strong approach to studying and building theory. Please also note that this essay does not pretend to exhaust a topic that has been discussed for at least the last 50 years.

1 Herbert A. Simon, *The Sciences of the Artificial*, 3rd ed. (Cambridge, MA: MIT Press, 1969).

2 Nigel Cross, "Design Research: A Disciplined Conversation," *Design Issues* 15, no. 2 (1999): 5–10; Nigel Cross, *Designerly Ways of Knowing* (London: Springer, 2006).

3 For example, see Klaus Krippendorff, *The Semantic Turn: A New Foundation for Design* (Boca Raton: CRC Press Taylor & Francis Group, 2006); Terence Love, "A Unified Basis for Design Research and Theory," in *International Design Congress-IASDR 2005: New Design Paradigms* (Douliou, Taiwan: International Association of Societies of Design Research, 2005); Wolfgang Jonas, "Design Research and Its Meaning to the Methodological Development of the Discipline," in *Design Research Now*, ed. Ralf Michel (Basel: Birkhäuser, 2007), 187–206; Sandeep Purao et al., "The Sciences of Design: Observations on an Emerging Field" (working paper 09-056, Harvard Business School, Cambridge, 2008), accessed March 8, 2017, http://www.hbs.edu/faculty/Publication%20Files/09-056.pdf; Frances Joseph, "Mnemotechne of Design—Ontology and Design Research Theories" (PhD dissertation, Auckland University of Technology, 2010), http://aut.researchgateway.ac.nz/handle/10292/1205.

4 Julie Rivkin and Michael Ryan, *Literary Theory: An Anthology*, 2nd ed. (Malden: Blackwell Publishing, 2004).

5 For example, see Cross, "Design Research" and *Designerly Ways*; William Gaver, "What Should We Expect from Research Through Design?," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ed. Joseph A. Konstan, Ed Chi, and Kristina Höök (New York: ACM, 2012): 937–46; Lassi A. Liikkanen, *Design Cognition for Conceptual Design* (Helsinki: Aalto University, 2010), accessed March 18, 2017, https://aaltodoc.aalto.fi/bitstream/handle/123456789/4745/isbn9789526030258.pdf?sequence=1&isAllowed=y.

6 Horst W. J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," *Policy Sciences* 4, no. 2 (1973): 155–69.

Introduction

The motivation for this work began with the concept of the science of design,[1] which studies design phenomena, whether process or artifact. At the same time, as pointed out for example by Cross,[2] framing the science of design using theories drawn from either the traditional sciences or the humanities is problematic. Design research academics have long struggled with different – sometimes contradictory – definitions and interpretations of key terms, including *theory*, *research*, *design practice*, and others.[3]

The word theory, for example, has been employed in at least two ways:
- to connote a general, systematic understanding of phenomena that lends itself to hypotheses that are testable through repeatable observations (typically used in science); and
- as a useful lens with which to produce an interpretation of an object under study (typically used in the humanities).

We understand the definition of theory in the sciences as a subset of the larger definition of theory in the humanities, since it has more specific criteria to meet. The scientific lens is only one such perspective – there are many. A quick review of the table of contents of Rivkin and Ryan's *Literary Theory: An Anthology*[4] provides a list of more than a dozen such perspectives. Yet neither the scientific nor the humanities approach is entirely satisfactory for design, which must accommodate generativity as a central concern.[5] As a result of these reflections, we propose that a theory in design should address the criteria presented in this article.

Method

We developed the following criteria through extended discussion and debate among a group of 6 researchers (the authors) representing different design research areas across four American countries – Brazil, Canada, Colombia, and the USA. The researchers are linked to design research and also have training and experience in the humanities, engineering, architecture, and computer science. The way we have complied this essay is not entirely structured. Taking our cues from key references in the design literature, each meeting either led to the next step or changed our trajectory. Sometimes we authors sought to build a consensus; at other times, divergence remained. Hence, the process was characteristic of that found when addressing ill-structured problems.[6]

During 12 meetings, each 3 hours long, we worked through existing proposals for criteria that should be met by a theory of design,[7] producing a master list of roughly 50 factors that could, ideally, be addressed by a theory, and finally consolidating those factors into the criteria that we propose in this paper. We are conscious, however, that this discussion does not pretend to exhaust the topic, which has been debated for at least the last 50 years.[8]

Design Practice

One of the most fundamental definitions given to the words *design practice* is from Herbert Simon, who states, "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones."[9] This simple definition carries several implications.

Firstly, Simon's definition associates the design process with the kind of thinking that leads to the *construction* of possible future worlds. Often, the act of designing implies working with incertitude, taking risks, and building several possible paths in a non-linear way. In this sense, design practice is essentially a