

Chasing Infinity: Defining the Purpose of Design

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Abstract: Definitions of design are numerous. No one definition seems to satisfy every audience or purpose, and perhaps no formal definition of a discipline should be expected to cover every eventuality. But a good definition should resolve remaining ambiguities while recognizing the many things we already know about the discipline. I will present a definition of design based on the idea of making choices in those particular situations where each decision has a theoretically infinite number of outcomes. This is presented in the context of philosopher Daniel Dennett's interpretation of Darwin's theory of evolution. I focus on the shift in perspective that occurs when one understands evolution as "design without a designer," and the implications of that shift for understanding human design activities. I also present ways in which this new definition might improve the understanding of design activities, particularly for students.

Key Words: *design definition, design theory, design philosophy, design education, Darwin, evolution and design.*

1. Introduction

As a teacher of design I have long sought to understand our discipline in a way that will help me help my students. Students come to us with high ambitions but only a vague notion of what they are getting involved in. They begin on a common path marked by our graphic design curriculum and then make their way to more singular destinations marked by a mix of our influence as teachers and their own personal aptitudes and interests. At the start their opinions mirror general societal beliefs about design as styling or a collection of clever ideas. Along the way, they pick up more professional attitudes about problem solving and design processes and, of course, the skills needed to work in their specific design domain. More importantly, we hope that by the time they leave school they will have absorbed the values of design as a discipline; knowledge that will sustain them through the many changes they will encounter in their lives and careers.

In 2009 design is generally recognized as an independent discipline that spans many professional endeavors and contributes to numerous other activities. The existence of a conference such as this, and a gathering of a large research community, confirms this recognition and indicates healthy interest in advancing the cause. While design has been described as many different things – an art, a science, a liberal art, or hybrid of all of these – most theorists now at least agree on the broad application of design across many fields, and can confidently describe common processes, methods, and attitudes displayed by designers engaged in a variety of activities.

And while people still see and experience design from varying perspectives, we have reached a point of stability marked by theoretical agreement around a range of definitions and a focus on design as a type of thinking we engage in.

And yet, no one definition seems to satisfy us all. Bloggers collect and discuss numerous definitions, and students search for definitions that match their particular experiences and growing professional sensibilities, while the general public still tends to focus on surface effects or the end results of what professionals see as a complex process. Theorists struggle to unite all these different points of view and many, at this point, claim there is no single definition that will satisfy everyone. Richard Buchanan, who has developed some of the most learned and far reaching definitions, cautions wisely that a single definition is not necessarily a desirable final goal, as each separate definition speaks to differing audiences who have varying needs [1]. It is not the final definition that we seek, but the lively conversation that definitions provoke.

2. Requirements for a Definition

You might well guess, at this point, that I am about to offer a definition of my own. But before I do, let me set out some requirements I hope it will meet. In my case, and for my students, I am looking for a definition that will accomplish several things:

1) The definition should provide a reason for design, not just a description of its activities. Without a reason or “intention” there is no meaning to a collection of activities. What is a game of baseball if you know all the rules but don’t know that the overall purpose is to score more runs than your opponent? Knowing the object of a game provides a reason to play, and knowing the purpose of design can motivate our students at every stage of their work.

2.) The definition should live and function in the real world, and in the world of other disciplines, without confusion. It should not conflict with what we already know about design, although it may cast that knowledge in a new light. Most of all, it should help us make sense of our real experiences of working in the field, and connecting with others.

3) The definition should identify design as a unique activity in and of itself. If my students ask what I am teaching, I would like to be able to say “design” and be able to explain fairly succinctly what that is. As a corollary to this I should be able to say what design is not, that is, to draw a boundary around its unique qualities. Although we say design crosses many fields, it does so because we apply its singular knowledge in many areas. We ourselves have no boundaries, but a defined discipline should have them.

4) The definition should remain consistent across all design domains and design activities. Consistency creates an advantage in terms of providing a definition that is easier to teach and to reinforce, but of course that is not reason enough to require it. Instead, as students test the veracity of the definition against their own rapidly expanding set of experiences, the definition should reinforce the value of design activity at every turn.

