

The Thinking Behind Design

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Abstract

What designers do—the thinking behind design—is not fully understood. Design is still often viewed as a black art rather than a rigorous discipline. Designers themselves have difficulty explaining how they make the connections that lead to the final solution and why those judgments are valid. While good design work can be done without understanding these forces, it is my hypothesis that the more designers know about the forces involved in design thinking and process, the better they will become as designers and the better they will be able to communicate design to others. This paper examines design as an approach to solving problems and what makes it different from other approaches. It examines design thinking as desire for a particular outcome, a philosophic viewpoint, a conversation, imagination, reason, judgment, wisdom, and a skill. And it explores the nonlinear, dialectical, and unique nature of the design process. Finally, it suggests that designers can view the development of understanding and ability as a design endeavor itself, and that it is possible to design oneself as a designer. Though the audience and focus is on designers, it is my belief that a better understanding of design along with increased ability to communicate design's rigor and value will ultimately benefit and advance the discipline as a whole.

Introduction

It is difficult for designers to explain what they do. In addition, those unfamiliar with design do not understand the rigor and logic of design thinking and process. This paper explores the nature of design behind the actions and the methods to help understand and improve design ability and communicate the value of design to others.

Inspiration

Two years ago, I began my graduate education as an interaction designer. While I had been practicing design in certain aspects of my work as a web developer before that, I did not think of myself as a designer, nor did I give much thought to the nature of design in general. As a graduate student, I was thrown into design projects and muddled my way through the design process employing newly learned methods. Everything seemed to be going well.

Then one day, in the middle of a project, at the end of a meeting where the team decided next steps and concept direction, I felt uneasy. I could not directly connect our research and previous analysis with our decisions moving forward. I imagined the design process as linear. The path behind us did not go very far. In the distance there was evidence of a previous path, but it ended abruptly. There was no discernable line between our previous efforts and our current position. Further, ahead of us, there was no path to follow, no way of knowing if we were going in the right direction. From an analytic standpoint, we were lost. However, it *felt* like the right direction.

What troubled me that day was the apparent illogical, nonlinear nature of design both in thinking and in process. I realized that while I was able to continue muddling my way forward in the direction that seemed right, I had no idea why it made sense to do so. I could explain what I was doing, but not how I was able to do it.

Was it intuition? Innate ability? Talent? Magic? I had no answer. As an aspiring designer, it seemed important to answer these questions, not only for myself, but also so that I might communicate the logic and rigor of my practice to others. There appeared to be other forces involved beyond the framework of the design process and the methods I had been taught. Something was missing.

This feeling inspired the research on which this paper is based. It led to questions about the nature of design separate from explicit methods and process. It is my attempt to understand the rigor and value of design for myself and to communicate it to others. But this is not meant to be strictly for me. My hope is that other designers can relate and use it to begin to understand the nature of design for themselves.

A Need to Understand Design

Most designers cannot articulate what they do (Lawson, 2006). They can describe methods and identify the steps they took along the design process. But try to get them to explain how they decided that the final solution was the right solution and see what happens.

If you understand the nature of design, you will notice that the latter is a trick question. There are no right solutions in design, only ones that are more preferred. If you are new to design this may be troubling. No right answer? How do you know if what you are doing is correct? This is one of the questions that troubled me as well. To understand why there is no right answer, it helps to understand the nature of design and design problems.

Design problems are malignant, vicious, tricky, and aggressive. Horst Rittel characterizes these as wicked problems, an idea stemming from a quest for an alternative to a linear, step-by-step model of the design process. Wicked problems cannot be exhaustively formulated, can have many explanations for the same problem, have no immediate or ultimate test, are essentially unique, and are symptoms of another problem. These problems are ill defined. “To find the problem is thus the same thing as finding the solution; the problem can’t be defined until the solution has been found,” (Rittel & Webber, 1973). Similarly, Schön (1983) says design problems must be “constructed from the materials of problematic situations which are puzzling, troubling, and uncertain.” (p. 40) Thus, design problems are uncomfortable and require a high tolerance for ambiguity.

In addition to the inherent ambiguity of design problems, because designers have trouble communicating the logic of their practice, design is often viewed as mysterious, a black art, and irrational. These are all untrue, of course. Design has its own rigor, logic, and discipline. But designers do not understand it well enough to articulate it. If designers cannot say what they do, how are others supposed to understand the nature of design and appreciate it fully?

The goal of this paper is to help designers understand the rigor, logic, and discipline of their design practice. This is not intended to be prescriptive, but to provide insights that will allow designers to explore and understand design for themselves. Therefore, the audience of my paper is other designers, new and experienced, who want to begin to better understand the nature of design—the thinking and the process—to improve design ability and solutions.

Better Yourself, Advance the Discipline

It is my hypothesis that understanding the nature of design can lead to improved design ability. Further, developing such an understanding will enable designers to better communicate what it is that they do to others. This could help correct the misconceptions about the rigor and logic of design and ultimately benefit the discipline as a whole.

Recently, Erik Stolterman, Director, Human-Computer Interaction Design and Professor of Informatics at Indiana University, and coauthor of two of the books referenced in this paper, *The Design Way* and *Thoughtful Interaction Design*, gave a presentation at Carnegie Mellon University that I attended. During his presentation, he acknowledged that designers often do not understand their own discipline. They do not understand the rigor, logic, and discipline of design. Later, in a conversation with him, he acknowledged his belief that understanding the nature of design will improve design ability and solutions.

