Harold G. Nelson and Erik Stolterman

the design way

second edition

Intentional Change
in an Unpredictable World

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Preface to the Second Edition

It was with mixed feelings of excitement and hesitancy that we approached the opportunity and concomitant responsibility for developing a second edition of this book. The excitement came from the opportunity both to refine some of the ideas introduced in the first edition and to add many of the new ideas that we have been working with over the last few years. The hesitation came from the realization that we might easily make changes and additions that would not necessarily be seen as improvements over what was accomplished in the first edition.

The responses we received from readers of the first edition convinced us that there indeed had been a need for the kind of book about design we wrote. Based on feedback from an astonishingly broad spectrum of readers we realized that there are people from all around the globe who are deeply engaged in advancing design scholarship. We found that there are many design practitioners who devote a significant amount of time and effort to the development of both their understanding of design as well as their improved practice of design. We also discovered that there are an immense number of people, new to the game of design, who are interested in becoming designers in newly emerging fields and professions that were just beginning to appear when we published the first edition. In addition, the growing interest in adapting design thinking to established fields, domains, or professions became apparent from the diversity of backgrounds of the readers making contact with us.

It is with amazement and satisfaction that we have followed the development over the last few years of the increasing general interest among a broad set of stakeholders in design thinking, design theory, and even in the philosophy of design. We started our work on the first edition in the early 1990s, finalizing the writing about ten years later. During that time we had little idea that design learning, design thinking, and design practice

would become such a recognized part of not only academia, but the realms of business and government as well.

The ever-growing interest in design as an important and essential approach to intentional change made it compelling to further develop our ideas from the first edition of this book. However, even if awareness and interest in design have grown, there is still a need for further advancing and championing the "big" ideas introduced in the first edition. We are still pushing to make a case for the recognition of design as its own intellectual and practical tradition of human inquiry and action on equal footing with science, art, and the humanities. Today it is even more important to make the case for an intellectually viable and well-grounded scholarly approach to design.

We see the second edition of our book as a continuation of the first edition's support for the development of a widespread design culture and a philosophy of design that is stable and true to the "nature" of design. Our intention is that this new edition will be even more supportive of the individual designer learning how to think and act with increasing competence in a designerly way.

This second edition has gone through both large and small revisions. Every chapter has been refined and modified. We have revisited our use of core concepts and terms with the purpose of being more consistent. We have added, updated, or removed references where it was important to do so.

We have also changed our approach to graphics in the second edition. We have introduced the notion of *schema* as the primary means for representing holistic concepts, ideas, and fundamental knowledge in visual form. This means that there is an increased importance vested in the graphics—that is, the schemas—to expand and complement the text in revealing or reflecting deeper understandings of design.

Among the bigger changes that appear in the second edition are two rewritten chapters—chapter 3, formerly "Systems," is now "Systemics" and chapter 10, "Production and Caretaking," is now "Craft and Material." We have completely removed the last part of the first edition—Character and Competence—and added a new part V—A Drawing Together—with two new chapters—chapter 14, "Becoming a Designer," and chapter 15, "Being a Designer." We have added an epilogue—"The Way Forward"—where we invite the readers to take a look into the future of design and their own design futures.

We are extremely grateful to all the students and colleagues who have commented on and critiqued the book over the years. This includes non-

academic colleagues and interested individuals as well who have provided us a tremendous amount of support and encouragement. The critiques, both positive and negative, have been very helpful and are appreciated. They have helped us to understand how we can further develop and communicate our ideas—to make them more available and relevant to our readers.

We would like to thank our colleagues and students at Carnegie Mellon University; The Naval Postgraduate School; Indiana University Bloomington; and Umeå University, Sweden. We thank the School of Computer Science at the University of Montana for their support. We also thank Anne Nelson for her continued invaluable assistance in crafting the draft document. We are very appreciative of Robert Sandusky's reviews of earlier drafts and his invaluable suggestions for their improvement.

We are particularly grateful to Doug Sery and the MIT Press for giving us this opportunity to publish the second edition of *The Design Way*.

Harold G. Nelson
Erik Stolterman

Prelude

Genesis is ongoing. As human beings, we continuously create things that help reshape the reality and essence of the world as we know it. When we create new things—technologies, organizations, processes, environments, ways of thinking, or systems—we engage in design. To come up with an idea of what we think would be an ideal addition to the world, and to give real existence—form, structure, and shape—to that idea, is at the core of design as a human activity. This book is about that activity.

Design is a natural and ancient human ability—the first tradition among many traditions of human inquiry and action. Everyone is designing most of the time—whether they are conscious of it, or not. Framing our understanding of design in this way, we define, and promote, a new philosophical look at this seminal human tradition through a reconstituted culture of inquiry and action. We identify that culture as The Design Way—manifested as a schema of the first tradition. This approach applies to an infinite variety of design domains including those fields that are traditionally thought of when we consider the concept of design, such as architectural and interior design, industrial design, engineering design, graphic design, urban design, information systems design, software design, interaction design, fashion design, and other forms of material and immaterial design. But our approach also allows us to include nontraditional design areas, such as organizational design, social systems design, educational systems design, workplace design, and healthcare design. Such a design approach can even be applied to significant social institutions such as governance, including the design of democratic constitutions (Sunstein 2001).

