CHAPTER 32

TAMING WICKEDNESS BY INTERDISCIPLINARY DESIGN

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The word "design" is most frequently employed to refer to the action of planning and making (designing something), but it is also used to describe the end result or artifact of this action (a design). In other words, it indicates both—process and product. And here, by "product," I refer not only to things like toasters and cars but also to websites, interfaces for mobile phones, signage, interior spaces, buildings, gardens, and cities. Thus, the practice of design is central to a variety of well-established disciplines including, but not limited to architecture, automotive design, industrial design, fashion design, graphic design, and interior design.

32.1 Introduction

The etymological root of the word "design" can be traced back to *designare*, Latin for "to mark out" or "devise." Both marking out and devising signify an intent to create concepts that can be realized and materialized as objects. In other words, a designed object is "reified intention" (Mitcham 1994, p. 220). Other oft-quoted descriptions of design include "conception and planning of the artificial" (Buchanan 1990, p. 78) and "courses of action aimed at changing existing situations into preferred ones" (Simon 1996, p. 111). While most explanations of design tend to focus on the cognitive activity of generating ideas that eventually achieve tangible form, Simon's definition is much broader in its scope and shifts attention to external conditions. In addition, it suggests a motive for change that expects designers to know and specify what a "preferred situation" should be, thereby introducing an ethical and moral responsibility.

In recent years, design's charter has expanded beyond creating goods and services for the market to include tackling the enormous challenges posed by environmental pollution, income inequities, poor access to healthcare, lack of clean drinking water, and other problems of a global scale. Whether it is the design of small devices or large systems, designers have to consider issues of aesthetics, usability, ergonomics, safety, accessibility, marketability, affordability, profitability, manufacturability, functionality, and sustainability. By necessity

The Oxford Handbook of Interdisciplinarity Second Edition, Robert Frodeman, Julie Thompson Klein, and Roberto C. S. Pacheco, Oxford University Press (2017).

therefore, design is interdisciplinary, and has to straddle craft and science, the humanities and the social sciences, as well as art and engineering in its practice and in its theory.

Design is generative and analytical; it demands creative thinking and critical problem solving. If such is the task of design, its practice necessitates that the practitioner and the theorist draw on knowledge that resides in disparate disciplines, and requires a type of thinking that can integrate multiple points of view. "Interdisciplinary skills are also particularly important for problem-solving in areas where there are a large number of variables together with high levels of uncertainty and risk. As Nobel Laureate Gunnar Myrdal commented 'problems do not come in disciplines' " (Gann & Salter 2001, p. 99).

If design's task, as Max Bill, rector of the influential Hochschule für Gestaltung in Ulm, once explained, is "to participate in the making of a new culture—from a spoon to a city" (Lindinger 1991), its scope can be vast and its impact significant. And while the design of a spoon might be possible through the collaboration between a designer and a metalsmith, the planning of a city certainly is not possible without the involvement of a large number of experts including urban planners, city officials, transportation engineers, citizens, and other experts representing a variety of disciplines, points of view, and interests.

32.2 Design Practice and Theory

> No single definition of design, or branches of professionalized practice such as industrial or graphic design, adequately covers the diversity of ideas and methods gathered together under the label. Indeed, the variety of research reported in conference papers, journal articles, and books suggests that design continues to expand in its meanings and connections, revealing unexpected dimensions in practice as well as understanding.
>
> (Buchanan 1992, p. 5)

Most definitions of design refer primarily to design practice as manifest in the professions of architecture, industrial design, fashion design, and so forth. Designers involved in such activity often refer to their task as problem solving, and view their work as a response to opportunities and needs in the market identified by corporations, entrepreneurs, consumers, governments, and nonprofit organizations. The variety of domains in which designers operate and the range of outcomes they produce have made it difficult to establish a thorough taxonomy of design disciplines. In addition, as it evolves, design takes on new meanings, adopts new methodologies, addresses a broader range of problems, and redefines its scope, making it challenging to keep taxonomical structures current. If one imagines the totality of the built environment (from the spoon to the city) to be the domain of the designer, it can be broadly (and incompletely) classified into the domains and disciplines shown in Figure 32.1.