Two other interesting distinctions he made, which I will refer to in this paper, are between design philosophy and the philosophy of design. I believe it is necessary to understand the relationship between these two, as they relate to the aforementioned objectives of improving the self and advancing the discipline. Design philosophy is the personal design philosophy of the designer. Being personal, it is unique, and connected to the background and experience of the designer. In a way, each designer needs to understand design for himself or herself. This is why I say that this paper is not meant to be prescriptive, but rather a way to begin understanding the nature of design for yourself. Developing a personal design philosophy, which this paper may help designers to do, benefits the individual designer. The communication of design philosophy by designers in aggregate, could create recognizable patterns that provide fodder for the philosophy of design—a view of design that informs the discipline as a whole.

This paper addresses design philosophy as seen from my perspective, but which I believe can help other designers develop their own philosophy. However, this exploration is done with the understanding the design philosophy and the philosophy of design are connected. The development of one affects the other in a cyclical nature that benefits both the designer and the discipline. Therefore, as a designer, if you better your understanding of design, you also help to advance the discipline.

A Note to Interaction Designers

As an interaction designer within a field that is still emerging and struggling to define itself, understanding the core of design seems relevant. People with different backgrounds, many of whom, like myself, do not have a traditional design background, are entering interaction design with a limited understanding of the nature of design, and perhaps are heavily influenced by previous approaches. Löwgren and Stolterman (2004) argue that a more thoughtful approach to design is required with respect to interaction design, as the challenges faced by interaction designers are becoming more complex. However, this paper is not limited to interaction design, as I will be discussing design as an approach, a way of thinking, and the nature of the process, and not prescriptive methods or references to specific design practices.

Design as a Conversation

Finally, I want to introduce Schön's idea of design as a conversation, as it is a theme that will present itself throughout this paper. "Introduce" is probably the wrong word, since his idea was stated a few decades ago. However, I believe it speaks strongly to the rigor of design thinking and process, and thus needs to be reintroduced into our vocabulary. The metaphor of the conversation relates both to knowing what design is for yourself and also what design is as a discipline. This paper, in fact, is a conversation that I hope leads to more conversation: one that designers have with themselves during practice and in reflection; and one that they share with others.

What is design?

Defining Design

To understand the nature of design, it is first worth defining design. This is no small task and a topic that is complex enough to consume an entire book. For the purposes of this paper, I will mention the difficulty of defining design and offer insights from my research that will support my exploration of the design thinking and process.

There is no one universal definition of design, which makes understanding what you do as a designer from a definitional standpoint problematic. The word design itself is problematic. John Heskett highlights the trouble of defining design, a word that can be used as both a noun and verb, by saying, “Design is to design a design to produce a design.” (Heskett) This is both correct and quite useless, but underscores the problem with trying to define design.

Other definitions of design include:

- “The invention of man-made things,” (Jones, 1992).
- “Design is the ability to imagine that which does not yet exist, to make it appear in concrete form as a new, purposeful addition to the real world,” (Nelson and Stolterman, 2003, p. 10).
- “Everyone designs who devises courses of action aimed at changing existing situations into preferred ones,” (Simon, 1996).
- “Design is the human power of conceiving, planning, and making products that serve human beings in the accomplishment of their individual and collective purposes,” (Buchanan, 2001).

For the context of this paper, I will borrow from these and say that design is the creation of what ought to be in the form of an artifact or a service, tangible or intangible. Notice the kinds of artifacts or services produced are not mentioned in my amalgamated definition or in any of the above. This suggests that no matter what kind of design practiced, whether industrial, communication, interaction, or fashion, to name a few, there is a universally binding force. There is commonality to design practice that is the same regardless of the methods used or the particular process. This is what we need to examine to understand the logic and rigor of design.

Design as an Approach

Design is a choice. It is an approach to solving problems where the variables are complex, the data incomplete, and the outcome uncertain. Design is expected to produce unexpected results. This is why words like invention, innovation, and creativity are often associated with design.

There are other approaches to solving problems that are not design. For example, science and art can be viewed as approaches to dealing with problems. Design is not appropriate for all problems. For example, problems that require a repeatable process, the discovery of things in the world that already exist, and empirically proven solutions, may be better suited for a scientific approach.

Schön (1983) argues that our society has been dominated by the other approaches, especially science and analytic thinking. The rise of science and technology produced a movement of Technical Rationality, he states, that aimed to improve the well being of people through the application of scientific theory and technique. It failed, however, to achieve its goals of creating wealth, achieving national goals, improving human life, and solving social problems (Schön, 38). As a designer, recognizing the dominance of scientific approaches to solving problems can help to understand how design is different and appreciate perspectives that view design as irrational.

In *The Design Way*, Nelson and Stolterman (2003) suggest that design is neither art nor science, but its own discipline. With respect to the problems that Technical Rationality attempted to solve and failed at, design offers itself as a powerful approach to tackling these and other complex issues, from user interfaces to social problems. It is an approach that will not yield the answer, because there is no single answer to a design problem, but will produce many appropriate solutions.

Similarly, Cross (2007) argues that in addition to the two dominant cultures of science and humanities, a third culture of design needs more attention. “The ‘third culture’ is not so easily recognized, simply because it has been neglected, and has not been adequately named and articulated,” (Cross, 2007, p. 17). In effect, what Cross is saying is that there already exists a design discipline, albeit a neglected one.