In the struggle to understand and interact in an ever more complex and dynamic reality, we believe the current traditions of inquiry and action prevalent in our society do not give us the support we need—as designers and leaders—to meet the emergent challenges that now confront us and

will continue to confront us in the future. The world is changing rapidly, sometimes with intent, but too often by accident. The world has proven to be unpredictable, despite the best attempts of science and technology to bring predictability and control to worldly affairs. The laws of nature may be universal, but the complex interactions of everyday events, whether provoked by accident or fate, result in unpredictable outcomes. The one thing that makes this state of affairs tolerable is the inchoate knowledge that change—desired change—can be wrought by human intention. Human intention, made visible and concrete through the instrumentality of design, enables us to create conditions, systems, and artifacts that facilitate the unfolding of human potential through designed evolution in contrast to an evolution based on chance and necessity—a highly unpredictable process.

In our attempts to design the world to be what we would like it to be, we find that the intellectual traditions at hand cannot fully support that task. Science, art, spirituality, economics, and technology are all important traditions of inquiry in their own right. However, they do not embody the unique attributes and competencies of the design tradition, with its corresponding approach to scholarship and praxis. Each of the prevailing traditions has developed a depth of knowledge and insight that is impressive, but it is often focused on only one aspect or dimension of our human experience—one that is necessary but not solely sufficient in the management of human affairs.

We believe the culture of inquiry and action that infuses design thinking is an essential part of the variety of human traditions of being in the world—of "human being." Even though other outstanding scholars (Schön 1983; Margolin and Buchanan 1995; Banathy 1996; Cross 2001; Krippendorff 2006) have investigated the concept of a design tradition, design has remained surprisingly invisible and unrecognized in the world at large. This book is an attempt to change this, making the case for design as its own tradition by formulating its fundamental core of ideas. *The Design Way* does not present a ready-made recipe on how to think about or engage in design. This is not a detailed hands-on book about design praxis (which is a topic that deserves several books of its own). It is not exclusively something for professional designers or design academics. It is a way to approach the reality of the human condition by intentionally embracing the richness of possibilities; the complexity of choices and the overwhelming challenges of getting it right—in short, a book on how to understand design.

Our ultimate desire is to encourage and promote a design culture. For any tradition to flourish, that tradition requires a nurturing environment,

a protective container within which its frontiers and prospects are defined and protected. A viable design tradition requires the enabling presence of a design culture, one that defines conceptual expanses and boundaries, and provides a context for setting particular limits on any design project. Such a design culture acts as a catalyst in the formation of social crucibles essential for sustaining the intensity of design action. It is a protective environment that provides the space and freedom necessary to foster a process that is both powerful and vulnerable at the same time.

What is presented in this book is a composition of what we believe a broad and deep understanding of design—as a tradition of inquiry and action—should include. This composition is, in itself, a design. It is not an attempt to present a scientifically true or accurate description of a design culture. Nor is it an attempt to answer all questions that might emerge concerning what a design culture might, should, or ought to, be. It is our understanding of design, as its own tradition and not merely a variant of science, or art, or technology, or spirituality. It is an effort to build a deeper understanding of design, based on ideas we believe must be present in the development and implementation of a design culture—the necessary ingredients for the release of design's full potential and promise for generative human agency.

What we have set out to do was to write a book about the philosophy of design in distinction to a book about the philosophy of science, the philosophy of the science of design, or the philosophy of design science. Those were all candidates but we very carefully attempted to look at design as its own tradition and not as a specific or special form of science, art, or any other existing approach.

It follows that we did not attempt to make our case using evidence-supported design (a Lockean analysis), or theorizing about design, (a Leibnizian analysis), or as a dialectic approach focused on design issues (a Hegelian analysis). Instead, we want to make our case using a design approach to inquiry. We do not ignore or reject science, art, and other traditions of inquiry—we sweep them in as part of design inquiry. This does not mean that we have just "made things up," however, any more than an artist just "makes up" a painting or a composer "makes up" a symphony. We have used the same design foundations and fundamentals we write about as touchstones for crafting the book. What we hope readers will do is to look at the ideas presented here from the stance of a designer.

The book is not a scientific treatise or a manifesto. It is a composition of ideas. We are not basing our concept on a body of data or a consensus of agreement among experts as would be rightly expected in a science-

based dissertation. It is true that there are habits of thinking that will be challenged in the way the book has been composed and in the ideas forming the color and texture of the overall composition. We hope that the book will be read from the design tradition rather than regarded from a science or arts and humanities tradition.

The Design Way is an introduction to many ideas that deserve a composition of their own. We feel that it is important, however, to present them here as a whole, as part of our composition. We are not proposing a particular theory, or a set of theorems, or axioms. Instead, we have chosen to use a schema of *foundations*, *fundamentals*, and *metaphysics* as the unifying elements of the book. The foundations are equivalent to the first principles or causes of other traditions such as science. The fundamentals we identify as those core concepts of the design approach that can be learned and improved on through practice and reflection. The metaphysics arises as a consequence of the interaction of the foundations and fundamentals of the design tradition, with one another and with the larger domains of human existence.

This structure of foundations, fundamentals, and metaphysics best reflects the level of our intention in making a case for a design culture. Over the years, we have found that these are emergent patterns that have continually informed the integration of our ideas as a whole. We find that it is possible to make a composition from this tripartite relationship; one that reflects, in different ways, what we see as the core of a design approach —a design way. The concluding part V titled A Drawing Together brings the foundational, fundamental, and metaphysical issues discussed in the book to bear on two integrative discussions concerning what is entailed in becoming a designer and what one must understand in order to practice as a designer. These two design dialogues form distinct compositional depictions of what a design culture might look like from a learner's perspective and from a practitioner's perspective.