3. A Philosophical Framework

The philosopher Daniel Dennett pointed the way towards such a definition when he wrote: “There is a single, unified design space in which the processes of both biological and human creativity make their tracks, using similar methods [2].” Dennett’s book, *Darwin’s Dangerous Idea*, is a passionate defense of the principle that the algorithm of evolution – descent with modification – results in “design” that occurs without the guiding hand of a “designer,” or God. This, of course, is at the heart of the dispute between Darwin’s ideas and some people’s religious beliefs.

But Dennett carries the idea further by discussing human design activities, and indeed all human activities, as an extension of this algorithm, placing humans securely on the “tree of life” it produces, instead of standing separate from it. Design, whether intentional or not, (human scale or evolutionary) becomes the central force not only in our lives but in the creation of everything around us, both natural and artificial.

To help us understand this, Dennett describes a “Library of Mendel,” an unimaginably large set of theoretical possibilities created by the sequenced combinations of each possible letter of the genetic code. As an image, he refers to Borge’s imaginary and infinite “Library of Babel,” from *Labyrinths* [3], a set of endless rooms containing every possible book that could be written with the existing letters of the alphabet. Some alphabetic combinations (or codes) are gibberish: an unimaginably large number of them. But an equally large number are actual possibilities: readable (or viable) in some way. This is the “design space” we exist in. It contains an unimaginably large number of theoretical possibilities, only some of which become real. Design activities are those which carry us from one meaningful or viable combination to another.

4. Definition and Demonstration

It is from the realm of all these theoretical choices, parallel to those described by Dennett (and imagined by Borges) that my definition arises. *Design can be seen as the discipline of thinking that allows us to make choices in those particular situations where we are confronted with an infinite number of possibilities.* We commonly use design skills to choose particular sets of relationships among things (tangible or not) that we can then describe as meaningful or useful or enjoyable to us in some way. The fundamental problem design solves for us as human beings is not visual, spatial, physical, experiential, or organizational. It is not only a rhetorical problem of exploring or resolving conflicting points of view, although that is an important component (or additional benefit) of the overall process. It is simply the problem of navigating through an endless sea of choices.

For our purposes, I want to demonstrate this idea of choices in an infinite design space in a way that more closely matches the experience of my students and, I will argue, the experience of all designers. Imagine, for a moment the abstract exercise of trying to place a lamp in the “right spot” on any particular table. It can be here (the left side), or there (the right side), or over here (in the middle). But it can also be anyplace in between, or forward and back, in increasingly small choices of increments, which turn into an infinite set of placements. If you imagine the location of a single lamp (leave aside the choice of which lamp to buy) as part of an interior design project, and realize that all of those choices are available for that one decision, you can begin to contemplate the infinite number of choices that any design situation involves.

The same sort of imaginative exercise can be applied to components of any other kind of design, for example, moving type around on a page. Start with a single letter, a lower case “a.” Imagine placing it in the middle of a standard size page. Now imagine it in a number of different typefaces. Then, rotate it slowly, in place, through 360 degrees. Slide it back and forth on the page, and up and down. Change it’s size. Finally, just for fun, think about changing the size of the page. Now that is a lot of choices, and we haven’t even gotten to making up a full word, sentence, or paragraph. All those choices exist, in theory, before the design of any page begins. And all those choices exist for every single element you eventually put on the page.

While the placement of the lamp or choice of a single letter may seem trivial, these are simple examples of a special kind of situation, defined by three necessary conditions, we confront constantly:

- 1) Design choices are those made from sets whose possibilities are incredibly large because the number of separate variables in the situation produces a large number of permutations and combinations.
- 2) Design choices are made from sets in situations where at least one variable is without boundaries, that is, the number of theoretical possibilities approaches infinity. (It may be that the conditions of #1 can produce similarly near-infinite sets – but I will leave that idea unexplored here.)
- 3) Design choices are choices we make explicitly, because they rise to the level of consciousness and consideration, and therefore we make them purposefully. However, as I will explain below, this does not mean we make them only to reach a known goal.