Design has not enjoyed the same level of understanding as other approaches. This lack of understanding means it is difficult for non-designers to appreciate. Educating and developing your understanding of design can help to educate others of the appropriateness and power of design to help improve the status of design as a discipline.

Bringing a design approach to bear on a problem means that a particular way of thinking and process of doing is employed. These two aspects, the thinking and the process, will be a main focus of the rest of the paper.

Personal and Universal

The idea of design being both personal and universal was touched upon earlier. But it bears mentioning again that when defining design it can be thought of as both individual and global, which I am referring to as design philosophy and philosophy of design respectively. Distinguishing the two helps in understanding the difference between defining design for yourself and the discipline of design. Ignorance of the relationship may hinder the individual designer by falsely attributing a personal design philosophy to all of design, and as a result continue to hurt the discipline.

Design Thinking

Like design itself, design thinking is difficult to simply define. It is an approach to finding and solving problems. It is a thoughtful desire to change the world using a combination of aesthetics, ethics, and reason (Nelson and Stolterman, 2003, p. 135). It includes imagination and reason, a combination of convergent and divergent thought, and creativity. Another characteristic is that it requires multiple lines of thought and the exploration of many alternatives, remaining open, and comfort with ambiguity. Design thinking might be thought of as dialectic, or a conversation. It involves design wisdom, judgment, and knowledge. Lastly, design thinking is a skill.

To dispel notions that design is mysterious or a black art, I will address some of the aspects of design thinking that demonstrate its rigor and logic, as well as what distinguishes design thinking from a scientific approach or an artistic approach. By examining the thinking aspects of design, I hope to combat the notions that design is mysterious or a black art and illustrate that the thinking behind design has rationale and logic, even if it is difficult to see. Much has been written about the nature of design thinking. However, it has not made its way into common practice as a way of understanding what designers do, and thus not something designers easily communicate.

Imagination and Reason

Though imagination and reason are not truly independent categories of thought, it is useful to look at them separately to understand design thinking. Design requires both imagination and reason. Imagination is the thinking we do when we fantasize. It may be the act of thinking through a situation that is possible but not actual. The creation of scenarios by designers is a form of imaginative thinking. Imagination is required to envision what the future state might be like. There is no way to deduce that-which-does-not-yet-exist. Certainly, imagination is a part of the design thinking process. Reason is deliberate thought toward an intended end. Lawson (2006) states that reason is reflective thought and problem-solving. Reason usually includes logic, problem-solving, and concept formation.

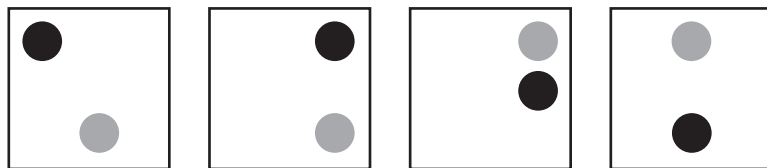
Imagining is drawn from individual experience, making connections in a relatively unstructured way. It is worthwhile to note that though imagination draws from individual experience,

for the purpose of design, it is directed toward solving a real-world problem external to the individual. This means that any imaginative thought will need evaluation by rational thought to validate its relevance to the real-world situation. Lawson (2006) states that the “control and combination of rational and imaginative thought is one of the designer’s most important skills.” (p. 138) From this perspective, being able to develop that skill and the use of such skill, contributes to the argument of the rigor and discipline of design.

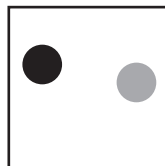
Convergent Thinking vs. Divergent Thinking

Reason and logic are commonly thought to be convergent in nature. Convergent tasks typically require deductive skills with the purpose of arriving at one identifiably correct answer. Conversely, intuition and imagination are known as divergent processes. Divergent tasks require an open-ended approach in search of alternative possibilities where there is no correct answer. Given the nature of design problems, the search for solutions among alternatives, as a whole, design is considered a divergent task.

Convergent task: complete the sequence



Divergent task: what might this represent?



Convergent and divergent tasks, after Lawson, 2006

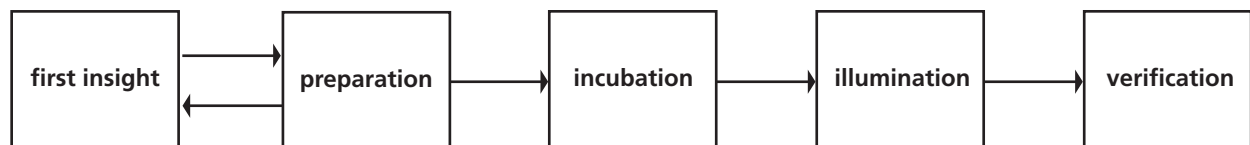
This does not mean that design thinking is not without convergent thinking. There are many parts of the design process during which convergent thinking is required, where logical analysis is needed, and optimal solutions can be determined. “Design clearly involves both convergent and divergent productive thinking and studies of good designers at work have shown that they are able to develop and maintain several lines of

thought in parallel,” (Lawson, 1993). Lawson (2006) suggests that while convergent and divergent thinking are needed by scientists and artists, designers most need the two in equal proportions.