Though the divisions that exist among the various forms of design practice fracture the discipline, they do serve a critical role. "There are, of course, some good reasons why these practices were separated in the first place, and the issue is not to meld them all into a new, comprehensive profession that is at once everything and nothing" (Margolin 1989, p. 4). The design and manufacture of a hand-held device presents a set of challenges that are far different from those faced by an architect who is called on to oversee the design and construction

The Built Environment	The Design Discipline
The city and its environs	Urban Design, Landscape Architecture, Planning
Buildings and their interiors	Architecture, Interior Design, Exhibit Design, Set Design
Products	Product Design, Industrial Design, Toy Design, Transportation Design, Engineering Design
Communications and new media	Graphic Design, Visual Communication Design, Web Design, Interaction Design
Services and infrastructures	Service Design, Process Design, Experience Design, Systems Design

FIGURE 32.1 The domains and disciplines of design.

Topics of study	**Definition**
Design Technology	The study of the phenomena to be taken into account within a given area of design application
Design Praxiology	The study of the design techniques
Design Language	The study of the vocabulary, syntax and media for recording, devising, assessing and expressing design ideas in a given area
Design Taxonomy	The study of the classification of design phenomena
Design Metrology	The study of the measurement of design phenomena, with special emphasis on the means for ordering or comparing non-quantifiable phenomena
Design Axiology	The study of goodness or value in design phenomena, with special regard to the relations between technical, economic, moral and aesthetic values
Design Philosophy	The study of the language of discourse on moral principles in design
Design Epistemology	The study of the nature and validity of ways of knowing, believing and feeling in design
Design History	The study of what is the case, and how things came to be the way they are, in the design area
Design Pedagogy	The study of the priniciples and practice of education in the design area

FIGURE 32.2 Areas of work and research likely to be involved in the future development of design studies (Baynes et al. 1977).

of a hospital. Similarly, the design of a car interior demands the attention of transportation designers, ergonomists, mechanical engineers, materials experts and others, making it a vastly different challenge from the design of an archeological exhibition about Egypt's history, for example, which might involve archeologists, exhibition designers, curators, graphic designers, historians, and other experts. The level of granularity in the division of design labor encourages the development of domain-specific knowledge and gives designers the opportunity to refine their craft. However, it also presents the danger of narrow and compartmentalized thinking that can seriously limit design's impact. In order to generate holistic and comprehensive solutions to problems of the built environment, collaboration among disciplines is imperative.

In addition to the professional occupations, though, it is important to recognize the emergence of *design studies*, an interdisciplinary activity established to study design itself and develop a theory of practice. Bruce Archer, one of design's leading voices and advocate for the establishment of design studies, created a taxonomy outlining 10 topics within which further research would be needed to develop a theoretical body of domain knowledge.

Design studies seek to develop reflexive knowledge about design itself, especially in the areas of the history, theory, and criticism. Margolin (2002) advocates three key areas of research: "design methods" (understanding the process of design), "project-oriented research" (knowledge from practice), and "design as a cultural practice" (recognizing design's place in society) (2002, p. 251). As the labels imply, these are interdisciplinary areas of inquiry that depend on thorough engagement with such disciplines as philosophy, history, psychology, education, and anthropology for their development.

32.3 Design Education: A Historical Sketch

> Students who wish to become designers in the postindustrial knowledge economy will enter an inherently multidisciplinary profession. This profession involves a wide variety of professionals, including scientists (physical, biological, and social), engineers (industrial, civil, biological, genetic, electrical, and software), and managers, as well as the many kinds of artists and artisans now called designers.
>
> (Friedman 2000, p. 200)

While most of the academic coursework that students undertake in design programs is tightly circumscribed by the individual disciplines, there is a growing recognition of the need to create transdisciplinary opportunities. The formal tradition of incorporating multiple perspectives into design education can be traced to the Bauhaus, which in 1919 strove to create a unity between arts and the crafts. Walter Gropius, in the *Program of the Staatliche Bauhaus* published in 1919 in Weimar, summoned architects, painters, and sculptors to return to the crafts (Wingler 1969). This manifesto proclaimed that there was no essential difference between the artist and the craftsman, and proficiency in a handicraft was essential to every artist. Therefore, *Werkstatt* (workshop) instruction held supreme significance, and made up a large part of the students' quotidian learning activities. That the academic title of professor was supplanted by *Formmeister* (Master of Form) or *Werkmeister* (Master of Craft), and "student" by "journeyman" or "apprentice," authenticated Gropius's predilection for the artisanal approach to education.

