

Examining Practical, Everyday Theory Use in Design Research

Abstract This paper discusses how theories (as objects) are used in articles published in Design Studies. While theory and theory construction have been given time and attention in the literature, less is known about how researchers put theories to work in their written texts – about “practical, everyday” theory use. In the present paper, we examine 32 articles and synthesize six models of “theory use” based on our examination.

Keywords

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1 Ken Friedman, "Theory Construction in Design Research: Criteria: Approaches, and Methods," *Design Studies* 24, no. 6 (2003): 507–22, DOI: [http://doi.org/10.1016/S0142-694X\(03\)00039-5](http://doi.org/10.1016/S0142-694X(03)00039-5); Terence Love, "Philosophy of Design: A Meta-Theoretical Structure for Design Theory," *Design Studies* 21, no. 3 (2000): 293–313, DOI: [http://doi.org/10.1016/S0142-694X\(99\)00012-5](http://doi.org/10.1016/S0142-694X(99)00012-5); Karl E. Weick, "Theory Construction as Disciplined Imagination," *Academy of Management Review* 14, no. 4 (1989): 516–31, DOI: <http://doi.org/10.5465/AMR.1989.4308376>; Karl E. Weick, "What Theory Is Not, Theorizing Is," *Administrative Science Quarterly* 40, no. 3 (1995): 385, DOI: <http://doi.org/10.2307/2393789>.

2 Jordan Beck and Erik Stolterman, "Can There Be Scientific Theories of Design That Do Not Scientize Design?" in *Proceedings, from the 11th European Academy of Design Conference: The Value of Design Research* (Boulogne: Paris Descartes University, 2015), accessed August 3, 2016, http://www.academia.edu/11241766/Can_there_be_scientific_theories_of_design_that_do_not_scientize_design.

3 Friedman, "Theory Construction," 513.

4 John Ziman, *Real Science: What It Is, and What It Means* (Cambridge, UK: Cambridge University Press, 2002), 128.

5 Simon Blackburn, *The Oxford Dictionary of Philosophy*, 2nd ed. (Oxford: Oxford University Press, 2005), 363.

6 John S. Gero, "Design Prototypes: A Knowledge Representation Schema for Design," *AI Magazine* 11, no. 4 (1990): 26; John S. Gero and Udo Kannengiesser, "The Situated Function-Behaviour-Structure Framework," *Design Studies* 25, no. 4 (2004): 373–91, DOI: <http://doi.org/10.1016/j.destud.2003.10.010>; John S. Gero and Udo Kannengiesser, "The Function-Behaviour-Structure Ontology of Design," in *An Anthology of Theories and Models of Design*, ed. Amarend Chakrabarti and Lucienne T. M. Blessing (London: Springer-Verlag, 2004), 263–83, http://link.springer.com/chapter/10.1007/978-1-4471-6338-1_13.

Theory is integral to any academic discipline. It takes researchers beyond observation and interpretation into the realm of sharable knowledge. Theory provides us with the means to structure knowledge, to evaluate and assess it, to construct it, and to share it. In the everyday practice of research, theory can be seen as a concrete tool used for practical purposes. For instance, theory can be used as an explanatory tool, or as a predictive one. But these are not the only ways in which theory functions as a tool. The use of theory is multifaceted and complex.¹ However, in this article our aim is not to demarcate or define theory. Instead, our aim is to investigate how researchers present their use of theory in written texts.

The reason for our investigation originates in a parallel study² which engages with the question of what constitutes a design theory. We have examined publications from many different domains of design research, and we have found that the way theory is mentioned, written about, and used can be difficult to understand. This difficulty pointed us towards the important two-part question of (1) how researchers in the design field use theory, and (2) how that use manifests in their writings.

Our interest is primarily in the everyday practice of theory use. By "everyday practice," we mean to distinguish between what we might call "revolutionary contributions" to the field and contributions that might be considered normal or routine. In order to accomplish this, we have examined a selection of articles from a single calendar year in one of the most prestigious journals in the design research community – *Design Studies*.

We propose six models that capture the different ways researchers use theory in their publications. We suggest that these models support a deeper understanding of the structure of publications in *Design Studies*. In addition, and perhaps more importantly, these models facilitate interesting and useful questions about the state of theory use in design research in general, such as: why is theory used more in some ways than others? How do authors employ theory in different ways in the same texts? To what extent does current theory use in design research tell us something about *design theory*, as opposed to other kinds of theory? What is the current state of theory use in design research?

We intend this paper to make two primary contributions to the field: First it describes the current state of theory use in design research; and second, it explores the implications of this existing state when it comes to design research in general. A deeper understanding of how theory is used in the design research community can potentially better position its constituents to be more intentional in their theory use.

Theory as an Object

Theory can be understood in many different ways. For instance, it has been described as a model,³ likened to a map,⁴ and defined as a way of looking at some phenomena "with explanatory or predictive implications."⁵ A simple distinction that we have found useful for our purposes is that theory can be understood either as an object (i.e., as a kind of knowledge entity) or as a process (i.e., as theorizing).

When a researcher develops an explanation of how or why some phenomenon occurs, they are engaging in theorizing – in a process. The explanation itself becomes a theoretical object. For instance, the FBS framework,⁶ CK theory,⁷ distributed cognition,⁸ and strong concepts,⁹ could all be interpreted as theoretical objects. A parallel distinction can be made between designing and a design: when a designer designs, they are engaged in design as a process, while the outcome of that process becomes the design(ed) object.

Both aspects are of course of great importance. So when we consider our research question, "How is theory used in written texts in design research," we have

to decide whether to approach theory as an object or a process. The approach for studying one would be quite different than the other. For our purposes, we made the decision to frame theory as an object.

Framing theories as objects can serve many different ends. For instance, it would be possible to study theories (as objects) in design to explore their constitution and structure, or to study their internal consistency, or their scope or depth. It would also be possible to compare and contrast theories with the purpose of gaining insight into the field where they are used. These ways of investigating theories can lead to detailed analyses of their intrinsic status. However, such approaches would require the theories under investigation to be opened up, and their inner workings exposed. We have taken a simpler approach: We are only interested in how theories are used as knowledge objects, and we are not interested (in this context) in the internal constitution of the object itself.