Creativity

Design is considered by most to be a highly creative endeavor. The commonly agreed upon phases of the creative process are first insight, preparation, incubation, illumination, and verification (Kneller, 1965). First insight is a formulation of the problem. In design, this is referred to as problem framing. Preparation is a conscious attempt to solve the problem. Often in design, there is a lot of back and forth being first insight and preparation, as attempts at the solution cause a reformulation of the problem. These first two phases are generally considered to be a period of intense, hard work.

Following this initial period is the more relaxed incubation phase. This is a period where no conscious effort is put toward solving the problem, though some speculate that the mind continues to work on it unconsciously. Illumination is considered the emergence of a solution almost out of thin air at an unexpected moment. And finally, verification is when the idea is tested and developed.



Five Phases of the Creative Process, after Kneller, G. F. (1965)

In design, these phases are not so separate. But this provides a picture of the creative process. In relation to the argument of rigor in design, it is important to note that the creative process is not easy. Framing the problem and devising a solution requires much hard work and discipline. And illumination only tends to occur after a period of long struggle. Lawson (2006) states, “good designers tend to be at ease with the lack of resolution of their ideas for most of the design process.” (p. 154) From my own experience, I can attest to things often only coming together at the end of the process. Those who desire more order and structure seem to be uncomfortable with such a thinking process.

To deal with the lack of resolution of ideas throughout the design process, designers either generate alternatives or pursue parallel lines of thought. Many alternative solutions may be developed early in the design process, progressively tested and refined until a final solution is chosen. In either case, designers do not simply wait for an idea to appear even if it seems that way. One characteristic of designers that make them valuable and successful at design is the ability to change direction in thinking to generate more ideas.

Parallel Lines of Thought

A common characteristic of design thinking is the ability to sustain parallel lines of thought. This is not simply coming up with a range of options, but simultaneously exploring and detailing multiple alternatives for different aspects of the design situation. This also refers to the parallel development of the abstract concept and the details.

An important point put forward by Lawson (2006) is that parallel lines of thought are possible only if the designer is willing to sustain myriad incomplete and uncertain aspects of a design without trying to resolve them too early in the design process. It might be said that through the development of multiple alternatives that the designer may have conversations between them, which helps to inform the direction he or she should take in response to the conversation with the alternatives.

Design Thinking as a Conversation

In *The Reflective Practitioner*, Schön (1983) suggests that designers reflect in action, combining critical thinking and tacit knowledge in the context of the design situation, and that this conversation forms the rigor of design thinking and process. As mentioned earlier, one of the barriers to understanding the nature of design and communicating it to others is that designers find it hard to explain tacit knowledge. Schön (1983) refers to this as knowing-in-action, the skillful act of doing without prior thought.

However, Schön (1983) notes, we sometimes think about what we do while we are doing it. He calls this reflection-in-action. As an example, he offers a baseball pitcher who finds his groove during the game. This feeling is a reflection on the know-how implicit to the performance, a recognition of the winning habits. In the highly skilled, reflection-in-action can occur so quickly that it is not expressed and thus difficult for others to see and

understand the conversation that took place with the situation that determined the resulting behavior or practice.

Reflection aids designers in dealing with divergent situations or wicked problems. As a conversation with the situation, reflection-in-action poses the question “What if?” and then analyzes the implications of the question. This is similar to the imagination and reason present in design thinking discussed earlier. The “What if?” question imposes an order on uncertain problems that allow designers to move forward. This is often referred to as problem framing. This question and consequence practice “shows how reflection-in-action may be rigorous in its own right, and links the art of practice in uncertainty and uniqueness to the scientist’s art of research” (Schön, 69). The question can be viewed as an experiment, and the implications of that experiment the test of the question that makes it rigorous. If the test fails, a new framing of the problem—or a new experiment—is produced. In this sense, the designer engages in a dialogue with the problem. In answer to the dialogue, the designer reflects-in-action on the problem framing and the implications and alternative explored that are implicit in the actions of doing. The question is posed through the doing, the results of which breed further action as they are reflected upon, always continuing toward a desired solution. Acknowledging the conversation between designer and the situation, Löwgren and Stolterman (2004, p. 23) state that good designers are good listeners and readers of the situation.

Design Judgment

Another argument for being more reflective is to understand more about the activity of judgment in design. Nelson and Stolterman (2003, p. 189) name in particular design judgment, which they define as distinct from other types of judgment in that the outcome uses “one’s own will to pursue desired ends.” Design judgment appears to be a factor unique to design that creates value in design as a pursuit of that which does not yet exist. What we desire to bring into being as designers is a matter of judgment, not of necessity or gained by chance. Rather, judgment is based on will and intention.

Design judgment does not rely on scientific measure to determine an objective or subjective outcome. “Design judgment is the ability to gain insight, through experience and reflection, and project this insight onto situations that are complex,

indeterminate, indefinable and paradoxical. This results in the emergence of meaning and value, through the creation of relationships that cause the appearance of unity, form, pattern and composition, out of apparent chaos.” (189) Design judgment provides a concrete particular understanding within a specific context. Good judgment is determined by the relationship of the outcome to that of the intention.

Nelson and Stolterman (2003) argue that design is about making critical judgments, and that this ability makes good design possible to achieve. They suggest that the process of achieving good design can be improved by treating design as an informed process of intention. This helps counter notions that design is a mysterious process or black art.