By 1923, this mission had been redefined with an emphasis on technology. This shift in focus was exemplified in Gropius's lecture, "Art and Technology: A New Unity," when the Bauhaus embraced the ideals of mass production over craft-romanticism. They had decided to train not craftsmen but collaborators for industry, craft, and building. The workshops were renamed laboratories with the purpose of building prototypes of designs suitable for mass production. Toward the end of its life, the Bauhaus became an architectural school, and it was eventually closed in 1933.

In 1937, László Moholy-Nagy founded the New Bauhaus in Chicago to continue the initial Bauhaus mission by forming art, science, and technology as the three primary dimensions of design. Moholy-Nagy sought advice from the philosopher Charles Morris, who was then developing his theory of semiotics. Morris established coursework at the New Bauhaus in order to achieve "intellectual integration" among these three key pillars of design. "Morris considered the design act to be a kind of semiosis, and he drew a parallel between the syntactic, the semantic, and the pragmatic dimensions of a sign and, respectively, the artistic, the scientific, and the technological dimensions of design" (Findeli 2001, p. 7). Though these theories did not take root at that time, the attempt does demonstrate Moholy-Nagy's desire to introduce philosophical and linguistic concepts in design education. The New Bauhaus, which later merged with the Illinois Institute of Technology, continues to function today as the Institute of Design.

The Hochschule für Gestaltung (HfG), founded in 1951 in the city of Ulm in Germany, expanded the Bauhaus vision and outlined design's task as participating in the making of a new culture. Tomás Maldonado, who led the school from 1957 for a period of 10 years, suggested a more rigorous interdisciplinary education that included social psychology, sociology, anthropology, cultural history, and perception theory. The arts were no longer considered a critical foundation for design, and there was a heavier emphasis on developing a stronger scientific basis. Maldonado was interested in developing scientific design methodology and turned to several new disciplines emerging at that time: "cybernetics, information theory, systems theory, semiotics, ergonomics" (Maldonado 1990, p. 223). Though these disciplines were not thoroughly integrated into the curriculum, engaging them allowed Maldonado and the Ulm school to investigate and develop design's own scientific base. This school, which eventually closed in 1968, has been singled out as having influenced design pedagogy all over the world.

The three schools—Bauhaus, New Bauhaus, and HfG—developed interdisciplinary curricula around three primary concepts: art, science, and technology. As design itself has evolved, design education has extended its interdisciplinarity beyond these three to include new disciplines. At the undergraduate level, most programs require students to take courses in the natural sciences, social sciences, and humanities (mathematics, physics, psychology, etc.) as a part of their general studies requirements. In addition, design programs also encourage or require courses in marketing, economics, anthropology, and so forth.

However, this does not qualify as transdisciplinary design education, and therefore several design programs have set up team-based learning environments where students from a variety of disciplines (frequently business, engineering, and anthropology) work together on projects. At the graduate level, design programs exhibit a higher level of transdisciplinarity, and it is not uncommon to find thesis and dissertation projects that critically engage several disciplines. Today, with varying degrees of integration, several departments and schools of design have partnered with programs in business, engineering, and the social sciences across campus and at times across universities. Arizona State University, Art Center College of Design, Carnegie Mellon University, Illinois Institute of Technology, Rhode Island School of Design, Stanford University, and the University of Cincinnati are but a few examples of academic programs actively engaged in interdisciplinary design education.

32.4 Interdisciplinarity in Design

The process by which the tangible and intangible things we live with come into being varies to a certain extent across the design disciplines, but it is typically conducted in cross-functional teams that include, in addition to the designers, engineers, market researchers, financiers, manufacturers, sales personnel, retailers, and other experts. In some cases, domain knowledge specialists are invited to participate to provide expertise particular to the project at hand. For instance, if the design project is the creation of new surgical tools, the team might include surgeons; if it is a new suspension bridge, it might have specialized structural engineers on staff; if it involves a new park for a city, zoning experts might participate as well.