Distinguishing a theoretical knowledge object in a publication is an important issue to address. For our purposes, we err on the side of inclusivity, since previous work has shown that theories can be referred to in research publications as everything – from “theory” or “model” to “perspective,” “rationale,” “idea,” “process,” and “phenomenon.”¹⁰ We are interested in identifying what could reasonably be construed as theoretical knowledge objects based on our own understanding of theory and our understanding of how other researchers in the design field understand and talk about theory.¹¹ As a consequence, the way we frame theory could be seen in alignment with a broad, inclusive definition of theory “as [an] abstracted knowledge [object] that tells us something about fundamental entities at the core of a discipline.”¹²

The way we frame theories suggests that the use of a theory can at least be understood in three ways: as a tool, as a reference, and as a knowledge contribution. In the following section, we will briefly discuss each of these aspects of theory as an object. There are of course other ways to understand theories as objects, but these are the ones we have chosen to focus on in our analysis.

Theory as a Tool

Framing theory as a tool implies that a user uses a theory for a particular purpose. Theory has been described and defined by many researchers in terms of its utility.¹³ It has been framed as a tool for explaining, describing, or predicting phenomena. It has been described in design research as a tool for “binding together” our knowledge of design practice and as a tool for “providing an understanding” of design writ large.¹⁴ Tools have functions that are in most cases related to a particular need or purpose. For instance, when a designer needs to communicate an idea quickly and cheaply to a stakeholder, she uses a sketch. Similarly, when researchers need to explain how or why some phenomenon occurs, they use theory – since theory provides a means of structuring knowledge in precise ways to share with other researchers.¹⁵ There are of course situations when particular tools are not well suited for the task at hand. Sketching is not necessarily an ideal tool for “selling” a design to a client. Similarly, theory is not necessarily an ideal tool for explaining reality in the same way that an analogy or metaphor might be. Finally, the tool metaphor lends itself to the idea of appropriation. Tools that were designed for one purpose often end up serving others. Pencil and paper, as tools for sketching, have structural properties conducive to low-fidelity 3D prototyping. Theory, a tool for explaining, predicting, or describing, has structural properties conducive to other purposes as well.

Theory as a Reference

Common definitions of reference include: the action of mentioning or alluding

7 Armand Hatchuel and Benoît Weil, “A New Approach of Innovative Design: An Introduction to CK Theory,” in *DS 31: Proceedings of ICED 03, The 14th International Conference on Engineering Design, Stockholm*, ed. A Folkeson, K Gralen, M Norell, and U Sellgren (2003), 109–10; Armand Hatchuel and Benoît Weil, “C-K Design Theory: An Advanced Formulation,” *Research in Engineering Design* 19, no. 4 (2009): 181–92, DOI: <http://doi.org/10.1007/s00163-008-0043-4>.

8 James Hollan, Edwin Hutchins, and David Kirsh, “Distributed Cognition: Toward a New Foundation for Human-Computer Interaction Research,” *ACM Transactions on Computer-Human Interaction (TOCHI)* 7, no. 2 (2000): 174–96, DOI: <http://doi.org/10.1145/353485.353487>.

9 Kristina Höök and Jonas Löwgren, “Strong Concepts: Intermediate-Level Knowledge in Interaction Design Research,” *ACM Transactions on Computer-Human Interaction (TOCHI)* 19, no. 3 (2012): 23; Jonas Löwgren, “Annotated Portfolios and Other Forms of Intermediate-Level Knowledge,” *interactions* 20, no. 1 (2013): 30–34.

10 Jo E. Hannay, Dag I. K. Sjøberg, and Tore Dybå, “A Systematic Review of Theory Use in Software Engineering Experiments,” *IEEE Transactions on Software Engineering* 33, no. 2 (2007): 87–107, DOI: <http://doi.org/10.1109/TSE.2007.12>.

11 Steven R. Haynes and John M. Carroll, “The Range and Role of Theory in Information Systems Design Research: From Concepts to Construction,” in *2010 International Conference on Information Systems (ICIS 2010) Proceedings*, Paper 136, accessed August 3, 2016, http://aisel.aisnet.org/cgi/viewcontent.cgi?article=1139&context=icis2010_submissions.

12 Erik Stolterman and Mikeal Wiberg, “Concept-Driven Interaction Design Research,” *Human-Computer Interaction* 25, no. 2 (2010): 95–118.

13 Yvonne Rogers, “HCI Theory: Classical, Modern, and Contemporary,” *Synthesis Lectures on Human-Centered Informatics* 5, no. 2 (2012): 1–129,

DOI: <http://doi.org/10.2200/S00418ED1V01Y201205HCI014>; Ben Shneiderman, Catherine Plaisant, Maxine S. Cohen, and Steven M. Jacobs, *Designing the User Interface: Strategies for Effective Human-Computer Interaction*, 5th ed. (Boston: Prentice Hall, 2009).

14 Amaresh Chakrabarti and Lucienne T.M. Blessing, “Theories and Models of Design: A Summary of Findings,” in *An Anthology of Theories and Models of Design*, ed. Amaresh Chakrabarti and Lucienne T.M. Blessing (London: Springer-Verlag, 2014), 15, accessed August 3, 2016, http://link.springer.com/chapter/10.1007/978-1-4471-6338-1_1; Friedman, “Theory Construction,” 511;

“Understanding Designing: What Are Designers Doing When They Design (John Gero),” YouTube video, 1:01:30, from the **ASP Course “Design Methods”** coordinated by Gaetano Cascini, filmed March 14, 2013, posted by “Alta Scuola Politecnica,” October 8, 2013, <https://www.youtube.com/watch?v=TRiET-j2ujvQ>.

15 Hannay, Sjøberg, and Dybå, “A Systematic Review of Theory Use”; Ziman, *Real Science*.

16 Hannay, Sjøberg, and Dybå, “A Systematic Review of Theory Use,” 87–107.

17 Karl E. Weick, “Theory Construction as Disciplined Imagination.”

18 Ziman, *Real Science*, 139.

19 George Psathas, *Conversation Analysis: The Study of Talk-in-Interaction, Qualitative Research Methods Series*, vol. 35 (Thousand Oaks, CA: Sage Publications, 1995); Harvey Sacks, “Notes on Methodology,” in *Structures of Social Action: Studies in Conversation Analysis*, ed. J. Maxwell Atkinson and John Heritage (New York: Press Syndicate of the University of Cambridge, 1984), 21–27. [Editor’s note] This reference note is added in the light of Danah Henriksen’s comments.