The idea of a design culture is one that promotes an understanding of design as transcendent of particular contexts, specific disciplines, or single concepts. For instance, it is commonly believed that design is simply a form of creativity. Creativity is thought of as the activity that gives design its special qualities even though creativity is equally important in the arts and sciences. But, even though creativity is seminal to design, design is larger and more comprehensive than that. Design is inclusive not only of creative thinking but innovative, productive, and compositional activities as well. Innovation and production differ from creativity in that they are

oriented to taking action in the real world whereas creativity can be done for its own sake. Design is realized through the manifestation and integration of ideal, if not always creative, concepts into the real world. Design is a compound of rational, ideal, and pragmatic inquiry. Design is constituted of reflective and critical thinking, productive action, and responsible follow through. Therefore, a single concept, such as creativity, does not capture the full richness of the design tradition.

A design culture needs to be broad in its scope and deep in its meaning and utility. Thinking about design in this way, we hope to define a firm platform from which designers, in any field, can bring this new appreciation for the potential of design into action. With this in mind, we will often use the term "design" to stand for this broader meaning of a design culture.

The process of design is always the most effective and efficient means of getting organizations and individuals to new places. Design is therefore about leadership—and leadership is therefore an essential element of any design culture. Leadership today demands action and the ability to act, based on an overwhelming amount of insufficient information within restrictive limits of resources and time. These demands cannot be met primarily from within the traditions of science, art, or pragmatic technology. These demands require leaders to imagine, implement, and communicate adequate responses that are sustainable—in all their implications. This is a task that calls for good judgment—not problem solving. It calls for compelling compositions and effective creations—not true solutions. We argue therefore that *The Design Way* is not only for designers, but for leaders as well. We believe that leaders and designers are often one and the same, and that it is important for leaders to recognize that their challenge is that of a designer—to determine direction and destination via the design tradition.

The Design Way is based on the notion of reflections and substance. We hope that the book, as a composition, will evoke an appreciation for what design is all about in both its form and substance. Each chapter is an attempt to reflect that substance and give it some form. Each reflection reveals an image of one aspect of design, which obviously is not enough on its own to reveal the bigger picture of design. We do believe, though, that by moving among these different reflective images, recognition and understanding of the substance itself (i.e., what design is all about) and its compound form will emerge. This means we encourage readers to choose to read those reflections (or chapters) that seem most interesting or suitable

- Strategies for gaining design knowledge with the purpose of taking action.
- Knowledge structures or cognitive representations of design thinking.
- Cognitive frameworks representing a means for managing systemic inquiry formulated around specific design issues.
- Insights into how to give form to infinitely complex information and sense data.
- Cognitive structures that organize subjective, objective, and imaginative design-thinking processes.

Design schemas are the product of creative insights into how to engage in design inquiry in the same way that breakthrough thinking—the "ah-ha!" moments in creative endeavors—are representations of possible solutions for particular design outcomes. They share the same underlying processes of subconscious judgment making that unify immensely complex inputs of information and design reasoning into singular images. The ability to create and use high-value schemas is at the heart of design scholarship, just as the ability to creatively posit well-formed hypotheses and test their validity is at the heart of scientific scholarship. We therefore hope that the reader will take the needed time to pause, examine, and reflect on the (often graphical) schemas we present. In line with the saying "a picture is worth a thousand words" we believe that a good schema has the same quality as a great photo. Great schemas invite close readings, offer many ways to be interpreted, and inspire different meanings and understandings.

We also hope that reading *The Design Way* will sway others to participate in the creation of a design culture as a consequence of the influences of a revitalized and reconstituted tradition of design. This means the book is not only for designers, or for those who hope to become designers: it is for everyone. Each person, in his or her own way, can become responsible for the creation of a design culture. With such a design culture in place, designers will find themselves encouraged to safely pursue their design intentions in an open and supportive environment on behalf of those they serve.

In our attempts to present a broad understanding of design, we have been pragmatic in our relation to other sources. We have drawn from many intellectual traditions, and we have used philosophers and design thinkers in ways not always obvious from a standard perspective. When we make a reference to a specific philosopher, or thinker, this does not imply that we endorse the entirety of his or her work.

To make the design tradition visibly distinct from other intellectual traditions, we sometimes portray those traditions in ways that may not do

them full justice. To make these traditions visible, we sometimes use an idealized and simplified understanding of their essential nature. This may seem offensive to some readers, who are led to believe our purpose is to diminish the richness of the other traditions in order to make the design tradition appear more valuable. This is not our intention, however, but merely an artifact of our pedagogical approach.

When it comes to our own ideas, we have tried to be congruent with the design tradition we are trying to explore and develop. It is the composition of our thoughts—as a whole—that carries the primary message. This means that when we discuss specific concepts—such as judgment, composition, contracting, communication, or character—we do this from within the design tradition. We do not try to provide universal definitions of these concepts that would apply across other traditions of inquiry and action. These concepts are defined through use in pragmatic design ways, with the specific purpose of revealing our grasp of design as a whole.

I THE FIRST TRADITION

Humans did not discover fire—they designed it. The wheel was not something our ancestors merely stumbled over in a stroke of good luck; it, too, was designed. The habit of labeling significant human achievements as "discoveries," rather than "designs," discloses a critical bias in our Western tradition whereby observation dominates imagination. Absent from the conflicting descriptions of Leonardo da Vinci, as either scientist or artist, is the missing insight into his essential nature as a designer. His practical, purpose-driven and integrative approach to the world—an archetypal designer's approach—is primarily what made him so distinct in his own time, as well as our own. Through his imaginative genius, augmentations to the real world were made manifest. This has been the contribution of all designers throughout human history. Outside of nature, they are the prime creators of our experienced reality.