Design can be described as an integrative discipline that resides at "the intersection of several large fields" (Friedman 2000). For Friedman, the natural sciences, humanities, and liberal arts as well as the social and behavioral sciences constitute the "Domains of Theory" while the human professions and services, creative and applied arts, and technology and engineering make up the "Domains of Practice and Application." However, classifying these domains on the basis of theory and practice presents problems; just as there are theories of engineering, there is application in the humanities. These disciplines should instead be conceived of as contiguous areas of study so as to demonstrate the interaction among them.

Figure 32.3 represents a model where design problems can be mapped out on the basis of engagement with other disciplines. The domain map of the design project therefore takes form on the basis of the nature of the problem and the disciplines required to be involved.

Mitcham (1994) has classified design into two broad categories—engineering design and artistic design; the former driven by performance specifications and the latter by form; the first by efficiency and the second by beauty. Engineering design uses physics and mathematics in visualizing its material outcomes, and artistic design relies on the senses and intuition in creating its results. However, with growing interdisciplinarity and the emergence of new subdisciplines within design, the boundaries of such classifications become blurred. For instance, Web and app designers create graphic user interfaces that determine the aesthetic character of a website or the interface of a smartphone (a form of artistic design), but

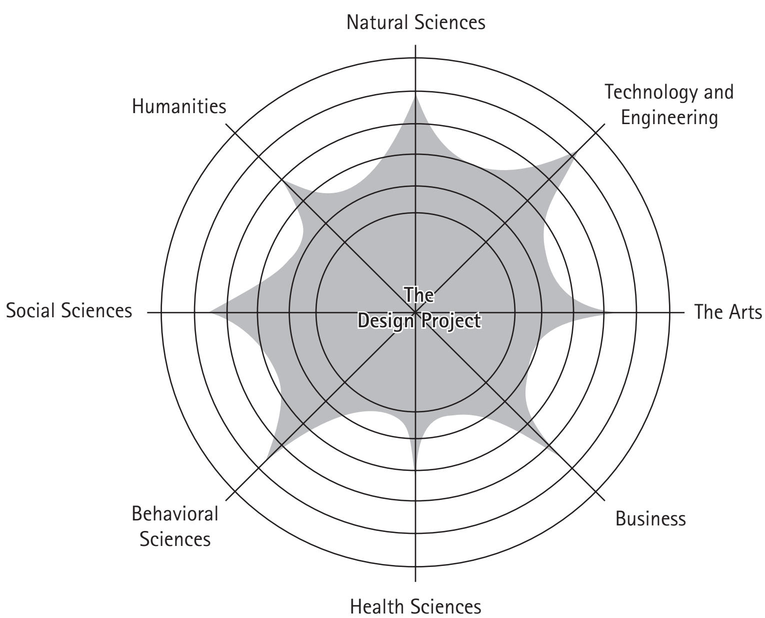

FIGURE 32.3 Domain map of a transdisciplinary design project.

many of them are also required to know some computer programming (a form of engineering design) in order to make the designs functional.

"Design is partly rational and cognitive, and partly irrational, emotive, intuitive, and noncognitive. It is rational to the extent that there is conscious understanding of the laws of nature; it is irrational to the extent that the sciences have not yet succeeded in revealing the laws of complex phenomena" (Buchanan 1995, p. 50). Most designers do not see their practice as purely artistic; although imparting beauty to everyday objects is certainly of importance, the agenda for design also includes solving problems that can improve people's lives and minimize impacts on the environment. In other words, engineering and artistic work are both central to design and not easily separable.

Scholars in design studies have sought to demonstrate that design possesses components that are unique and distinct from other disciplines (Friedman 2000; Cross 2002). "The underlying axiom of this discipline [of design] is that there are forms of knowledge and ways of knowing that are special to the awareness and ability of a designer, and independent of the different professional domains of design practice" (Cross 2006, p. 100). In other words, regardless of the object (building, garden, signage, app, etc.) being designed, designers follow a certain set of cognitive and physical processes that are unique to the discipline.