Design Knowledge

Design knowledge, or knowledge embodied in the actions of the designer, makes it difficult to articulate decisions throughout the process because the knowledge surfaces intuitively. But it is important to understand where the insights and judgments come from so the answer does not become magic. Design knowledge emerges from a conscious not-knowing (Nelson and Stolterman, 2003, p. 44). The following chart represents the different types of design knowing, and while explaining all of these requires more than I can provide in this paper, it is important to note that design thinking is defined as conscious not-knowing. While there are unconscious and subconscious elements of design knowing, they are balanced by both conscious knowing and conscious not-knowing.

conscious knowing	-	reason
unconscious knowing	-	intuition
subconscious knowing	-	imagination
conscious not-knowing	-	design thinking

Design Knowing, after Nelson and Stolterman, 2003

Design Wisdom

Perhaps another way to think about the rigor and logic of design is to explore what is meant by design wisdom. Nelson and Stolterman (2003, p. 18) make a distinction between what we commonly think of as the wisdom of reason and wisdom of the

knowing hand. The former is often viewed as the summation of data, translated into information, which is then transformed into knowledge. The knowing hand, they say, is connected to the wisdom of reason, but also requires integration with observation, reflection, imagination, action, and production.

Another characteristic of design wisdom is its ability to shift between the analog experience of life and an analytic perspective of the world and then back. This is the ability to hold in mind and have a conversation between the whole (analog) and the parts (analytic) of a situation. Again, we see an analytic side of design, but this time paired with the analog, which is necessary so that “life continues to be experienced as a whole,” (Nelson and Stolterman, 2003, p. 19).

Design Thinking as a Skill

As a final note on design thinking, and although in many ways this was suggested in the earlier sections, I want to explicitly point out that design thinking is a skill. As such, it can be developed like any other skill. If you want to be a good designer, you must understand and develop the skill of design thinking just as you would develop the skill of drawing. This paper serves to help understand design thinking as a skill rather than a mystery to provide designers with a foundation for developing and further exploring this skill.

Design skills can be developed by reflecting critically on earlier designs and actions. They can also be increased by critiquing existing designs. Each time a designer critiques his or her work or the work of others, the sense of the relationship of the details, or the parts, and the whole are further developed.

Summary

Like design itself, design thinking is complex. Any simple definition leaves a lot to be explained. Design thinking is a desire for a particular outcome, a philosophic viewpoint, a conversation, imagination, reason, judgment, wisdom, and a skill. It is thought around an approach to solving highly complex and ambiguous problems that have no absolute answer.

Design Process

While there is a framework for the design process that designers can follow, it is not a prescriptive how-to guide. One reason I felt a disconnect between actual design work and the process I had learned was that the design activity did not proceed as linearly as a cursory look at the process suggests. In fact, the design process is “too complex and diverse to fully describe in any universal or general way,” (Löwgren and Stolterman, 2004, p. 15). However, designers need some plan, description, or model of the design process to organize and evaluate their work. To use any theory or model of the design process, designers need to be critical, rather than adopting it completely.

In this section, I will examine the design process and activity to show that while nonlinear, the design process has order. Understanding the nature of design process will help designers in understanding the nature of design and their relationship, or role, in regards to the process.

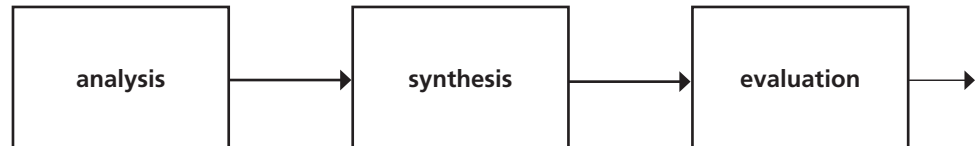
Further, it seems like designers and nondesigners can be led through the design process with good results. My early experience as a designer confirms this, as I did not understand the nature of design but did grasp the framework and methods enough to be successful. However, a better understanding of the process sheds light on the nature of design itself. This knowledge can help to improve the ability of the designer and enhance the potential of delivering good design solutions. Again, my hypothesis is that the more designers understand the nature of design, the better they understand how to increase design ability, understand what they do, and communicate that to others.

Fundamental Aspects of the Design Process

Certain aspects of the design process do not relate to a particular phase or activity. These aspects are present throughout the design process. One fundamental aspect is the recurrent leap between the details and the whole. Designers constantly jump back and forth between abstract ideas and the constraints of reality. Another fundamental aspect is that the design process is characterized by dilemmas. Dilemmas do not have one solution. Design situations, therefore, have no absolute solution to be found. “Instead, a dilemma can only be resolved by a creative leap, by transcending the limitations of the present,” (Löwgren and Stolterman, 2004, p. 17). Thus, creative thinking is another fundamental aspect of the design process.

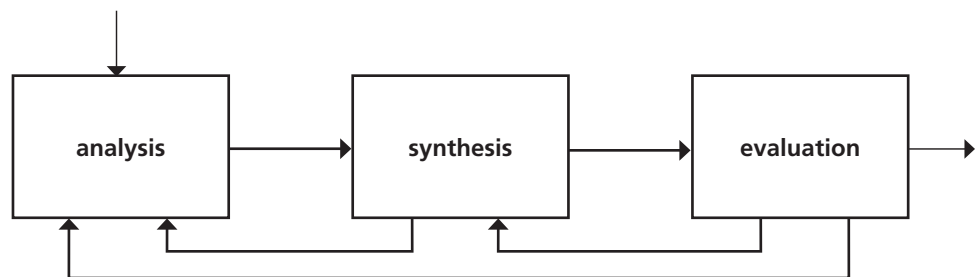
Nonlinear Process

One simple model of the design depicts the process as three parts: analysis, synthesis, and evaluation. Analysis involves the exploration of the problem, problem framing, searching for patterns, and declaring objectives. Synthesis is the attempt to move forward and create a response to the problem. Finally, critical evaluation is brought to bear on the generated solutions against the defined problem.



