ARCHITECTURAL RESEARCH METHODS

SECOND EDITION

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Chapter 2

Does Design Equal Research?

2.1 INTRODUCTION

In the first edition of this book, we addressed several facets of the relationship between design and research. It is enough here to stake our position on the matter—namely, that there are indeed key differences between the two, which we will elaborate shortly, but then only so we can demonstrate the many similarities and connections between them. In other words, we argue that design and research constitute neither polar opposites nor equivalent domains of activity. Rather, the relationship between the two is far more nuanced, complementary, and robust.

Over the past decade, there has been a particularly lively debate in architecture and allied fields about the extent to which "design" is or should be a template, or more broadly perhaps, a new "paradigm" for research in creative or professional domains. Just within the confines of the peer-reviewed journal, *JAE* (*Journal of Architectural Education*), architectural academicians have taken a notably diverse set of positions on the matter. For instance, in discussing the essential role of research in architecture, Stephen Kieran explicitly describes the relationship between design and research as essentially divergent, but complementary: "Research brings science to our art. . . . To move the art of architecture forward, however, we need to supplement intuition with science."[1] Kieran's discussion of the design research laboratory at the University of Pennsylvania in some ways harkens back to some of the earliest efforts to promote architectural research as voiced in the initial issue of *JAE* in 1947[2] and as represented, for example, by the heyday of the Architectural Research Laboratory at University of Michigan, from its establishment in 1949 through the mid-1970s.[3]

In a second example, author Matt Powers shares with Kieran the assumption that design and research represent essentially distinct domains of activity, but comes to quite a different conclusion about how, or if, the two can be integrated. Indeed, Powers asserts that since research embodies the scientific model of knowledge as "truth" and "fact" based on quantitative data, any overt integration of design and research "diminishes the most important aspects of each activity."[4] Better, he argues that design disciplines work toward the development of a "discipline-dependent scholarship" that moves "away from the shadow of science and toward its appropriate place within academia."[5]

Similarly, author B. D. Wortham argues against research that is "narrowly defined under a scientific rubric," but veers in a slightly different direction by arguing that studio teaching can be research in the sense that "it makes multiple contributions—to the academy, to education, and to the serving and reshaping of society."[6] This view of research as an active contribution to communities, Wortham claims, draws credence from the historical development of land grant universities, and represents a more appropriate model of "discipline-based research."

In a critique of Howard Gardner's theory of multiple intelligences, David Wang and Amber Joplin have proposed yet another way to relate design with research. In explaining why design, curiously, is not one of Gardner's "intelligences," Wang and Joplin proposed that *all* of Gardner's intelligences share implicit traits that are explicit vis-à-vis design. This is because at its most fundamental level, design is related to the innate human ability to plan and pattern any disparate set of inputs toward a comprehensible, or desired, end. In other words, design is a phenomenological "substrate" that permeates "all of Gardner's intelligence categories and thus contributes to their 'end state' manifestations."[7] This is why design cannot be neatly subsumed exclusively under one intelligence category. It should be clear that research, as itself an activity that plans and patterns inputs toward desired ends, is intimately relatable to the human capacity to *design*.

Finally, in a more recent *JAE* article, David Salomon traces the development of the "research studio" as a replacement for the independent design thesis prevalent in many architectural schools.[8] In doing so, Salomon stresses a concept of architectural research that is more pluralistic than most of the previously cited authors, and bears some similarity to Wang and Joplin's position. He sees the research enterprise as encompassing both qualitative and quantitative methods, yielding both "objective truths" and "personal fictions." In other words, both design and research are, he claims, "well-fabricated hybrids."