20 Barney G. Glaser and Anselm L. Strauss, *The Discovery of Grounded Theory: Strategies for Qualitative Research* (Piscataway, NJ: Aldine Transaction, 2009), 45.

to something or the use of information to ascertain something. When theory is used as a reference, it most often appears in the introductory and/or background sections of a given written text. With this type of theory use, researchers often reference frameworks and models *instead of* referencing theory per se. Other investigations of theory use in written texts have found that authors refer to theories as everything, from “theory,” “model,” “perspective,” “rationale,” “idea,” “process,” to “phenomenon.”¹⁶ In many cases, the reference remains vague. For instance, the reference might amount to little more than authors’ names, or a paper title and the publication year. The names and the publication year “stand in” for an explicit citation of a particular theory or theories. Theory as a reference can perform several functions that may appear in concert or individually in a given research paper. For instance, a theory can be used to establish the basis for a research project, to situate a text within a lineage, to establish the knowledge base of the writer, or to show connection to a community or school of thought. We will discuss some of these in greater detail when we present our models of theory use.

Theory as a Knowledge Contribution

When theory is used as a tool or as a reference, it usually means that the theory in question already exists. Characterizing theory as a *knowledge contribution* suggests that it had not existed prior to the researcher’s articulation of it. The researchers brought it into being by formulating their results such that they would be understood as a theory, for instance, as a set of constructs and their definitions, as well as a set of propositions about how the constructs relate to one another.¹⁷ This formulation of a theory becomes a knowledge object. How this object is to be “used” by others is partly a consequence of the authors’ claims about it, and partly a consequence of the readers’ interpretation. For example, the author might claim that the knowledge contribution relates to existing theory, or the research problem at hand, or to something else entirely. But it would also be possible for a reader to see applications beyond the authors’ claims. For example, the mathematicians who developed tensor calculus did so “without any premonition of its later use in physics,”¹⁸ in particular in the General Theory of Relativity. In our analysis, we have primarily focused on what the resulting theory is claimed to contribute and *not* on reader interpretation.

With the notions of theory as a tool, a reference, and a knowledge contribution in mind, we turn our attention to describing our approach, including the conceptualization, design, and implementation of the current research project.

Approach

Prior to assembling a corpus of texts, we established that we would engage in a round of “unmotivated looking”¹⁹ in order to see how the texts *could be said* to use theory without establishing or imposing strict definitions of “theory” or of “use.” One of the challenges we faced at the outset of our work was that of defining “theory use.” How might we capture what it means to “use” theory? We found that framing theory as an object pointed us in the direction of an answer. When theory is seen as an object – or a *thing* – then it becomes possible to see a theory as a tool. When theory is seen as a tool then we can define “use” in terms of how it functions in a text. What purpose does theory fulfill in a given written text?

These initial questions and decisions were not guided by existing “theoretical frameworks,” but rather by a “general perspective... [and a] general problem area.”²⁰ These initial decisions could therefore be seen to be in alignment with the initial decisions of a grounded theory approach.

There are many different publication venues one might look at in order to

study how design researchers use theory in written texts. We decided to collect one year's worth of articles ($n=32$) published in *Design Studies*, which is one of the top journals in the field. It is one of the oldest design research journals, and it aims to provide an interdisciplinary forum for inquiry into design activities. It has been a key source of material for scholars seeking answers to questions about how to define, construct, and evaluate theory with a particular focus on *design theory*.²¹ We do not position our analysis as a response to or critique of this existing content. Rather, we see our work as complementary: a contribution to our collective knowledge of theory in design research.

In order to determine which function theory performs in the works included in our corpus, we adopted an emergent coding approach. We separately reviewed the corpus, and recorded preliminary observations about how theory functioned in each text. Then we reconvened to analyze and compare our observations.

This stage yielded four groupings, which we named *originating*, *positioning*, *shaping*, and *shaped*. Originating papers were those whose research questions originated from theory, or whose question was about a specific theory or theories. Positioning papers were those that positioned their work in relation to existing work that may or may not have included theory per se. Shaping papers were those that used theory in a manner similar to positioning papers, with the difference being that theory actually shaped – or re-shaped – the original research question. Finally, shaped papers were papers that used theory as a filter through which to pass preliminary research findings. We saw findings as shaped by theory.

We adopted these four groupings as a coding scheme, and independently applied them to the texts in the corpus. However, we found that this preliminary coding scheme did not yield an acceptable level of reliability. So we continued discussing the similarities and differences in our application, and we iterated upon the coding scheme accordingly.

In parallel with this iteration, we developed models to represent the relationships and interactions between theory and the other core elements in our selected papers. In attempting to establish what could constitute the core elements of our selected papers, we made the decision to model as few elements as possible: fewer elements reduce the complexity of the models but also lead to coarser descriptions. And while we relied on grounded theory techniques to generate kinds of theory use, we developed our list of core elements of a research publication based on two widely used reference texts on research and academic writing.²² We ended up with the following core elements: *question*, *examination*, *findings*, and *theory*. Questions identify the needs or interests that the researcher deems worthy of understanding, explaining, predicting, or describing. For example, our framing question identifies an interest in understanding how theory is used in design research. Examination captures the approach taken to answer the question – that is, it includes all forms of analytical or empirical work done by the researcher to investigate the question at hand. Findings refer to the outcome of this examination. Theory is the fourth core element in each of our models.

It is obvious that by using so few elements to capture complex objects such as research papers, there is a concomitant loss of precision. However, it is not our intent to precisely capture on a detailed level the intrinsic structure of each article. Instead, our purpose is to find a level of analysis that makes it possible to extract patterns, similarities and differences across articles in a manageable way. We believe that our level of analysis has made this possible.

After we developed the original set of four models, we critiqued and iterated on them by independently applying them to the papers in our corpus. Our critique focused primarily on the match between the models and the papers. Did the models accurately capture the essential structure of the core elements in each

²¹ Friedman, "Theory Construction," 507–22; Terence Love, "Philosophy of Design," 293–313; Terence Love, "Constructing a Coherent Cross-Disciplinary Body of Theory about Designing and Designs: Some Philosophical Issues," *Design Studies* 23, no. 3 (2002): 345–61, DOI: [http://doi.org/10.1016/S0142-694X\(01\)00043-6](http://doi.org/10.1016/S0142-694X(01)00043-6).

²² Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams, *The Craft of Research*, 2nd ed. (Chicago: University of Chicago Press, 2003); Kate L. Turabian, *A Manual for Writers of Research Papers, Theses, and Dissertations: Chicago Style for Students and Researchers*, 8th ed. (Chicago: University of Chicago Press, 2013).

paper? Or did they distort the structure of – and interaction between – the core elements? We also questioned whether our proposed category names accurately conveyed the content of the models. Both questions motivated several rounds of iteration. For instance, our first four models did not account for the use of theory as a methodological and/or analytical tool. We developed additional models to account for these types of theory use. In the interest of completeness, we also developed a model to account for papers that do not show any use of theory. However, this type of paper did not appear in our corpus, which is itself interesting.