Cross describes design's unique activities as "designerly ways of knowing, acting and thinking" (Cross 2001). Multidisciplinarity, interdisciplinarity, and transdisciplinarity too can be described as three related yet distinct forms of knowing, acting, and thinking. As Klein explains in chapter 3 of this volume, these three terms "constitute a core vocabulary for understanding both the genus of interdisciplinarity and individual species within the general classification." These three terms also represent varying levels of integration among disciplines. While multidisciplinarity might signify a mere juxtaposition of several disciplines aligned to tackle a specific problem, transdisciplinarity refers to the transcending of disciplines in developing transformative solutions to complex societal problems. "Multidisciplinarity signifies the juxtaposition of disciplines. It is essentially additive, not integrative . . . The participating disciplines are neither changed nor enriched, and the lack of 'a well-defined matrix' of interactions means disciplinary relationships are likely to be limited and transitory" (Klein 1990, p. 56).

Generally speaking, in multidisciplinary projects, experts from several disciplines are involved, but their work may not always intersect. In such situations the problem may be segmented into smaller components that can then be appropriately handled by single disciplines. On the other hand, interdisciplinarity refers to situations where the knowledge and tools of one discipline inform, influence, and redirect the results of another. Much more disruptive and difficult to manage, engagement of this nature typically signals a destruction of disciplinary boundaries with the hope of generating new knowledge that would be impossible to produce by a single discipline.

Klein's descriptions of the various forms and degrees of engagement among disciplines can be applied to design practice as well as design studies. Design practice can be described as Klein's "trans-sector transdisciplinary problem solving," where the emphasis is on the "research questions and practices, not the disciplines." The process of new product development, where several disciplinary experts work together, frequently along with potential consumers, falls under this form of interdisciplinarity. Design studies, on the other hand, fits the model Klein labels "critical interdisciplinarity." This form of interdisciplinarity questions and challenges dominant structures of knowledge, and can therefore be transformative. It is in interrogating the rules set up by disciplines that critically interdisciplinary work blurs the boundaries between them. “Critical interdisciplinarity seeks to take the effort involved in mastering or going deep into any one discipline and spread it over a number of disciplines, going just as deep in a discipline as is necessary or appropriate to grasp the essentials” (Frodeman & Mitcham 2005, p. 513). In this process of engaging other disciplines, design can enrich itself with new points of view and more holistic conceptions of its process and products. And armed with this knowledge, designers might be better equipped to create products and services that are a lot more appropriate to their cultural contexts of use.

However, managing complex projects through interdisciplinarity teamwork is not easy. “This is the challenge for design research—to construct a way of conversing about design that is at the same time both interdisciplinary and disciplined. It is the paradoxical task of creating an interdisciplinary discipline. This discipline seeks to develop domain-independent approaches to theory and research in design” (Cross 2006, p. 100).

32.5 The Size, Scale, and Scope of Design Problems

Contemporary design practice is conducted in a world that is globally more connected, technologically more complex, and economically more intricate than it has ever been before. “The scale, penetration, and velocity of global capital have all grown significantly in the last few decades of this century” (Appadurai 2001, p. 18). The complexity engendered by these global capital flows is expected only to increase in the future, complicating design’s task even further. In response to these impending developments, design has already started to reimagine its scope. New conceptions of design now define its charter as the development of systems rather than single artifacts. There is recognition that designers need to consider global needs rather than individual wants. New design thinking emphasizes concerns of social equity and environmental responsibility, pushing design’s purview beyond its historical fixation on form. It is now also commonly accepted that design alone cannot solve these problems in isolation. The sheer complexity of these issues warrants deep engagement with other disciplines.

“The kinds of problems planners deal with—societal problems—are inherently different from the problems that scientists and perhaps some classes of engineers deal with. Planning problems are inherently wicked” (Rittel & Webber 1973, p. 160). One can argue that, in general, design (construed broadly to include city planning that the authors refer to) is often called on to tackle problems that are wicked, and that they require new methodologies to tame them. Such problems are difficult to formulate; they do not have right or wrong solutions; they do not have a logical end; and they are often symptoms of other problems.