Carefully designed artifacts accompany the remains of our earliest ancestors. Designed implements have been found that predate the earliest human fossil remains discovered so far. In fact, it is evidence of design ability, and activity, which allows an archeologist to distinguish between a species that is not quite human and one that is. So, it appears that it is our very ability to design that determines our humanness.

Design is a *tertium quid*—a third way—distinct from the arts and sciences. In support of this argument we make a case for the reconstitution of *sophia*—the integration of *thought* and *action* through design. We make a case for design as its own tradition, one that reintegrates sophia rather than following the historical Western split between science and craft or, more recently, between science and the humanities. A similar split can be found in everyday language between thinking and doing, theory and practice, white collar and blue collar, and so on. A great deal of argument and discussion about this split has come about in the aftermath of the

famous formulation by C. P. Snow (1959) of the humanities and sciences as two cultures that would not or could not be reconciled.

In the same way that confusion often arises whether architecture is a midpoint between science and art, the nature of design, too, is misrepresented. However, design is not a midpoint between the applied arts and sciences. Design is a third culture with its own founding postulates and axioms, with its own approach to learning and inquiry. Design is inclusive of things found in science such as reason and in the arts such as creativity. But just as science is inclusive of creativity it does not follow that science is the same as art or that art is subsumed under science. They are different ways of approaching and being in the world. This is also the case for design.

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. Design is the *first tradition* among the many traditions of inquiry and action developed over time, including art, religion, science, and technology. We design our cosmologies, our homes, our businesses, and our lives, as well as our material artifacts. As such, design touches nearly every aspect of our experienced world. It is an important capacity, not only for those who wish to be designers, but also for those who are served in the design relationship as well. Things that really count, and are highly valued, come from design, when not directly from nature.

Possessing the ability to engage so powerfully in the world is the essence of human potential. But it is also true that humans are fallible. Design activities can do, and have done, great service for humanity. But design has done great harm as well. We cannot know for certain, that what we design is what ought to be designed. We cannot know what the unintended consequences of a design will be, and we cannot know, ahead of time, the full, systemic effects of a design implementation. We can be godlike in the cocreation of the world, yet we cannot be godlike in our guarantee that the design will be only what we intended it to be, for the reasons we intended, even with a full understanding of the necessity of the design in the first place. We will always be startled by the appearance of unintended consequences and unpleasant surprises.

An archetypal designer is represented in the Greek pantheon of gods in the persona of Hephaistos—the lame god whose counterparts appear in African and Middle Eastern mythology as well. Depending on the particular story you read, the reasons for Hephaistos's lameness vary. However, as a consequence of his condition, he was required to create tools and devices—designed artifacts, if you will—which enabled him to overcome his handicap, setting him apart from the other, more perfect gods. His great

originally means the skill of the craftsman, the carpenter (Iliad XV.412), the seafarer (Hesiod, Works 651), the sculptor (Aristotle, Nic. Eth. Vi.1141a). Sophia originates in and refers to the aesthetic hands of Daedalus and of Hephaistos" (Hillman 1992).

However, during the time of these philosophers, sophia was divided. In the philosophic writings of Aristotle, wisdom (sophia) became primarily the concern for first principles and causes—thus cleaving it from practical wisdom and productive action. Sophia was further divided into knowledge of ideals (the abstract) and the capacity for practical actions (the concrete). As McEwen explained:

> For Plato, episteme and sophia no longer had anything do with skill. Daedalean episteme, the uncertain, elusive knowledge of experiences, was subsumed to, absorbed by the certainty of knowledge as seeing, eidenai, with the eidos, the things seen, fixed and eternal, as its ultimate object and source. . . . The earlier understanding that sophia-as-skill, the complement of a techne that allowed kosmos to appear,was itself the very revelation of the divine in experience, had been lost. (McEwen 1993)

Sophia was not only divided into separate parts, but the resulting components were also placed at the extremes of a hierarchy. In Plato's Republic, those who *thought* about things were elevated to the pinnacle of society, while those who *made* things were positioned at the bottom of the social hierarchy. This hierarchy can be seen continued in today's world. Polarities between people, such as white-collar and blue-collar workers, management and labor, thinkers and doers, continue to play out this division of sophia. The split widens further in the polarization of ideas, like rigor versus relevance, emotion versus intellect, thinking versus doing, or abstract versus concrete. This split has proven detrimental to any formation of an inclusive and developed understanding of design as a human activity dependent on the integration of both sides.

Design's historical roots were further frayed when Aristotle's four causes—material cause (substance), instrumental cause (means), formal cause (forms), final cause (ends)—that he used to describe and explain the world were reduced in the Middle Ages to just two causes: material cause and instrumental cause (i.e., pure science and applied science). The original understanding of sophia—design—in the pre-Socratic era not only included Aristotle's full complement of causes, but also required the addition of other causes that focused on making and production—in distinction to just description and explanation.

These historical polarizations and separations have influenced the way in which we today understand and justify taking any collective action.

1. understand problem
2. gather information
3. analyze information
4. generate solutions
5. assess the solutions
6. implement
7. test
8. modify

Figure I.3
Solving tame problems (Rittel 1972)

Without an intellectual understanding of the tradition of design in place—in its pre-Socratic form—we have looked to other traditions of inquiry for insight into the nature of, justification for, and management of change.

The dominant trigger for initiating change in human affairs is, today, primarily based on the existence of a clear and immediate understanding of a particular problem or set of problems. Political action, professional performance, economic decisions, social planning, and business choices are almost entirely justified on the grounds that life is a set of problems requiring practical, efficient, and effective solutions. Much of formal education or training is based on preparing students to better identify and solve problems creatively, quickly, fairly, rationally, and prudently. This essentially reactive mode, applied to every realm of life, is reinforced and supported by well-developed procedures for problem solving. Horst Rittel (1972) has identified such problems as "tame" (see figure I.3).