Our critique and iteration finally led to six models:

- 0) No theory,
- 1) Theory as the object of study,
- 2) Theory as a contextualizing tool,
- 3) Theory as a shaping tool,
- 4) Theory as a methodological tool, and
- 5) Theory as an analytical tool.

In the following section, we will explain each of these models and point to relevant examples from our corpus. For each model, we include textual excerpts from our corpus in order to illustrate the type of content that pointed towards a particular model. We want to enable readers to evaluate the texts on similar terms as we did.

Models of Theory Use

One of our goals was to make each model easy to distinguish from the others, and so we present them in a simple visual format accompanied by brief explanatory text. The models consist of four core elements: question, examination, findings, and theory. We use arrows to show the relationships and influences between core elements as well as to indicate their logical placement in the texts. Solid arrows indicate obvious and strong influence, and dotted arrows indicate *potential* influence. It is necessary to emphasize that these models are abstract representations of the texts we have studied with the purpose of capturing common patterns. They are visualizations of different kinds of theory use, and there is no one-to-one relationship between texts and models. In fact, to describe one text it may be necessary to use multiple models.

In our discussion of each model, we use the notion of “talkback” to refer to the influence that the findings may have on other core elements. For instance, the findings may talk back to the initial question with an answer of some kind. Or they may talk back to a particular theory by suggesting changes to it. In some models, the talkback can be aimed at more than one element.

No Theory

This model accounts for those texts that do not invoke any use of theory (see [Figure 1](#)). The research text is motivated by a question, which is followed by an examination and findings. In this model, the findings talk back to the original question, but not necessarily to the examination. There were not any examples of “no theory” in our selected articles. However, we believe that it is important to acknowledge that papers that do not use any theory do exist. For example, papers that do not use theory *per se* may still lead to theory. They may take a grounded theory approach, whereby they do not cite any existing theory but rather attempt to build theory from empirical data. This could mean that the “talking back” to the question may be in the form of a proposal of a theory. However, this theory is not employed in any way by the authors, and therefore does not fall under the purview of our examination. It should instead be seen as a product of research: a knowledge

contribution. Finally, we should note that the concept “no theory” is difficult to operationalize. Is the inclusion of a common concept – design thinking, for example – minus any references still the use of theory, or not? Throughout our study, we have tried to make such judgments to the best of our abilities, and have tried to apply these judgments consistently.

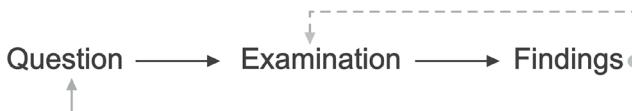


Figure 1 The “no theory” model.

Theory as the Object of Study

In this model, a theory – or some aspect of a theory – drives the research question (see [Figure 2](#)). This could be restated as “the question is about the theory itself.” Once the researchers formulate a question, they proceed to the examination stage. This stage might entail empirical or analytical research, or it could take the form of scholarly reasoning or thought experiments. This stage yields a potentially wide variety of findings whose nature is tightly coupled with the nature of the examination. In other words – empirical research is likely to yield findings of a different kind than a thought experiment. Of central importance for our question of how theory is used is the way in which these findings talk back – or not – to the framing theory and question.

In this model, findings can result in a “theory prime,” which can be thought of as a revision or iteration of the initial theory. Moreover, when theory is the object of study, findings are necessarily in dialogue with the theory.

We found several examples of this model in our corpus. In most cases, it was quite straightforward to identify theory as an object of study, since authors tended to make claims about the contribution of the paper as a revision, extension, or modification of an existing theory. For example, in their work on the FBS framework, Cascini et al. claim that, “This paper proposes an extension of Gero’s [FBS] framework aimed at representing Needs and Requirements and their relationship with the Function, the Behavior and the Structure of an artifact.”²³ We can see parallels in Oh et al.’s text on design critique in architecture studios. “In this paper, through a review of publications that are concerned with the architecture design studio as well as other areas of design, we identify a basic set of factors that enable us to articulate the variables that affect the practice of critiquing in design studios.”²⁴ Cascini et al. build on an existing theory of designing, and Oh et al. could be interpreted as formalizing a theory of critique in design studios.

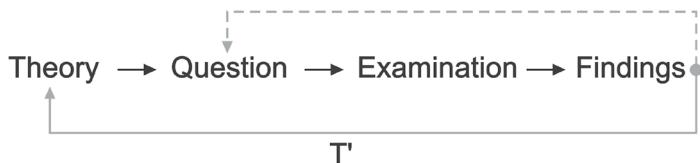


Figure 2 The “theory as object” model.

Theory as a Contextual Tool

In this model, researchers start with a research question (see [Figure 3](#)). Theory is used as a tool for contextualizing or situating the research question within a particular discourse. Theory does not in any significant way change the question, but it does result in “position taking” relative to other questions and existing research. It is not always the case that the author appeals to theory per se. In many cases, the knowledge object that the researchers reference may be called “theories” or “models” or even in some cases just “ideas” “concepts” or “perspectives,” among

²³ Gaetano Cascini, Gualtiero Fantoni, and Francesca Montagna, “Situating Needs and Requirements in the FBS Framework,” abstract, *Design Studies* 34, no. 5 (2013): 636, DOI: <http://doi.org/10.1016/j.destud.2012.12.001>.

²⁴ Yeonjoo Oh, Suguru Ishizaki, Mark D. Gross, and Ellen Yi-Luen Do, “A Theoretical Framework of Design Critiquing in Architecture Studios,” abstract, *Design Studies* 34, no. 3 (2013): 302, DOI: <http://doi.org/10.1016/j.destud.2012.08.004>.

25 Hannay, Sjøberg, and Dybå, “A Systematic Review of Theory Use,” 87–107.

26 Shoshi Bar-Eli, “Sketching Profiles: Awareness to Individual Differences in Sketching as a Means of Enhancing Design Solution Development,” *Design Studies* 34, no. 4 (2013): 476, DOI: <http://dx.doi.org/10.1016/j.destud.2013.01.007>.

27 Michael Leitner, Giovanni Innella, and Freddie Yauner, “Different Perceptions of the Design Process in the Context of DesignArt,” *Design Studies* 34, no. 4 (2013): 494–513, DOI: <http://doi.org/10.1016/j.destud.2013.01.006>.