The complexity and wickedness of these problems makes it impossible for any single discipline to be able to plan and implement solutions. In such situations, one mechanism by which to devise and deliver comprehensive solutions is through an intense and integrated collaboration among disciplines. And it is critical that problems taken on are not merely parceled into smaller components to be handled by individual disciplines but addressed in a highly integrated and transdisciplinary manner. “Transdisciplinary approaches are far more comprehensive in the scope and vision . . . Whereas 'interdisciplinary' signifies the synthesis of two or more disciplines, establishing a new method of discourse, 'transdisciplinarity' signifies the interconnectedness of all aspects of reality, transcending the dynamic of a dialectical synthesis to grasp the total dynamics of reality as a whole" (Klein 1990, p. 66).

The healthcare system in the United States, for example, presents a series of wicked problems. Take the issue of designing an effective patient transfer system for a hospital. Patients are generally transported between ambulances, emergency rooms, waiting rooms, laboratories, surgical wards, and pharmacies and using gurneys, stretchers, rolling beds, wheelchairs, lifts, hoists, and other devices. While being transferred, they are often hooked up to IV poles, oxygen tanks, or vitals monitors, and the transfers might involve, in addition to the patients themselves, nurses, nurses' aides, family members, social workers, and paramedics. Healthcare workers moving patients from one position (reclining in a bed) to another (sitting in a wheelchair) often hurt their backs, and research shows that nurses experience more injuries on the job than any other professionals. This has led to lost work, reduced pay, and workers' compensation claims, which become financial burdens for healthcare workers and hospitals. In addition, the problems posed by the growing rate of obesity and the increasing average age of nurses pose additional difficulties for hospital personnel who might have to move bariatric patients (those weighing more than 152 kg).

A patient transfer system will not only have to handle the problems listed above, but it will need to be cost-effective, able to accommodate patients who represent a wide range of body types and cultural backgrounds, easy to install, effortless to use, and above all, safe for patients and healthcare professionals. And unless it is able to adapt to existing as well as new hospital buildings, it will not be compelling enough to hospital administrators and purchasing departments. This problem is difficult to understand thoroughly: It possesses no single right, wrong, or objectively perfect solution; and it lacks finite and reliable evaluative criteria. It is clear that developing such a system would need to involve teams of hospital staff, healthcare workers (nurses, nurses' aides, paramedics, ambulance drivers), engineers, product designers, and marketing professionals, all working to inform and transform each other's thinking. This is merely one example of design's wicked problems that demand transdisciplinary efforts.

32.6 Taming Wicked Problems by Design

For Rittel, design's wicked problems are also ill-behaved because they frustrate the designers' efforts of wanting to create and follow a clear pathway to the solution from analysis to synthesis (Rittel 1971). In addition, solutions developed to tame wicked problems are difficult to evaluate, and it is difficult for designers to know whether to continue the process of searching for better solutions. While not all problems that designers tackle behave so badly, there are several, especially in the healthcare and transportation industries, that certainly do. Buchanan argues that design problems are wicked because "design has no special subject matter of its own apart from what a designer conceives it to be" (Buchanan 1992, p. 16). Designers tackle problems from a variety of domains, and the products of their labor range from paper clips to airplanes. For example, while a biologist may focus his or her life's scientific efforts on the narrow and highly specialized examination of butterfly coloration, an industrial designer may be called on to handle the unique problems of the creation of a car, a guitar, or a chair within the span of a few months. The domain knowledge required to practice design needs to be abstract enough to be applicable in a variety of contexts, while being specific enough to appropriately address the challenges at hand. And, the difficulty in being able to develop content expertise in several domains makes it even more attractive to engage disciplines that possess deep knowledge in those topical areas.

If design problems pose a unique set of challenges, designers need a unique set of tools with which to tackle them. Brainstorming, mind mapping, visualization, prototyping, storyboarding, scenario development, and so forth, are some of the commonly used methods in design praxis. However, while these methods can help with discrete segments of the problems, they do not serve as overarching strategies for taming or coping with wickedness. Roberts (2000) classifies problems as simple, complex, and wicked, and offers three unique coping strategies that she titles *authoritative, competitive*, and *collaborative.* She cautions that no single approach can present itself as a panacea, and decisions about selecting the most appropriate strategy will depend on the specificity of the problem. Authoritative strategies are recommended when a few key stakeholders are in positions of power in the problem-solving group, competitive strategies work best when power is dispersed and contested, and collaborative strategies serve well in the remaining situations (Figure 32.4).