Tame problems are appropriate for simple or trivial concerns, but more important or significant issues are better characterized, according to Rittel, as "wicked" problems (see figure I.4). The characteristics of wicked problems do not lend themselves to simple procedures, or even easy characterizations. If taken seriously, the wicked nature of these types of problems leads to paralysis. This paralysis is most often skirted by the assumption that wicked problems can be simplified and recast as tame problems. This, of course, exacerbates the original wicked problem situation and creates an even greater mess.

The characteristics of a wicked problem are not descriptive of the process for determining solutions to such problems, but are merely explanative of the nature of wicked problems. These characteristics are the result of the limits and paradoxes of reason when applied to real-world situations in human affairs that are unique, contingent, unpredictable, and complex.

- cannot be exhaustively formulated
- every formulation is a statement of a solution
- no stopping rule
- no true or false
- no exhaustive list of operations
- many explanations for the same problem
- every problem is a symptom of another problem
- no immediate or ultimate test
- one-shot solutions
- every problem is essentially unique
- problem solver has no right to be wrong

Figure I.4
Characteristics of wicked problems (Rittel 1972)

By treating a wicked problem as a tame problem, energy and resources are misdirected, resulting in solutions that not only are ineffective, but also can create more difficulty because the approach used is an intervention that is, by necessity, inappropriately conceptualized. Most of our significant everyday encounters with a problematic reality have the characteristics of wicked problems. Very few everyday situations of any importance can be described as tame problems. For instance, there is never only one best solution to such problems. There are only solutions that are good or bad. There is no one correct approach or methodology for solving these problems, and it is not possible to formulate one comprehensive and accurate description of a problematic situation from the beginning. Tame and wicked problems are not governed by the same logic. The strategies developed to deal with tame problems are not only different in degree, but also different in kind from those required for dealing with the complexity, ambiguity, and epistemological uniqueness of wicked problems.

The focus on problems, whether wicked or tame, as the primary justifiable trigger for taking action in human affairs has limited our ability to frame change as an outcome of intention and purpose. It means that wise action, or wisdom, is starved of its potential (Nelson 1994). Wisdom—specifically that which we call design wisdom—is a much richer concept than problem solving, because it shifts one's thoughts from focusing only on avoiding undesirable states, to focusing on intentional actions that lead to states of reality which are desirable and appropriate.

As only the intellectual or reflective components of the pre-Socratic concept of wisdom (i.e., the wisdom of reason) remain present in Western thought, wisdom is most often treated as simply the summation of data, translated into information, which is then transformed into knowledge.

On the rare occasions that wisdom is discussed in practical settings, the challenge is how to make and maintain the linkages between the rational components of wisdom, while accommodating the challenges of unique particular design situations.

The wisdom of the knowing hand—that of making, producing, and acting—must be connected to the wisdom of reason. But, wisdom in the realm of design requires that we take a step back. Design wisdom requires the reconstitution of sophia. Design wisdom is an integration of reason with observation, reflection, imagination, action, and production or making.

Another demand that design wisdom makes on us is to reintroduce the analog into a world long dominated by the digital and the analytic. The digital and analytic perspectives have heavily influenced Western traditions of thought for centuries. For instance, the division of the day into hours, minutes, and seconds that are indifferent to the particular qualities of any one day is an example of the digital. The division of land into grids indifferent to terrain or social habitation is another example. The division of sound or light waves into electronic pulses is another form of digital translation. The digital approach divides information into packets that are stable and congruent but detached from the qualities of the substance or event itself.

The division of all academic reality into disciplines of the sciences or the humanities, and further into narrow disciplines, is an example of the analytic. The analytic is an approach that divides things into constituent parts or categories of similarity using ordering systems. The division of professional services into areas of expertise is another example of the analytic. This approach has allowed us to make significant advances in technology and related scientific endeavors. Unfortunately, concurrent with this, the analog has become conspicuous in its absence in contemporary technical societies. This absence is a natural consequence of societies divided and separated by specialization, by taxonomies and categorizations, by social hierarchies and by administrative conveniences.

Individuals struggle to comprehend their experience of life as an analog reality—an integrated, complex whole that is not cleaved into clear, distinct, and separate taxonomies or categories. The digital and analytic approach to making sense of this undifferentiated experience helps to facilitate intentional change by reducing the overwhelming complexity of any particular situation and by providing instrumental distinctions that can become elements in new design compositions. Design wisdom has the ability to shift from an analog experience of life, to a digital or analytic

perspective of the world and *back again*. This is done by means of a design process that begins initially with a complex, undifferentiated situation, which then transitions through a process of discernment and distinction and ultimately terminates with the integration of innovative designs into a desired seamless reality for those being served directly or affected incidentally. Therefore, one of the most vital aspects of design is that the outcome of any practical digital and analytic intervention must be transformed back into the analog. This is to assure that, with each new design addition, life continues to be experienced as a whole.

One more factor in design wisdom concerns the nature of change. Change is an oft-evoked concept in politics, planning, management, and other forms of intervention, but it is often not clearly articulated. In the tradition of scientific thinking, change is a consequence of either chance or necessity. Probability theory and statistical analysis are examples of approaches to change as a result of chance. In human affairs, chance is often experienced as luck, or fate, whereas scientific principles, or laws, and rules of behavior are examples of how we react when necessity (or certainty) is the cause of change.