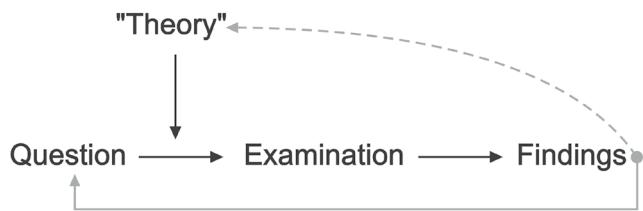
28 Gabriela Trindade Perry and Klaus Krippendorff, “On the Reliability of Identifying Design Moves in Protocol Analysis,” *Design Studies* 34, no. 5 (2013): 612–35, DOI: <http://doi.org/10.1016/j.destud.2013.02.001>.

others.²⁵ Once the question has been contextualized, the examination proceeds. The examination yields findings and, in this model, findings can (1) talk back to the original framing question, and (2) either talk back to the contextualizing theory, or not.

It could be argued that any research finding derived from a question that has been positioned by theory inevitably talks back to the theory. But it is not clear that this relationship manifests itself in writing. It may not be of interest to the researcher to engage with the contextualizing theory, since that was never the purpose or intent. It is also the case that if a researcher wants to talk back to theory, then they must be more deliberate in positioning their work – by making an effort to form a more coherent understanding of existing theory. If the authors position their work by referencing different sources without forging strong relationships or connections with those sources, then the task of “talk back” becomes more difficult, since there is no coherent theory to address.

Most – but not all – of the texts in our corpus contain examples of theory as a contextualizing tool. Bar-Eli’s paper, “Sketching Profiles,” is one example. The author writes, “Researchers such as Sezgin, Stahovich, and Davis (2006), Sezgin and Davis (2008) and Plimer and Apperely (2004) developed a user interface for design that feels as natural as paper.”²⁶ Similarly, Leitner et al. begin their paper on DesignArt using theory as a contextual tool. They write, “There is a growing group of design practitioners who operate around the fields of conceptual (Schouwenberg & Staal, 2008) and critical design (Zimmerman, Forlizzi, & Evensen, 2007). The body of work that is being produced aims to challenge assumptions and offer a social critique of the world and design itself: it is this field that journalistically and academically can be referred to as DesignArt (Coles, 2005, 2007; Poyner, 2005).”²⁷

Figure 3 The “theory as contextual tool” model.



Theory as a Shaping Tool

When theory is used as a shaping tool, a research question is posed and put into a dialogue with existing theory (see Figure 4). The outcome of this dialogue is a new question or set of questions, which we call question prime. Once these new questions emerge, the researchers proceed to the examination stage and, ultimately, to findings. Findings are then put into dialogue with question prime and (potentially) with the shaping theory. But in most cases, the findings do not talk back the shaping theory at all. They primarily result in (1) answers to the revised question or (2) descriptions of possible directions for future inquiry.

For all the models where theory is not the object of study it might make sense to distinguish robust talk back from other kinds. By “robust talk back,” we mean talk back resulting in a changed theory. In contrast, less robust talk back could manifest in writing about the value or utility of a theory without exploring the implications of such writing for the theory itself.

Perry and Krippendorff provide an example of theory as a shaping tool when they write, “This paper discusses issues and ways of measuring the reliability of segmenting verbal protocols of design activity, a central focus of design research.” They identify the theoretical object “design moves” in the abstract, but amplify its role in a subsequent section of the paper. “The present study uses the qualitative concept of ‘design moves’ as the criterion for unitizing/segmenting transcripts of design processes....”²⁸



Figure 4 The “theory as shaping tool” model.

Theory as an Analytical Tool

In this model, theory is used as a tool for analyzing and interpreting findings (see Figure 5). The results of this analysis could be said to yield findings prime. These results then talk back to the original question, and either to the analytical tool or not. Even as an analytical tool, theory in this model also has a contextualizing function, in the sense that the theory chosen for analytical purposes also reflects the researcher’s position and aim.

Oak exemplifies the use of theory as an analytical tool throughout her paper on reported speech.²⁹ A particularly salient example occurs when she writes, “The location of the registrar’s words … immediately after the specific derisory term ascribed to the crematorium (‘chicken hut’: as spoken in repetition by the architect in line 3), is [significant] since, by placing this particular instance of self-quoted speech after the negative judgment, the registrar indicates that such disapproval is open to negotiation. That is, this ‘chicken hut’ assessment is a view held by others but not necessarily shared or reinforced by her (Clift & Holt, 2007; Drew, 1998).”³⁰ Her concluding point is an instance of findings prime, which is achievable through the application of theory as an analytical tool to a set of preliminary findings.



Figure 5 The “theory as analytical tool” model.

Theory as a Methodological Tool

As a methodological tool, theory shapes the examination stage (see Figure 6). One can imagine many examples of theory used as a methodological tool. For instance, a philosophical examination of the nature of design from a pragmatist perspective informs the kinds of questions one would ask as well as how one might go about answering those questions. Critical theory informs a particular kind of research design. Narrative theory informs particular kinds of data collection. And there are many others. In this model, the findings talk back to the original research question, and – as with other models – the findings potentially talk back to the theory.

Vallet et al. explicitly link their examination to theory when they write, “We chose to carry out participant observation in an academic context to match our theory driven research question. The controlled conditions of a lab experiment allow us to focus on the eco-design activity without the bias of real-life constraints.”³¹ Of course, theory as a methodological tool need not be the same as the theory undergirding the research question. Vallet et al. perhaps manifest stronger cohesion between types of theory use than other papers. While Grierson does not necessarily align the different theories she uses in her paper, her paper manifests the use of theory as a methodological tool. She writes, “Blessing, Chakrabarti, and Wallace’s (2009) Design Research Methodology was used. It was beneficial in adding rigor to the work through a requirement for a deeper understanding of phenomenon via focused descriptive studies.”³²

In this section, we have thus far presented six models describing how theory was used in written texts published in *Design Studies* during the 2013 calendar year. Authors used theory as an object of study, a contextual tool, a shaping tool,

²⁹ Arlene Oak, “‘As You Said to Me I Said to Them’: Reported Speech and the Multi-vocal Nature of Collaborative Design Practice,” *Design Studies* 34, no. 1 (2013): 34–56, DOI: <http://doi.org/10.1016/j.destud.2012.08.002>.

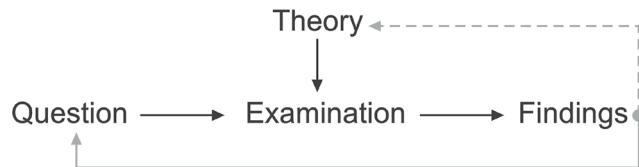
³⁰ Ibid., 48.

³¹ Flore Vallet et al., “Using Eco-design Tools: An Overview of Experts’ Practices,” *Design Studies* 34, no. 3 (2013): 352, DOI: <http://doi.org/10.1016/j.destud.2012.10.001>.