False perception of a linear design process

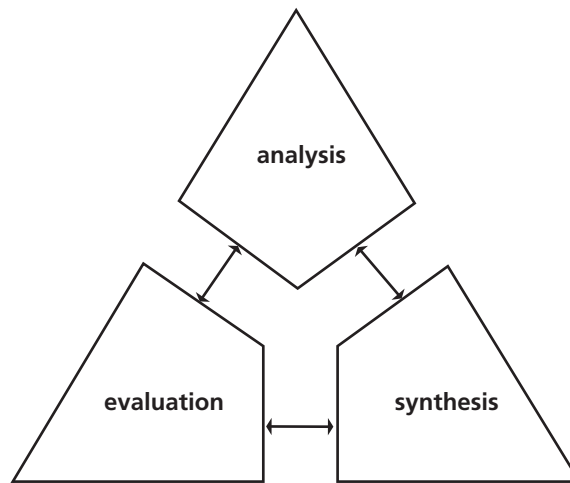
However, the design process is not actually this linear. An examination of design process by various designers will reveal many approaches. Regardless where designers begin, there are feedback loops between the parts of the process, as one part of the process may affect work in another. For example, synthesis may reveal that the problem framed in the analysis phase needs to be redefined. Or evaluation may yield a need to a return to the beginning if the solution does not satisfy the problem.



A generalized map of the design process, after Lawson, 2006.

This model still suggests a linear process of sorts. Lawson (2006) notes that studies of actual designers show that this is not as clear as it appears. Some designers start by generating solutions to help frame the problem and then turn to the functions of analysis. The design process “rather resembles one of those chaotic party games where the players dash from one room of the house to another simply in order to discover where they must go next,” (Lawson, 2006, p. 39). This analogy seems similar to

the experience that led me to begin questioning the nature of design: the path was not linear and needed to be discovered along the way.



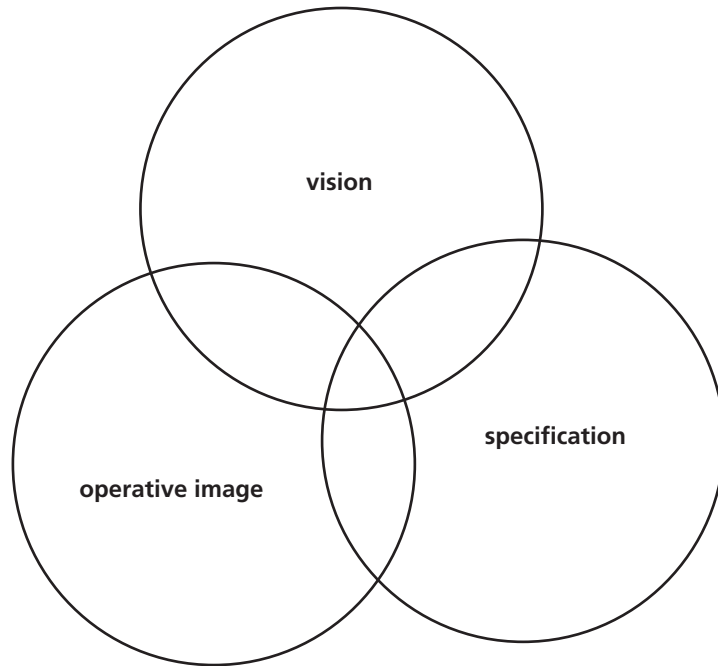
A more honest representation of the design process, after Lawson, 2006

Lawson (2006) further suggests that knowing that the design process consists of analysis, synthesis, and evaluation will not actually help designers design. He notes that designers often do not follow their own maps of the design process. But if we are trying to understand the nature of design and what designers do, the model of the process is useful in making the point that some of the mystery and confusion about design comes from a lack of understanding of the design process.

Dialectical Process

As mentioned earlier, designers need to remain critical of theories and models of the design process. This is because there are several ways to model and describe the nature of the design process. To illustrate this, I will now examine another view of the design process, which embodies three abstract levels that influence each other in a fully dialectical process.