There is no question that the design process—whether played out in small and medium-sized design consultancies or in large corporations—does involve power hierarchies and disputes among stakeholders (as well as disciplines). While authoritative or competitive strategies might lend themselves to simple problems that involve few stakeholders or small projects that can be quickly executed, it is the collaborative strategy that can work best for design's wicked problems. Collaboration offers the benefits of shared costs, the possibility of more comprehensive solutions, and better problem prediction.

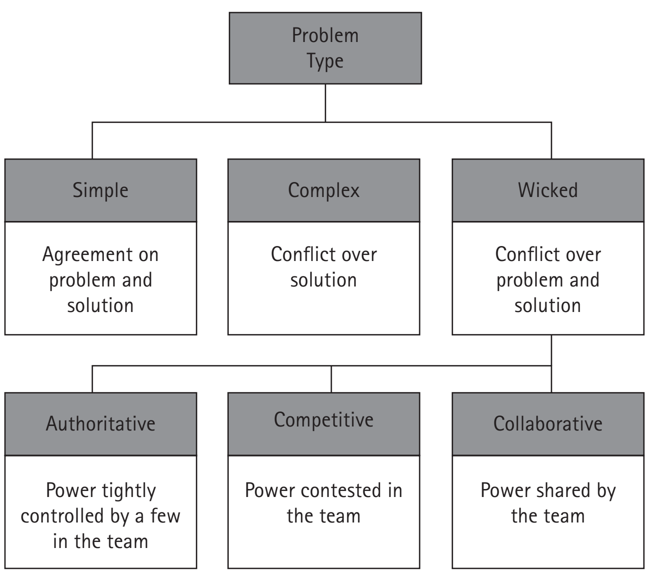

FIGURE 32.4 Coping strategies for wicked problems (developed from Roberts 2001).

32.7 Design Futuring

"In our endeavour to sustain ourselves in the short term we collectively act in destructive ways towards the very things we and all other beings fundamentally depend on. Such long-standing and still growing 'defuturing' needs halting and countering" (Fry 2008, p. 22). Defuturing, or taking the future away, is how Fry defines what humans have done and continue to do in making this world increasingly more unsustainable, socially and environmentally. Practices of design are certainly to be held responsible for this condition of unsustainability that has generated friction among our social, technological, and natural worlds. Instead of creating Simon's "preferred situations" we have done the opposite, and in the process erected a vast number of wicked problems (such as loss of biodiversity, species extinction, global poverty, income inequities, environmental pollution, and so on).

Fry suggests that we should be engaged in "remaking our own world" (Fry 2008, p. 249) if we are to tackle these problems of unsustainability. In order to do so, we will need to think big, think creatively, and think in transdisciplinary teams. Educational programs will need to prepare students with the skills and tools they can use in their professional careers to be able to tackle these issues. "But if knowledge is to be genuinely interdisciplinary, it needs to do more than simply reach across campus. . . . Our academic research portfolio must include an account of how to effectively integrate knowledge within the decision-making context faced by governments, businesspeople, and citizens" (Frodeman & Mitcham 2005, p. 513).

It is clear that active participation from a large number and diversity of stakeholders is critical to doing transdisciplinary design in practice and teaching it at the university. "The concept of superimposing various disciplines to address the problem or project in question could spawn a new hybrid category of design activity, which will emancipate itself from traditional disciplinary concepts" (Meurer 2001, pp. 52–53). This superimposition can be effective in design praxis and in design studies only if the boundaries among the overlapping disciplines can be made porous through truly integrated transdisciplinarity. Over the years, design's function has evolved from a craft-based practice of creating artifacts to the planning of complex systems. The collaborative strategy that transdisciplinarity brings to problem solving can help deal with the complexity of design problems. However, the highest possible level of integration among disciplines is necessary for this strategy to be truly effective. Only thus can society's wicked problems be tamed.

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