³² Hilary Grierson, “Detailed Empirical Studies of Student Information Storing in the Context of Distributed Design Team-based Project Work,” *Design Studies* 34, no. 3 (2013): 382.

a methodological tool, and an analytical tool. Papers using no theory were absent from our corpus.

Figure 6 The “theory as methodological tool” model.



Preliminary Categorizations

In light of these models, we can ask how the papers in our corpus use theory? To which model(s) do they adhere?

Table 1 illustrates our interpretation of how each paper in our corpus uses theory. It is obvious that most texts use theory in multiple ways. For instance, several papers use theory both as an object of study *and* as a contextual tool. Where there seemed to be a combination of types of use, we distinguished “primary” from “secondary” types. A solid black dot indicates that a particular type of theory use is primary. We considered a type of use to be primary if (1) it was essential in framing the paper, or (2) we found *more* evidence for its presence within the text.

- 16 of the 32 articles used theory as an object of study. 14 of these 16 used it primarily as an object of study. Only two did not.
- Overall, 27 of the 32 articles used theory as a contextual tool. 12 of these 27 used theory primarily as a contextual tool.
- Nine of the 32 articles used theory as a shaping tool. Six of these nine used it primarily as a shaping tool.
- Seven of 32 articles used theory as a methodological tool – none of these seven used it primarily as a methodological tool.
- Finally, 11 articles used theory as an analytical tool, and only two of these 11 used it primarily as an analytical tool.

Discussion

Our models reflect the different ways researchers make use of theory beyond the commonly referenced uses of explanation, generalization, prediction, and the like. Theory can be used to motivate inquiry, contextualize research, shape research questions, and guide methodology and analysis.

During the process of developing and applying the models, we generated some questions about the current state of theory use in design research. It is of course possible to see the potential application of our models in other research venues, but we limit the scope of our claims (and questions) to our corpus of one year’s worth of articles published in *Design Studies*. As such, we do not frame our approach or findings as an attempt to provide answers to questions about theory use in research in general. Nor do we claim that our findings represent design research in any definitive way. Our findings – at most – represent a subset of the field. However, we are convinced that our approach creates possibilities for asking new kinds questions about the use of theory when it comes to design research writ large.

For instance, based on the results of our analysis, we can ask questions such as: why is theory used in some ways more than others? Why are some combinations of models more frequent than others? But we can also ask more complex questions, such as: what does it mean to say that research findings ‘talk back’ to theory? Are there different kinds of ‘talk back’? What is the difference between models where theory is an “internal component” of the process and those where it is an external component? In this section, we will discuss some of these questions.

Table 1. Summary of which papers in our corpus manifest which models.

	Object	Contextual	Shaping	Methodological	Analytic
Aesthetics... (Xenakis)	●	○	○		
Inclusive Design... (Heylighen)	●	○		○	
SMI... (Chandrasekera)	●			○	
Function Propagation (Crilly)	●	○			
Refine Variety Metric... (Verhaegen)	●	○	○		
Affordance (Still)	●	○			
Theoretical Framework... (Oh)	●	○			
Capability... (Dong)	●	○			
Design Thinking... (Goldschmidt)	●	○			
Problem Solution (Wiltschnig)	●				
Situating Needs... (Cascini)	●				
Wicked Problems... (Farrell)	●	○			
Expert Representation... (Fu)	●	○	○		
Design Cognition... (Dong)	●	○	●		○
Precedents... (Stenbel)	●			○	○
Soundscape... (Fowler)	●			○	○
Cognitive Strategies (Ozkan)	●				○
Digital Sculpting... (Alcaide-Marzal)	●				○
Synchronous... (Rahman)	●				○
Inclusive Design... (Herriott)	●				
Sketching... (Bar-Eli)	●				
Different Perceptions... (Leitner)	●				
Analyzing Creative Behavior... (Snider)	●				●
Framework... (Halskov)	●				
Templates... (Cheong)	●		●		
Analyzing Product-Service... (Bertoni)	●		●		
Eco-Design Tools... (Vallet)	○	○	●		○
Comparing Activity... (Cash)			●		
Reliability... (Perry)			●		
As You Said... (Oak)	○	○		○	●
Initial Mental Representation... (Bjorklund)		○		○	○
Empirical Studies... (Grierson)		○		○	○

Why Is Theory Used in Some Ways More than Others?

Our preliminary results indicate a prevalence of texts using theory as an object of study and as a contextual tool. How might we account for this pattern?

³³ Bruce Archer, “The Nature of Research,” *Co-Design Journal* 2, no. 11 (1995): 6–13; David Durling, “Discourses on Research and the PhD in Design,” *Quality Assurance in Education* 10, no. 2 (2002): 79–85.

³⁴ Karl Popper, *The Logic of Scientific Discovery*, 2nd ed. (London: Routledge, 2002).

As with most scholarly venues it is necessary for the researcher to demonstrate knowledge of related work. Such knowledge warrants authorial claims of interest or novelty, and serves as evidence of one’s overall qualifications to contribute knowledge to a field. In this way, to engage in an ongoing discourse by referring to theory could be seen as a way to distinguish legitimate contributions from illegitimate ones or, in other words, authentic contributions from inauthentic ones.

It is also necessary for a researcher to justify or provide reasons for their research projects and the approaches they take. This points toward another possible answer to the question of why theory is used quite often as a contextual tool. By referencing existing research – and thus contextualizing their own – authors do not have to explain in as much detail the reasons behind their research project, or the approach itself, since these have potentially been established or anticipated by others.

Taken together, these two explanations may account for why theory as a contextual tool appears so frequently in our corpus. But it goes without saying that frequency does not equal necessity; authors do not have to use theory as a contextual tool. After all, a few of the articles in our corpus apparently did not use theory as a contextual tool. Yet they were still published. Of these five articles, we might ask: what does it take for a text that *does not* use theory as a contextual tool to count as legitimate, valid, or authentic? How do the authors of such texts justify or give reasons for their work?

If we accept the claim that theory as a contextual tool bolsters implicit claims to legitimacy, validity, or authenticity, then we might also perceive a great deal of value in using theory as a contextual tool. This does not mean that theory as a contextual tool is inherently more valuable than, say, theory as an analytical tool. And our intention here is not to argue for the value of one kind of theory use over another. But we do want to draw attention to *perceived value* as a potential answer to the question of why theory is used in some ways more than others.