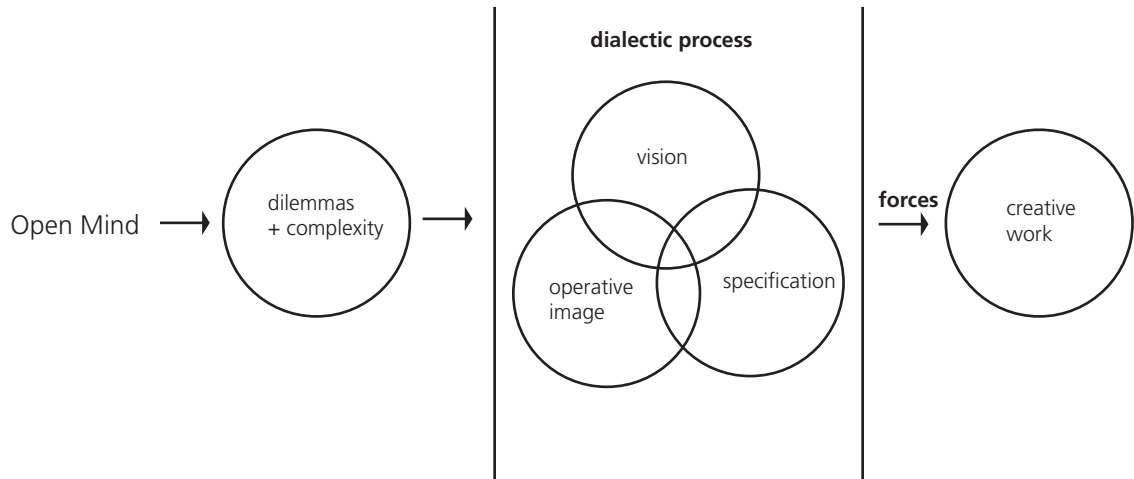
Löwgren and Stolterman (2004) outline three levels of abstraction in the design process: the vision, operative image, and specification. Vision emerges when the designer first confronts a design situation. This vision may seem intuitive, and acts to structure first attempts to understand the situation. It takes place inside the mind of the designer, and is often fuzzy. The beginning of the design process may entail several competing visions.



Design process, after Löwgren and Stolterman, 2004

The next stage of the process involves the development of the operative image, which is an externalization of the vision. Its development results from a dialectic process between the situation and the operative image, as well as the operative image and the vision. This conversation will impact the initial vision, which may change during the process. This is similar to Lawson's portrayal of the design process, where the designer moves between stages at will in response to the situation.

Nelson and Stolterman (2003) argue that this dialectic process forces creativity. This view counters the notion that designers wait around for a creative spark, and instead suggests that creativity starts with delving into the situation with an open mind. "The complexity of the relationships between the situation, the vision, and the operative image will 'force' creative work, which then tends to come naturally in response," (Löwgren and Stolterman, 2004, p. 19).



A representation of Löwgren and Stolterman's idea of creative work stemming from a dialectic process

When the operative image has been developed it functions as the specification for the final design. Another process, which Nelson and Stolterman (2003) call the construction process, then begins. Though, they note, that there is no clear division between design and construction.

Again, they describe the design process as fully dialectic. It is neither linear nor iterative. The three levels of the process, the vision, operative image, and the specification, influence each other throughout.

Designing the Design Process

In looking at the aforementioned views of the design process, none is absolutely correct. But neither are wrong. The dynamic nature of the design process, the uniqueness of every process, means there is no singular way to model it. The designer creates it each time. Löwgren and Stolterman (2004) introduce the idea that as part of any design process designers need to design the process itself. Designers shape it, decide what to do, and how to carry out the process. They suggest that good designers know “almost nothing is given or true when it comes to what and how to design,” (Löwgren and Stolterman, 2004, p. 41). On the one hand, therefore, I have noted that designers need to remain critical of models and theories of the design process. On the other, designers should look at the design process as part of the design task. This perspective aids in understanding the role of the designer in the design process, may provide some comfort with the complexity and ambiguity of the design process, and acknowledge a value of the designer that does not receive much attention.

Summary

As I have shown, the design process is not procedural. It is nonlinear and dialectical. There is no one true end of which to reach, as there are many possible outcomes or solutions to the same problem. The design process itself is designed by the designer, which makes it rather ambiguous, just as design problems are ambiguous. The nature of design is very ambiguous, and designers need a high tolerance for ambiguity to move successfully through the process.

Designing Oneself as a Designer

Understanding design methods and general process is much easier than understanding the nature of design itself. I have acknowledged that design thinking is a skill and the design process is designed by the designer. Now, I will suggest that the development of design ability and understanding the nature of design is a design endeavor as well. A designer who wishes to improve his or her ability to the fullest sees it as something that has to be designed. Löwgren and Stolterman (2004) suggest that theories, concepts, and ideas about design are practical intellectual tools, and that good designers recognize this. Earlier, I noted that designers need to have an open and reflective mind. We can extend this idea to suggest that designers also need to challenge their own thinking and assumptions. Through this reflection on the self, the design of oneself as a designer may begin.

Design can also be viewed as “a process of thought in the mind of the individual designer” (Löwgren and Stolterman, 2004, p. 21). We might say that to be good at design, designers need to understand the nature of design. But as the design process is unique and the thinking that takes place rather complex, it is difficult to simply identify this nature. This paper is meant to provide a starting point for developing a deeper understanding of design not only to know what designers do, but also to start designing your own understanding of design, and designing oneself as a designer. This relates back to Stolterman’s idea of a personal design philosophy. But in developing a personal design philosophy, it becomes easier to articulate what designers do in a broader sense, contributing to the growth of the philosophy of design, or the advancement of the design discipline as a whole.

There are different perspectives on what it actually means to be a designer. Some view everyone as designers, while others adamantly reject that. For the purpose of acknowledging a distinct discipline of design, I submit that there is a difference between the professional designer and non-designers. Nelson and Stolterman (2003, p. 293) suggest that there are seven qualities (7 c’s) that make a good designer.