Design wisdom—as a first tradition—provides an escape from this limited state of affairs. Change, as a consequence of design cause and intention, is an approach available to us, as a third option (Nelson 1987). In order to develop a robust tradition of design thinking, this concept of intention needs to be added as an agent of change to the ones already existing. The concept of change needs to be deepened as well in this context. Change—in relationship to design wisdom—has multiple levels of meaning, significance, and consequence (see figure I.5).

The challenge to cultures, or societies, on how to deal with change at these multiple levels was formulated by Arnold J. Toynbee (1948), and presented in mythic terms in the work of Joseph Campbell (1968) (see figure I.6). According to Toynbee's findings, based on his research into the behavior of past civilizations, social systems historically evoke four types of responses when confronted by change. The only cultures that seem successfully to move through major challenges, or crises, are those that engage in change in a radical and proactive manner that is consistent with design wisdom and leads to transformational change.

Of course, cultures, civilizations, nations, and other forms of large-scale social systems can escape major change over extended periods of time. But, when the pressures for change build internally or externally, accidentally or intentionally, successful survival and improvement seem to come only as consequences of an approach that can radically transform the existing

at least in the beginning stages of its development, joining with others with similar interests.

We believe the first step in establishing a design culture is to conceptualize design as a unique way of looking at the human condition with the purpose to create change. To that end, we need to develop and use design wisdom as a frame of reference grounded in its own unique tradition. It is, in effect, our first tradition, as was discussed earlier. The remainder of this book deals with considering the character and consequences of this idea more fully.

In any particular design, there are specific dimensions of art, technology, and science, but in the totality of that design, in its inclusiveness of generalized aspects of the experienced world, it has a commonality with all applications of design. Herbert Simon (1969), speaking from an engineering background, made a seminal contribution to the development of a broader understanding of design by introducing the concept of the science of the artificial—design. There has been a continuation and expansion of this idea, in more recent work, among others by Schön (1983, 1987), Banathy (1996), Boland and Collopy (2004), Krippendorff (2006), and Cross (2011).

That design thinkers hail from a variety of backgrounds should not come as a surprise. Designers from any design field, formally defined or not, can relate to other designers because they all are striving toward the same goal; they are hoping to add to, or change, the real world. They do this through their service-related creativity and innovation, in both particular and universal ways.

Culture is never a natural occurrence. Cultures can be created by design, however. Cultures are a living tension between tradition and innovation, between stability and change. This type of social structure and process can be changed, developed, deepened, misunderstood, or misinterpreted. Working to develop a conscious design tradition, it must be remembered that any change to a cultural tradition can easily be blocked by unseen habits or forces not easily understood. A social culture often consists of ideas, norms, and a "common sense" understanding that are taken for granted, often without questioning their origin or benefit. This means that it is imperative to maintain both open and critical minds in the creation of a design culture within the milieu of established social cultures.

Evan as we focus on the cultural similarities among different kinds of designers, we do so based on a recognition and acceptance of their differences. It is important to acknowledge that every formally recognized professional designer has a specific field of design expertise—a range of specific

crafts, skills, and knowledge, forming professional domains such as: industrial design, architecture, information design, software design, urban design, organizational design, educational design, instructional design, and so on. It is equally important to remember that every informally recognized designer has a similar field of expertise. Every designer's competence relies on his or her knowledge and skills, concerning materials, tools, methods, languages, traditions, styles, and so on, found in his or her specific design field.

This book is not centered on those specialized competencies. Instead it concentrates on the characteristics and qualities of the cultural tradition within which all designers practice. We argue that, to be a thoughtful and responsible designer, any general understanding of what design is ultimately about has to be critically appraised, by you—the individual designer, client, stakeholder—or anyone else affected by design. In addition, any understanding of design should be the result of reflective practice, intellectual apperception, and intentional choice. This book is meant to be a resource in the facilitation of such an individualized understanding of design.

II FOUNDATIONS

Although it is common to assume that any new way of thinking must be defined by a new paradigm (Kuhn 1962), it is equally important to uncover the conceptual foundations upon which a new culture of inquiry plans to stand. The design hypostasis we present in the following four chapters acts as the supporting platform for the design approach.

We believe these chapters cover the seminal ideas supportive of a design culture. When studied, these foundational concepts will help any designer—or champion of design—develop an understanding of the conditions necessary for real design inquiry and action to flourish.

In these chapters, we will focus on the particular, service, systemics, and the whole, and explore each of these foundational precepts in detail.

imagination, and innovation. It can only confirm potentiality and assist realization.

Designers want to be able to make good design judgments that will, at the very least, make a company efficient, a nonprofit effective, or a governmental agency politically popular. They want to make designs that lead to better products, services, organizational behavior, or global sustainability. They also want to be seen as designers worth the compensation, prestige, and trust they desire, or receive.

Leaders and managers, as well, are facing ever-increasing demands on their design judgment skills. The market overflows with workshops and training sessions that promise to provide the right sequence of learning experiences leading to easily accessible, and cost-effective problem-solving skills. The underlying promise is that these skills will consistently provide ready-made, transferable solutions to the complex problems facing leaders today. Design and creative problem-solving processes for business have been commoditized into branded approaches for delivering expected outcomes. The challenge and mystery of designing, as pointed out by Roger Martin (2009), have been tamed by recipes that disappoint more often than not. His recommendation is that designers need to return to unscripted approaches to design. "Design thinking," for example, has been transformed into rule-based algorithms fashioned out of heuristics that seemed to have worked within limitations in the real world (see figure 1.1).