If using theory as a contextual tool increases the likelihood of publishing, then perhaps it is more likely that theory will be used as such. If using theory as an object of study seemingly leads to more interesting or novel approaches to conducting research, then perhaps it is more likely that theory will be used as such. If using theory as an analytical tool seemingly leads to a novel interpretation of empirical results, then perhaps it is more likely that theory will be used as such.

However, our findings suggest that authors *do not* perceive a great deal of value in using theory as an analytical tool or as a methodological tool in their written texts. Only two articles use theory primarily as an analytical tool, and no articles use theory primarily as a methodological tool. We find this quite surprising. First, using theory as an analytical and/or methodological tool is commonly taught in research courses. Most PhD students are trained in research methodology.³³ This includes both the practical or “mechanical” application of methods as well as the more philosophical and theoretical underpinnings that shape different approaches. Second, taken to its extreme, following Karl Popper,³⁴ we might say that all research design, observation, and analysis is “theory-laden” – that is, that there is no way to approach, capture, or analyze data *without* the influence of some specific theoretical lens. This is perhaps why PhD students are trained to analyze data through theoretical lenses – to apply theoretical perspectives in analysis. Why then do we see so little use of theory as a methodological and/or analytical tool in our corpus? Is this unique to design research? Or is this common across fields?

Our intent is not to suggest that authors *do not* use theory as an analytical or methodological tool – only that they frequently do not write about it. If researchers in fact use theory as an analytical tool, then how do we account for the gap between use and writing? And if they really do not use theory as an analytical tool, then perhaps we need to ask why not?

Do the Findings Talk back to Theory?

It seems as though not all research findings are put into dialogue with theory. Yet there exists in each model the potential for findings to talk back to theory. Why do some findings – but not others – talk back to theory?

One possible answer is that findings talk back to theory if the researcher is actively engaged in theorizing, as is probably the case when theory is the object of study. If the purpose of a text is to build upon, revise, or critique existing theory, then the findings will naturally take the form of talk back. But if theory is a methodological tool, for example, then the research questions are not about theory and perhaps there is no need or desire for that kind of talkback.

However, there always exists the potential for talkback in the form of an examination of the value of theory as a methodological tool. For example, an author might acknowledge the ways in which theory as a methodological tool lends itself towards particular analyses and outcomes. They might acknowledge the limitations of a theory as a methodological tool in light of their findings, which we would consider to be talkback.

While this kind of talkback is interesting – and potentially useful to the community of design researchers – it is not necessary. The point of a publication that makes use of theory as a methodological tool is not necessarily to assess the value of that theory. There is more often than not a different primary question. But what about theory as a shaping tool? In our corpus, why is there very little talkback between findings and theory as a shaping tool, when theory as a shaping tool plays such a central role in shaping the research project?

An important distinction between theory as an object of study and “shaping theory” is the relationship between theory and the question. Recall that when theory is the object of study, the question is *about* that particular theory. When theory is used as a shaping tool, it does not result in a question *about* the theory. For instance, Perry and Krippendorff establish a research project around “measuring reliability of segmenting verbal protocols of design activity....”³⁵ The authors use the “qualitative concept of ‘design moves’” to *reshape* their research question.³⁶ But their question does not take the concept of design moves as an object of inquiry. “Design moves,” as an object, is not built upon, revised, or critiqued, as it would be if the theoretical concept were an object of study.

It has been argued elsewhere³⁷ that talkback to theory can be inferred in an argument, even if it is not explicitly stated in the text. We might call this “tacit talkback,” where the talkback to theory must be interpreted by the reader rather than made explicit in the text. When we ask whether findings talk back to theory, we are not asking about tacit talkback. We are asking about explicit talkback made manifest in the text since we believe, in alignment with Friedman, that “explicit and articulate statements are the basis of all theoretical activity.”³⁸ Tacit talkback, in our view, moves away from theoretical activity, which is not to degrade its utility or value.

We find the results of our analysis interesting since they reveal patterns of theory use, development, and theorizing that are otherwise difficult to see. To what extent our results say something specific about design research and whether it is less engaged in theory development than other disciplines is impossible to know without conducting a comparative study.

Research does not have to lead to theory development. New observations and discoveries can also be deemed meaningful research contributions. And when it comes to design research, it has been argued that a design or prototype can be a knowledge contribution in itself.³⁹ However, we suspect that design research, as a result of the way theory development is done, is less successful if the purpose is to accomplish any form of cumulative knowledge production.

³⁵ Perry and Krippendorff, “Reliability of Identifying Design Moves,” abstract, 612.

³⁶ Ibid., 614.

³⁷ Hannay, Sjøberg, and Dybå, “A Systematic Review of Theory Use,” 87–107.

³⁸ Friedman, “Theory Construction,” 507–22.

³⁹ Mikael Wiberg and Erik Stolterman, “What Makes a Prototype Novel? A Knowledge Contribution Concern for Interaction Design Research,” in *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational* (New York: ACM, 2014), 531–40, DOI: <http://doi.org/10.1145/2639189.2639487>.

⁴⁰ Donald A. Schön, "The Design Process," in *Varieties of Thinking: Essays from Harvard's Philosophy of Education Research Center*, ed. V.A. Howard (New York: Routledge, 1990), 110–41.

⁴¹ Ibid.

Is Theory an "Internal" or an "External" Component?

Three of our models position theory as an external element relative to the other key elements of a research publication. By "external," we mean that the theory sits outside the *core path* from question to examination and findings. We can contrast "externally" positioned theory to "internally" positioned theory, which sits inside the path. Two of our models position theory as an internal element: theory as object of study, and theory as shaping tool. What does theory as an internal element imply about its relationship with other key elements? What does its position as an external element imply? One way to explore answers to these questions is to consider research publications as figurally complex artifacts.

Schön defines figurally complex artifacts as those "where addition or subtraction of one element changes the functional meanings of other elements with the result that the [text] must be considered different as a whole."⁴⁰ He exemplifies figural complexity with the activity of adding or subtracting a note to/from a melody or adding "a patch of color" to a painting.⁴¹ In both cases, the partial change requires a change in considering the whole. The same is true of a publication. Theory is a key element in our models. And so the addition, removal, or modification of theory has implications for the whole text.

Perhaps some elements are more readily changeable and varying in their impact on the whole text. The positionality of a theory – in other words, its internal or external position relative to other key elements – might result in greater or lesser impact on the text as a whole. For example, theory as a shaping tool occupies an internal position relative to other key elements; modifying it modifies the other three key elements: question, examination, and findings. But theory as an analytical tool occupies an external position relative to the other key elements; modifying it modifies only the findings, and leaves the question and examination "intact." This perhaps implies that internal theories are more pervasive in a text than external theories, where "pervasiveness" describes the breadth and depth of a theory's impact on the other key elements.