In our example of the variable possibilities of the letter “a,” the number of possible typefaces is incredibly large, but it is bounded (a choice among an existing set). The size of the typeface, or its placement on the page however, is not bounded, as each change or move, can be extended by another and another and another in an infinite range. In our interior design problem, the choice of style of lamp is bounded in the same way as the choice of actual typeface. While that choice is large, it is not infinite and comes from an existing set. (In other words, we could go shopping, and that is not design.) But the choice of placement of the lamp, even on a small table, is at least theoretically infinite.

Of course each choice we make (or have the possibility to make) has a different outcome, one that can be judged from many points of view. This takes us into the territory of the relationship between means and ends, and in some ways it may seem that this argument is just a simplification of the idea of “wicked problems” that is so prevalent in design theory [4]. I recognize the importance of that idea, but while I see it as related to the necessary conditions for design, it is not the reason for design. Over time, by shifting from a focus on the type of problems being solved to the type of thinking designers use, design theorists have recognized we are dealing with both actors and the environment they act in. Current design theory is rich in description of both these things, as well as in descriptions of their actions. But it still leaves us looking for a reason for these actions, particularly one which can elevate design to the level of other major disciplines while still standing separate from them.

That reason becomes more apparent when we consider our own evolutionary heritage. The psychologist Steven Pinker wrote: “The mind is a system of organs of computation designed by natural selection to solve the problems faced by our ancestors in their foraging way of life [5].” Our human abilities and specific traits were

built up over time, with each new trait selected because it helped us adapt to conditions or problems confronting us. Those problems have always included making decisions in the face of indeterminate or incomplete information. In fact, the problem of making choices is not unique to human beings, it begins with any creature that changes state or moves. So decision making mechanisms are deeply embedded in our brains and are used in a variety of situations, but only when the choices become *explicit* and involve those theoretically infinite possibilities do we call them “design.” Not only are we conscious of these choices (simply aware of them) but we generate them, consider them, weigh alternative outcomes, and attempt to establish or predict the relative values of our potential actions within a constantly changing environment where there can be no “best or final answer.”

The result of the three conditions I describe above, and the infinite array of theoretical choices they present to us, is a purpose for design. It is a specific kind of decision making which is necessary for human survival, and which is not defined by the methods and practices of other disciplines.

5. Attaining Goals versus Making Choices

One could fairly ask: what is new in this definition? It defines a type of problem being solved, admits to the means/ends issues so prevalent in design theory, references design as a kind of thinking, and simply uses the making choices, which sounds like agreement with rhetorical definitions of design. What I believe this definition suggests is a change of perspective that, while admitting things we already know about design, resolves conflicts or ambiguities which arise when we try to put those different parts and pieces together to form a more complete picture. A review of some of the requirements I initially set up may help to reveal this.

First, I was looking for a reason for design, something to give it meaning beyond a description of design activities. The early design methods movement was caught up in process descriptions, but to be fair, many great definitions since then have given meaning to design in various ways. And those who still work in the descriptive area often do so in an attempt to map out the territory of design thinking within a set of deeper assumptions. So perhaps I am looking for more than just meaning itself, but a different meaning than what I take from most existing definitions.

What many of these definitions have in common, from Herbert Simon’s “Everyone designs who devises courses of action aimed at changing existing situations into preferred ones [6],” to Richard Buchanan’s more recent “Design is the human power to conceive, plan, and realize products that serve human beings in the accomplishment of any individual or collective purpose [7],” is a sense that the accomplishment itself (the result, or goal or purposes) is paramount, because our wishes, desires, or needs are both the starting and end points of the process. This is an outcome of a very natural feeling that for something to be created (designed) someone must have created it.

But the controversial result of Darwin’s theory is the idea that design can occur without a designer, through a series of simple algorithmic steps, resulting in the accumulation of order over time. The full explanation is complex (and beyond the scope of this paper), but Dennett describes genetic variation as producing “drift” through the space of possibilities, and selection as providing “lift” or increase in order [8]. This is often

perceived as improvement or progress (particularly when looking backward over time) but in reality is just movement through a space of possibilities. After all, one form of life is not “better” than another (although it may be better adapted to particular conditions at a particular time) and there is no hierarchical end point to the process of evolution [9].