A desire for consistency and certainty has been part of the human condition for as long as recorded time. The earliest cosmologies, with their associated rites and rituals, were all meant to give structure to chaos and mystery. But, even with a cosmology in place, there has always been less predictability than desired, and more unpredictability than tolerable.

Figure 1.1
Approaches to inquiry for action

Ancient Greek decision makers would go to great effort to ask the Oracle at Delphi for a simple answer to their straightforward question, only to be given responses that, by necessity, required deeper thinking on the questioner's side. The early Christians found that their leader spoke only in parables, leaving centuries of interpretation as to what the "true" answers were. Despite the popularity of these traditional sources of wisdom, decision makers have continued to look for other means of inquiry that will provide information that is more accessible, straightforward, accurate, and consistent over time.

In the Western tradition, the right answer was soon identified as an outcome of rational thought, using the protocols of the scientific method. This approach worked so well for gaining a better understanding of the natural world, and for the creation of sophisticated technology, that it was only natural that managers, administrators, and even designers would begin to depend heavily on this particular form of inquiry as well. However, this scientific approach, with some exceptions, has not provided the kind of guarantee of outcomes one would imagine possible. This comes from confusion between what is true and what is real. Science deals only with what is true, but leaders or managers—and definitely designers—must deal with what is real, in addition to what is true.

When something is true, it has to be true in all cases and situations. We do not accept as a scientific truth a statement that sometimes is true, and sometimes not. Science deals with what is general and universal. There are extensive discussions concerning whether some of the newer scientific methods used in social science, such as case studies, interpretative studies, or qualitative methods, have the ability to create any kind of universal, or generalizable, truths. If a rational method leads only to an understanding of a specific case, and not to some universal truth, then it is not really considered to be a scientific method. Based on this kind of thinking, modern social science is often accused by other researchers of being the same thing as journalism or even creative writing. However, it is still the case that all research strives for trustworthiness, which can be understood as a measure of truth. Research, in all fashions, aim at producing knowledge that is trustworthy and thereby has a higher degree of universality than other forms of knowledge.

In science, we strive to reason from ultimate particulars to universal principles and laws. This is done by the method of *induction*. Through science, we can also explain something quite particular with the help of the universal, by the method of *deduction*. But, the process for creating the *ultimate particular* is not based on scientific induction or scientific deduc-

tion. There is no scientific approach for creating an ultimate particular because science is a process of discerning abstractions that apply across categories or taxonomies of phenomena, while the ultimate particular is a singular and unique composition or assembly. Creating that which is unique and thus particular, therefore, cannot be accomplished using a scientific approach.

An action taken by an individual at a specific time and place is an example of something that is an ultimate particular. The outcome of a specific design process, such as a chair, a curriculum, or a policy, is an ultimate particular. It is something unique. It is not the universal chair, the universal curriculum, or the universal policy. We create a particular, which when taken together with other particulars makes up the whole of our experienced reality. Even when products are designed in great numbers, with wide distribution, they still have the quality of being particular and not universal, since they do not represent the only possibility for accomplishing the same end or serving the same purpose and in situ they are truly unique and an ultimate particular.

Design is a process of moving from the universal, general, and particular to the ultimate particular—the specific design (see figure 1.2) (a related