One might conclude that, since external theories potentially have lesser impact on other key elements of a text, this means they can be treated with less care and attention. We can explore this conclusion with contextualizing theories in mind.

Contextualizing theories are externally positioned relative to the other key elements in a text, and they are also – arguably – more flexible than other types of theory. They can be added and removed ad hoc with seemingly little consequence for other key elements. Unlike adding a note to a melody or adding a patch of color to a painting, citing an additional piece of literature seemingly does little to change the whole text in an obvious way, especially if the citation amounts to little more than a name or number in a long sequence of citations. It is even possible to imagine cases where contextualizing theories are added to publications days before submission deadlines with no consideration given to how these late additions impact the other key elements.

Even if contextualizing theories seemingly have lesser impact on the other key elements in a text, this does not mean they should be treated with any less care and attention than other theories with more apparent textual impact such as methodological or analytical theories, both of which are also external. The addition or subtraction of contextualizing theories has the result that the text must be considered *different as a whole*.

We have discussed, for instance, the ways in which contextualizing theories demonstrate knowledge, and legitimate or authenticate knowledge contributions. Demonstrating knowledge and legitimating contributions do not necessarily prescribe changes or modifications to other key elements of the text. But they certainly change the framing of the other key elements. Not treating contextualizing

theories with care and attention – what we might call misuse – potentially calls into question the authority of the researchers as well as the legitimacy of their contribution. This is similar to the issue Ken Friedman identifies in his critique of “scholars who have not read the works they cite.”⁴²

Our models help illustrate the ways in which external theories may seem to have less impact on the other key elements of a text. But this seemingly lesser impact misrepresents the important role of external theories to the text as a whole.

⁴² Ken Friedman, “Research into, by and for Design,” *Journal of Visual Art Practice* 7, no. 2 (2008): 155.

Reflections and Contributions

In this paper, we set out to explore the current state of theory use in published design research texts. We examined one year’s worth of publications from one of the most prestigious journals in the field, *Design Studies*, and we developed six models to represent the ways in which these publications could be said to use theory. The six models include no theory, theory as the object of study, theory as a contextualizing tool, theory as a shaping tool, theory as a methodological tool, and theory as an analytical tool. We suggest that these models (1) reflect our deeper understanding of the structure of written texts in *Design Studies*, (2) establish a path towards more intentional theory use in future design research, and (3) reaffirm the value of our initial question as a framework for studying theory in the design research community.

The Structure of Written Texts

A deeper understanding of how theory is used in design research cannot be achieved through speculation alone. While researchers have speculated about the ways in which theory *can* or *should* be used, there needs to be complementary inquiry into the ways it is *actually* used. One way to conduct this inquiry is – as we have done – to assemble a small corpus of written texts from a journal and analyze for theory use. This approach yielded several insights for us about the way in which written texts are structured with particular attention given to “how” and “why” theory fits within that structure. Our six models provide preliminary answers to both the “how” and “why” questions of theory use, and they provide an understanding of the structure of written texts that we believe has not been articulated before. The models serve other, potentially more useful purposes as well, in that they open a new space for researchers (1) to ask questions about theory use, and (2) to become more intentional in their own theory use.

Intentionality

After our analysis, we are convinced that a deeper understanding of how theory functions in written texts can lead to more intentional theory use. And more intentional theory use could potentially lead to greater systematicity and avoidance of pitfalls in at least three different ways. First, researchers can be more systematic in their evaluation, selection and application of particular theories, as some theories may be better suited for certain functions than others. Second, researchers can avoid the mistake of treating contextualizing theories with less care and attention simply because they seem to have less impact on the text as a whole. Finally, more intentional theory use involves – in part – attending to the way in which findings talk back to theory. The way in which findings talk back to theory has implications for the theory itself. The implications might be utilitarian. For instance, how or why was this particular theory useful to the researchers? The implications might also be revisionary. For instance, in what ways did a particular theory prove itself limited? What implications do these limitations have for future research both in terms of theory development and/or theory construction?

⁴³ Hannay, Sjøberg, and Dybå, “A Systematic Review of Theory Use,” 87–107; Tracy Hall et al., “A Systematic Review of Theory Use in Studies Investigating the Motivations of Software Engineers,” *ACM Transactions on Software Engineering and Methodology (TOSEM)* 18, no. 3: 10.

Research Framework

While much work has been done on theory development, construction, and evaluation, there appears to be less inquiry on the practical, everyday use of theory in written texts. We believe that our analysis is one of only a handful of studies examining the practical, everyday employment of theory in scholarly publications.⁴³ And we are convinced that there needs to be more. Based on our outcomes, we believe that we have demonstrated the value of the question, “How are theories used in written texts in design research?” as a valuable departure point for future research.

We answered this question with six models, but we can imagine how this question might yield a variety of different approaches. For instance, one might aggregate a much larger corpus of texts, develop a priori codes to describe different “kinds” of theory use, and train coders to conduct a rigorous content analysis. This would surely yield interesting and useful results for the design research community. But the question also lends itself to more philosophical approaches where, for example, the researchers might interrogate what it means by using theory and arrive at conclusions quite different from ours.

If design as a discipline aspires to establish a robust, legitimate identity as a research domain then we suggest that it needs to consider the question of practical, everyday theory use carefully and attentively from multiple angles.

Conclusion

Research leads to publications describing the project, process, and outcomes in concert with an argument in support of those outcomes. The way researchers integrate and use theory in their writings seems highly complex while at the same time possessing concrete and practical implications. We see the question of how theory is used in design research in particular as interesting, important, and, notably, underrepresented in the existing literature. To address the question, we had to develop a working definition of theory, a means of detecting theory use in written texts, and a way of modeling that use.

We preliminarily define theory as an object that can be understood as a tool, a reference, and as a knowledge contribution. This definition provided us with a lens through which to look at a small corpus of design research publications in an attempt to understand how theory is used. We leaned heavily on the notion of theory as a tool since this understanding keys us into the purposiveness with which researchers invoke theory in their writings. Our analysis informed our development of six (preliminary) models to represent the different ways in which we perceive theory use in our corpus. The models include no theory, theory as an object of study, theory as a shaping tool, theory as a contextualizing tool, theory as a methodological tool, and theory as an analytical tool.

We believe we have demonstrated that the models themselves can be applied as analytical tools geared towards answering important questions about the current state of practical, everyday theory use in design research. Their application leads to interesting results and inevitably to more questions. We hope that this research contributes to a wider understanding of how design research can and should present its relationship to theory in its written texts.