Of course, unlike evolution, human design does involve a designer. However, the idea that design is a series of decisions within a space of infinite choices implies a subtle, but important shift in our relationship to design as a purposeful, or goal oriented activity. There is no doubt human design projects begin with some sort of goal in mind: we want to build a particular kind of building, publish specific material in a book, create a system to deliver accurate prescriptions, or develop a way to get people to play a new game together online. While the initial choice of goal may seem to narrow the search space considerably, in fact it doesn't. Because design search spaces are infinite, the initial choice we make simply shifts our attention to a different set of choices, which remains equally large. In fact, every choice we make shifts our attention to a different set of choices. The reason we are “designing” in the first place is because we don't know what choices we will make within each of those sets. Since each possible choice or outcome represents a different value in our minds (which will become our reason for making the choice) we cannot say what our true endpoint is. We can say we make each choice on purpose, but only because at each decision point we establish what that purpose is and whether or not our choice is viable on those terms.

In professional design situations we sometimes try to make a distinction between what the client says they “want” and what we eventually come to discover they actually “need.” In those cases, the relationship between desire and satisfaction appears to be less direct than was originally stated. In more formal terms, we often talk about the “requirements” of a particular design, or specific criteria a design needs to meet. We even speak of criteria as being the “measurable” portion of the problem. But in that kind of formal analysis we explicitly separate criteria from the way we intend to meet them. By saying that there are different ways to meet the criteria (which we will choose between) what we are really saying is there are other values we intend to decide upon which are yet to be defined or negotiated. So while part of the reason for designing may be to achieve certain stated outcomes, we cannot say its full purpose is the attainment of goals that are known in advance. It makes less sense then, to say the purpose of design is to attain goals (which we only know some of), than to say it is to make choices; those choices made under the specific conditions outlined above.

While you may want to argue that this difference between “goals” and “choices” is small, it seems to have some other important consequences. Immediately, we begin to see how our definition meets our second condition: that it live in the real world. By this I mean that design must fit into some larger scheme in a way that is not confusing. We ourselves fit into a larger scheme: we have a position on the Darwinian tree of life and we obey the laws of physics and chemistry. We do not control everything external to us although we attempt to harness these things in impressive ways, by understanding external laws. When we view design as the kind of thinking which allows us to make choices under certain special conditions, we are seeing it as a method for solving a distinct problem for us as human beings, just as other disciplines are methods for solving problems in their separate domains. Many have viewed design as “problem solving” but it is only problem solving of a very special kind – the problem of infinite choice.

At the same time, the choices we make are not separate from the choices that resulted in us. As we are part of the natural world, the artifacts or plans we produce are an extension of it [10]. Seen from afar, we are simply nature's way of producing nails, watches, computers, or any other artifact or idea. The choices we generate and make are a continuation of an evolutionary process that certainly did not begin with human beings, and may not end with them either. This should leave us with a peculiar feeling of both humility and hubris. On the one hand we are part of something much larger than ourselves, which makes our decisions seem trivial. On the other hand, our collective decisions have a huge impact as we navigate through the realm of theoretical possibilities that may become our future. Design has an important role to play as the kind of thinking that deals with our future choices in the grand scheme of possibilities, but design also plays that same role on a very small scale, in many of the daily decisions we make.

All disciplines can be seen as types of thinking that deal with certain varying conditions we confront, no one being more important than another. As mentioned above, these types of thinking are collections of many cognitive skills and basic physical abilities, built in layer on layer over time through evolution. We ourselves are not strictly "disciplinary" beings but use all our skills in various combinations, as the need arises. By defining design as a discipline that deals with a specific condition we confront, it becomes easier to see its unique relationship to other disciplines.