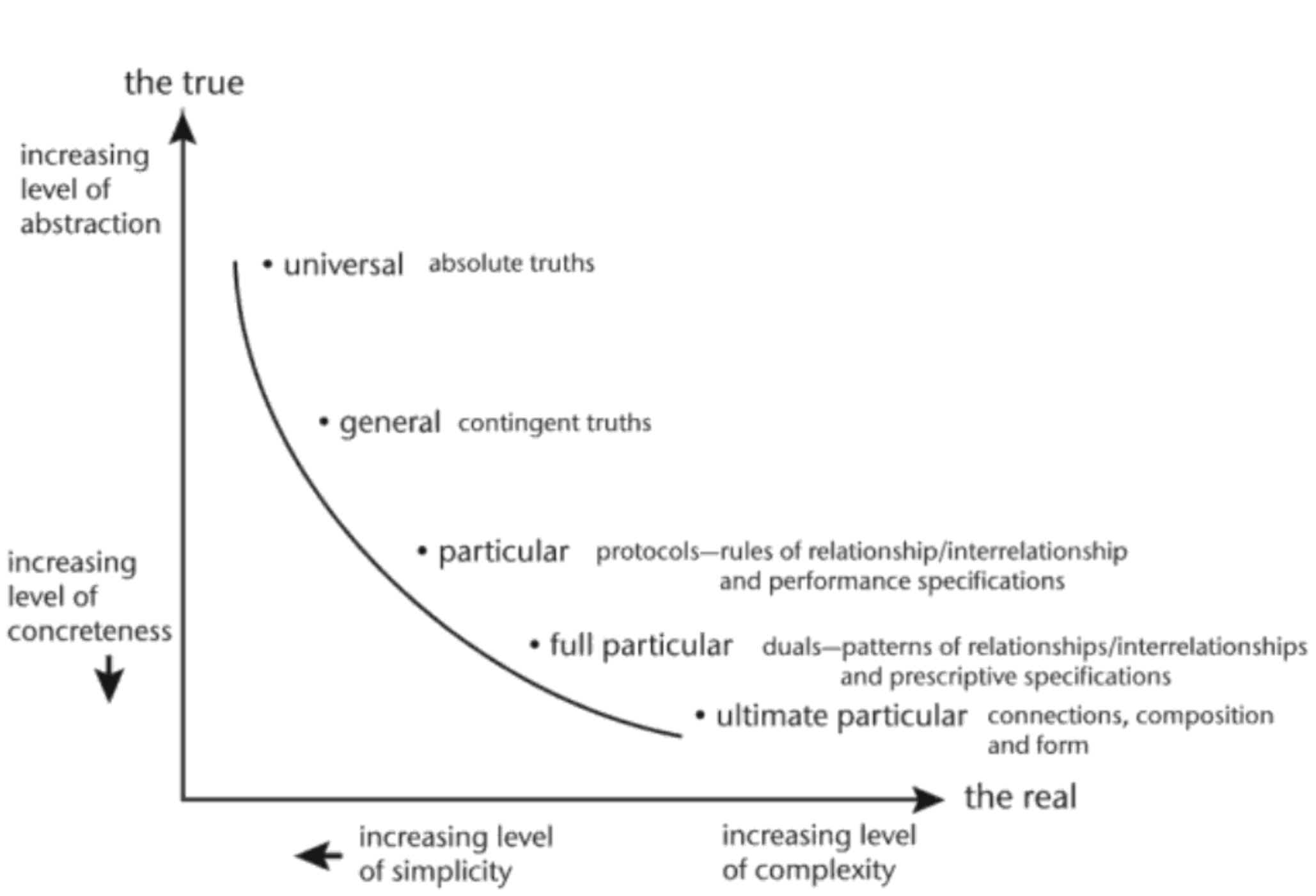

Figure 1.2
Universal to ultimate particular

concept called *full particular* is developed in Sunstein 2001). The way this is done is by making design judgments. What we desire to come into existence is a matter of judgment—based on design *will* (volition) and *intention* (aim)—and can never be found in explanations, descriptions, or predictions. Design will and design intentions are the means for initiating and directing change based on human agency. It is design will and design intention, guided by design judgment, that transform the abstractness of relevant scientific knowledge and other forms of knowledge into a final unique design, the ultimate particular. The ultimate particular is that which "appears" in the world.

In design, we are not dealing with a universal or contingent truth—we are dealing with the particular; as well as with that which is real. Distinctions between what is true (e.g., universal or general) and what is real (e.g., particular, full particular, and ultimate particular) can be made in the following ways. A painting by Cézanne is real; the atomic weight of copper is true. An experience is real; a scientific theory is true. An organization is real; a proven principle or law is true. An individual's perspective is real; a predictable trend is true. The true, on the one hand, comes from patterns of accurate descriptions, and explanations, through controlled observation, such as William James's "tough-minded" empiricism. The true can also come from careful abstract reasoning, and logic, as in William James's "tender-minded" rationalism (James 1975). The real, on the other hand, is the result of particular actions, taken through specific judgments, and formed by distinct intentions.

Right decisions and appropriate actions in human activities do not and cannot arise from what is true only. When this fact is not appreciated, it leads both designers and decision makers into dead-end states of *analysis paralysis* and *value paralysis*. Decisions, and actions, must be based on what is real, and ideal, in addition to what is true. The real and the true are, of course, not exclusive. When dealing with the real, we often benefit from the instrumental support given to us by scientific knowledge, which is essential to any designer. There needs to be a symmetry between the real and the true, and not polarity. We need to find the unity between the two, rather than a compromise.

Over time, many different ways of conducting inquiry into what can confidently be considered to be true have been "designed" as opposed to being inherently obvious. These differing forms of inquiry have been sufficiently successful—in the right context, and at certain moments in history—to be championed as superior forms of inquiry, regardless of the situation or need. This is especially true of inquiry based on the scientific

method. The hegemony of science and scientific thought, in the developed world over the last century, is an indicator of the winner of the most recent battle for dominance among systems of inquiry. A belief in the scientific method, as the only and superior valid method of inquiry for describing, explaining, and interceding in the world, is a hallmark of our technological age. Science, as an activity of disciplined inquiry, has often been called the new religion of the contemporary age.

C. West Churchman introduced the idea of designing systems of rational inquiry by contrasting, and comparing, historical forms of inquiry (Churchman 1971). The basic types of rational inquiry Churchman discussed are fact nets, consensus, representation, dialectic, progress, mechanism, teleology, and probability. Churchman used the thought processes of famous philosophers as examples of the designs of inquiry he presented. All the approaches he discussed are constructed in the tradition of the true—the scientific search for knowledge. They are all based on the idea of a rational approach that is guided by strict rules on how to go about finding knowledge. In today's world of design, we can find modern approaches resembling all of these various scientific traditions. A designer can greatly benefit from having a basic knowledge of traditional systems of inquiry. Such knowledge can help in evaluating the constant flow of "new" approaches but also as a tool for critical examination and reflection on one's own approach.

The design tradition, however, requires that we follow a different path. The choice a designer makes, as to how to acquire knowledge, deeply affects how his or her design work is done. If the designer chooses a scientific approach, the whole design process will have strong similarities to a research process. This will limit or eliminate not only what is considered to be the preconditions of the design, but also what is possible, what is needed, what is desired, and what the eventual outcome will be. It will no longer be a design process.

In some cultures, the most dominant form of inquiry is the spiritual. In the spiritual tradition, knowledge is not necessarily something we have to gain for ourselves, or discover in the world. It is instead handed down to us, through different channels, from some divine or spiritual source. The work of a designer, who builds on this tradition, will be radically different from designs based on scientific methods of inquiry. It is not uncommon, even in today's technological world, to find designs inspired by and even argued to be "given" to humans from a higher source.

Another form of inquiry, over which there is a great deal of disagreement, is defined as intuition. Intuition is a form of unconscious knowing.