- Character: strive for wholeness of person—intention
- Connection: to be interrelated and interrelating—meaning
- Courage: to be creative and innovative—purpose
- Capacity: to learn—to not know, to know
- Capability: to make/produce—excellence
- Confidence: to do/act—change
- Competence: know facts/possess skills

These seven characteristics, they say, should be constantly reflected upon. Again, we acknowledge reflection as being integral to design thinking, in conversation with the situation, in analyzing the design process, and in designing oneself. This constant reflection can be said to provide the rigor of design, the form in which logic plays a role to produce the appropriate but the unexpected.

Finally, and this may be obvious by now, but design thinking needs to be developed for oneself. An experienced designer cannot simply tell a novice designer his or her ways of thinking. Nor can I say exactly what one needs to do to understand design and develop oneself as a designer. It is my hope that this paper may help to recognize the need to develop this personal understanding.

Future Direction

The nature of design and understanding what designers do is not a simple matter. The discipline of design is still struggling to both define itself and demonstrate its value. While this paper offers some insights into the rigor and logic of design through design thinking and the design process, there are many more topics we could talk about in understanding design.

During my research, I came across many books and articles that influenced my thinking on the topic of this paper, but which I did not have time or room to investigate. Also, the above exploration of design thinking and process stirred several new questions. For future study and exploration, I noted them in this section.

My first question: Why is the discipline of design not more unified? In general, the authors cited in this paper talk about design in a similar ways. Though there still much debate about what design is and what it can do. If the discipline was more understood, this paper would likely not exist. For as a masters student of design, it should be easy for me to explain what design is for myself and to others. But as I argue, this is difficult to do because the logic and rigor of design is not something you can prove.

Another topic that deserves further exploration is the relationship between science, art, and design. I have suggested that the three belong on a similar plane. Though I realize that much more work needs to be done to understand this relationship before stating this confidently. For now, it is a hypothesis. But I believe it does have merit since, as noted, Nelson and Stolterman (2003) present this idea in *The Design Way*.

Third, though this paper does serve partially as an educational tool to become acquainted with the thinking behind design, further works could be done to detail a strategy for design education. How is it that so many designers cannot explain what they do? Is this a failing of design education? I focused more on the theoretical side of design. But is there a way to better combine this with design practice?

Finally, while this paper was designed for the betterment of designers, a similar paper should be written to address business or non-designers. My goal was to enable designers to communicate what they do to others, but it would be worthwhile as well to speak to the business community directly. Also, it may be good

to begin a dialogue with the scientific community on the rigor and logic of design as a legitimate approach but different from a scientific approach.

Final Thoughts

The exploration into the nature of design, what designers actually do, how they think, and whether the process is rigorous and logical began with my personal struggles as a designer. It was almost impossible for me to begin answering the questions I had about the thinking behind the methods. As a professional designer, I believe it essential to understand the nature of design to become a better designer and to communicate what I do to others.

While the journey I took and the journey of every designer is personal, there are aspects of design that are common to all designers, regardless of in what field of design is practiced. Though I call myself an interaction designer, the thinking and the process outlined here pertains to design in general. I assume every designer will be able to connect with the material. I am interested in acknowledging the commonalities—the nature of design common to all designers—not just to understand what designers do but also to contribute to the unification of the discipline in order to make it better understood, better practiced, and ultimately stronger both within the design community and outside of it as well.

One of the key practices mentioned here that both provides the rigor of design thinking and means to improving individual design practice is that of reflection. Schön's reflection-in-action was acknowledged by the other authors cited, which shows the impact of the idea on those designers who consider the nature of design seriously. However, it seems we still do not have a good or simple way to explain the rigor and logic of design. Perhaps design is too complex an endeavor for this ever to be the case. Still, I believe as designers, we must remain critical of our own thoughts on design and continue to question and attempt to define what it is that we do, when design is appropriate as an approach to solving problems, and what value we provide.

My hypothesis is that there is a rigor and logic to design. But this rigor and logic is different from the more familiar scientific or analytic approach. There is no one correct solution to a design situation, and design solutions cannot be proven empirically. The thinking that occurs during the process is nonlinear, going back and forth as necessarily between the different phases. We can view this as a conversation with the problem, where actions taken by the designer yield consequences and new information

to be reflected upon. The new insight may cause changes in how the designer views the problem or the solution being generated. The process is not magical, but does require a bit of muddling through to get to the desired outcome. The muddling through is purposeful, however, and not haphazard or reckless. It is also not a matter of waiting around for a spark of inspiration.

Design is hard work. It requires determination in the face of ambiguity and being comfortable with a process where parallel lines of thought and several alternatives are held together until the desired outcome is produced. This process may appear mysterious and uncomfortable to those who work better with a clearly defined problem and an empirically proven solution.

Finally, design cannot be truly learned or understood without doing it. Reading about design does not make one a designer. This paper, and any writing about design, should accompany actual design practice. As stated earlier, remain critical of all process diagrams and writings about design and reflect on how they relate to the thinking, doing, and making of your practice. It is my hope that sharing my dilemma and the insights of this paper, your design practice will be further augmented by thinking and reflection as you design yourself. I urge designers to balance practice with theory, and action with reflection. Design yourself as a designer. Develop your understanding of design—your personal design philosophy—to improve your design ability and enable you to communicate more confidently what it is that you and other designers actually do.

Think of yourself as a design process. Think of the subject matter of this paper as the framework to help you understand what you need to do to design yourself as the designer you desire to be. This is not prescriptive, but a way to help you think about improving your design ability and contributing to the development of design as a discipline.

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