Uniqueness was my next condition: my definition should describe a purpose not claimed by other disciplines, and should not be a combination of other activities. The difficulty for design theorists has been to define a discipline that is related to and is a part of so many things, without being overtaken by them. After all, Simon's definition (above) begins "Everyone designs..." and his quest (along with contemporaries such as Donald Schon and many others) was to identify and give intellectual legitimacy to an activity that he saw occurring across a number of professions. Design activity appears in the realm of science, art, engineering, and many other domains, leading to possible confusion as to whether or not it is actually part of those activities. Simon defined it as a science, by making a distinction between sciences of the natural and artificial worlds. Others have been reluctant to divorce art from their definitions of design, especially those who see themselves as creative beings who rely on more intuitive or direct (less quantitative) methods. Initially, Bruce Archer looked to define clearer design methods in opposition to the more intuitive methods of art [11], but when that approach began to feel too inflexible, he modified his views and proposed design as a form of thinking [12], a view taken up by Cross, Lawson, and many others.

That still left open the question of what we were thinking about, beyond processes and methods that had been previously described. I have dealt with this problem above, recognizing that there are other good attempts to find deeper meaning in our work. In our case, a definition that presents design as a specific form of decision-making in all types of situations allows design to participate in the widest possible range of human activities while still being specific as to what design itself is. By narrowing the terms of that decision-making to a particular type of problem that presents itself to us over and over again we can be precise about the value of design activity in all the different places it appears, and yet the reason for its appearance – our ongoing need to make that specific type of decision – is always the same.

Consistency was another requirement of our definition. If the description above represents a kind of “external” consistency, showing similarity in design activities across different domains, we still need to look at “internal” consistency: what happens during various stages of our work. Anyone involved in design, or who studies it closely, comes to understand it as a process. Current theory recognizes design as a generalized heuristic search, an orchestrated trial and error process that involves evaluation of a succession of prototypes.

We teach students to generate and evaluate prototypes at every level (and in every type of design), from initial sketches or notes, to potential scenarios, to more complex mockups, design drawings, comprehensives, or conceptual models. The process is the same whether they are deciding on the general direction of a project or attending to the tiniest final detail. We want them to generate and evaluate any number of alternatives, make a selection, and then deal with the results of that selection. The scale of decision-making changes, but the type of decision being made does not. It is still a choice from an infinite array. When a graphic design student makes a last minute decision about the final size or placement of a headline, or the spacing between two typographic elements, they still make it in the context of that infinite set of possibilities: here, there, or somewhere in between; a little smaller, a little larger, or even a little larger still – and always with the possibility to jump to a completely different portion of the search space (an alternative design direction) if the current direction fails to satisfy.

Visualization of the infinite search space provides several other educational benefits. It quickly convinces students of the need for massive iteration at every point in the design process, and helps to visually map the difference between exploring variations within similar ideas versus exploring widely differing concepts. It demonstrates the value of varied approaches and styles, as each different method or path gets us to alternative places within the search space, and shows that those variations can be assigned differing values, depending on the point of view of the evaluator. Most important, it provides a repetitive structure and method for all of the work, for all subject matters and for all stages of the project.

We teach methods that order the process somewhat, such as focusing on larger issues before getting caught up in details. But we know our minds do not move through design problems in any strictly definable order and we cannot possibly hope to visit any but the smallest possible fraction of possibilities. By realizing each decision is a movement through an infinite decision space we attempt to establish a path and a reasonable range of exploration, appropriate for the time allowed or level of innovation expected. It may be valuable, in future, to investigate this range of search possibilities in relationship to how we choose to use the design process.

Certainly in the professional or “applied” fields of design there are times when our search range is relatively narrow and other times when we seek a more expansive view. When designing the pages of a novel we are in that narrow range, closer to things we already know, yet we still have an infinite set of choices in that specific area. When designing a new system or trying to invent a completely new product category we expect a higher level of “innovation,” which simply means moving to a more distant or distinct portion of the search space. But in every case, and at every level, our purpose remains consistent: to make the particular choices that present themselves as conscious decisions within sets of unimaginably large possibilities.

6. Conclusion

Better definitions of design will help us “unlock” its value for more people, making its methods and benefits accessible to them. Current formal definitions are limited in their ability to consistently cover all instances and applications of design, and particularly in their ability to allow us to understand it as a unique discipline with its own subject matter and specific boundaries in relationship to other disciplines. By viewing design as this special form of decision-making I have tried to shift our perspective in a way that ties existing knowledge of design together, bringing it into sharper focus against a background of other activities or disciplines people engage in. Design becomes a consistent action, in a particular type of situation we can clearly delineate.

My conclusions are, so far, philosophical and anecdotal. I have found this to be an effective basic definition for students, who struggle to find a reason for changing their initial attitudes and perceptions. One of the most difficult attitudes to change in beginning graphic design students is the idea that their main purpose is to come up with a single clever solution to a design problem through some sort of intuitive creative process. By defining the game as a search through an infinite space of possibilities it is much easier to get them started on the path toward deep exploration, multiple iterations, and eventually the questioning of goals themselves. A definition of a “a good design process” then flows more naturally from the demonstrable need to explore and understand more of the theoretically possible alternatives in the search space, at any level of the problem at hand.

Similarly, working as a trained designer in groups of non-designers (experts in other fields) I find myself examining the differences in our expertise and points of view, and sometimes explaining my motivation to make contributions to the work process in particular ways. This definition, which clearly presents the designer as one who generates and examines alternatives in situations where many alternatives could exist (if people would only look at them) is one that resonates in those situations. Without using too much of the philosophical background, discussing the value of looking at as many different potential pathways as is feasible has proved useful in getting non-designers to understand what designers do. So in the case of students learning to design the definition helps make their actual design activities more understandable to them, while for an external audience it helps articulate the value of those activities themselves, as well as the differing relative values of various possible outcomes. A comparison of this theory with applied research might validate some of these effects, both in education and in professional application.

More importantly, further philosophical discussion and consistent application of these ideas will test whether or not this definition resolve difficulties we have in understanding the nature of our work. Many of us have worked in several different areas of design, and have experienced the many social and technological changes that occur (and keep occurring) as our world evolves. It has become impossible to rely on any definition of design that speaks only to one activity or group, or even one that promotes any particular social or societal benefit. This is not to say we cannot have those high aspirations for our professional work, or gain a deeper understanding of the issues embodied in each kind of work. The value of this definition is that it covers all of the different needs and purposes that have been articulated for design, and should continue to explain those design activities well into our changing future.

NOTES

[1] Buchanan, Richard (2001) Design Research and the New Learning, In *Design Issues* vol. 17, no. 4 , p. 6

[2] Dennett, Daniel (1995) *Darwin's Dangerous Idea*, Touchstone , New York, p.123

[3] Borges, Jorge Luis (1964) Library of Babel. In *Labyrinths: Selected Stories and Other Writings*, New Directions Publishing Company, New York.

[4] Buchanan, Richard (1995) Wicked Problems in Design Thinking. In *The Idea of Design*, edited by V. Margolin and R. Buchanan, The MIT Press, Cambridge, MA.

[5] Pinker, Steven (1997) *How The Mind Works*. W.W. Norton & Company, New York, p. 21

[6] Simon, Herbert (1981) *The Sciences of the Artificial*, 2nd ed. The MIT Press, Cambridge, MA, p. 129

[7] Buchanan (2001), p. 9

[8] Dennett, p. 125

[9] Ibid, p. 133

[10] Ibid, p. 144

[11] Archer, Bruce (1965) *Systematic Method for Designers* Council of Industrial Design, London, p. 1 (Reprint of seven articles from *Design*, 1963-1964) In introducing the need for design methods, Archer refers to the traditional “art of industrial design” as “something close to sculpture.”

[12] Archer, Bruce (1979) Whatever Became of Design Methodology? In *Design Studies* vol. 1. no. 1, p. 17. In this later article Archer writes: “My present belief... is that there exists a designerly way of thinking and communicating that is both different from scientific and scholarly ways of thinking and communicating, and as powerful as scientific and scholarly methods of enquiry, when applied to its own kind of problems.”