Although these several examples are by no means fully representative of the diverse points of view in the field, they nevertheless convey some themes common within the architectural academy. One of the most pervasive is a tendency to equate research with a rather narrow view of science as exclusively based on fact and quantitative data, and therefore alien to the intuitive qualities of design. We take a different view of the matter, in at least two respects. First, the range of disciplines commonly implied by the term *science* are in fact more varied in underlying assumptions, methods, and practices than typically appreciated by those outside those disciplines.[9]

Second, we prefer to use the term *research* throughout this book in preference to more focused terms such as *science* or *scholarship*. By research we mean to include works of inquiry occurring across the range of disciplines (sciences, social sciences, the humanities) and professional fields. In this regard, we appreciate the more inclusive perspective expressed in Salomon's article, although we take issue with Salomon's inclination to frame his argument at the level of what we have termed *tactics* (see Figure 1.3), that is, quantitative and/or qualitative analyses. As we indicated in Chapter 1, we believe it is more fruitful to emphasize the broader conceptual level of strategies—or types of research designs—that can be employed across the many topic areas of design research.

2.2 DEFINING DESIGN AND RESEARCH

As is evident from the preceding chapter section, the debate about the equivalence—or lack thereof—between research and design is often contentious and complicated. Moreover, whether explicitly stated or not, many authors (e.g., Wortham, Powers) conflate two issues that are best considered separately: (1) the similarities and/or differences between research and design, and (2) their relative or potential credibility as standards for tenure and promotion in the university context. Both are important issues to address in this context, and for that very reason we aim to disentangle them by discussing them in sequence, moving to the second issue in the later sections of this chapter.

To reprise our introduction to this chapter, we take the stand that design and research are most appropriately and usefully understood as relatively distinct kinds of activity, but they indeed embody many important similarities, including many complementary and overlapping qualities. We will begin by identifying what we believe are the most important distinctions between the two and then describe the many robust similarities they share.

In a somewhat ironic twist, we find ourselves agreeing with some authors whose eventual conclusions we would also dispute. For instance, we very much appreciate Powers's argument that "well meaning [sic] designers and faculty members diminish the value of design by arguing, counterproductively, that design is something it is not, indeed should not aspire to become: research."[10] Yet Powers goes on to argue that there is an underlying epistemological difference between design and research. In contrast, we would argue that both design and research can, and do, occur across a range of epistemological assumptions. Design can be conducted within a postpositivist understanding of knowledge (i.e., usually assumed to reflect the "scientific" method), and research can and does occur within non-"scientific" epistemologies, including what is often referred to as constructivist or subjectivist perspectives.

Throughout this book, we will describe and review many exemplar studies that demonstrate the robust range of architectural and design research across multiple epistemological positions, theoretical schools of thought, and strategies. A detailed discussion of these issues will follow in Chapter 3.

The design (or practice) versus research debate is hardly unique to architecture, and indeed some of the very same discursive positions are found in many other creative or professional fields, including the visual arts, product design, business and consultancy, planning, landscape architecture, and urban design, among others.[11] On one side of this debate, Milburn et al. take a position regarding research in landscape architecture that mirrors Powers's position in architecture: that equating design and research is a disservice to the unique qualities of each, although Milburn et al. do acknowledge that design and research processes have much in common. However, in urban design, Ann Forsyth takes a more integrative approach in looking at how both research and design practice have contributed to innovation in the field. She envisions the potential for urban designers to become "exemplars of interdisciplinary research, serving as the human face of the research turn while expanding and deepening their own body of knowledge."[12]

2.2.1 *Design Defined*

Over many recent decades, scholars of design theory, researchers, and practitioners have proposed a broad array of definitions to describe the essence of design activity. Two of the most well recognized scholars on the subject are Herbert Simon and Donald Schon. One of Simon's most frequently quoted observations on the nature of design is that designers devise "courses of action aimed at changing existing situations into preferred ones."[13]

Schon, however, maintains that Simon's characterization is too focused on instrumental problem solving with an emphasis on "optimization." Instead, Schon's argument, broadly speaking, is that design thinking is fundamental to the exercise of "reflective practice" in all professions. Following the philosopher Dewey, Schon argues that a designer is one who "converts indeterminate situations to determinate ones."[14] In the more specific instance of the physical design professions (architects, landscape architects, interior designers, etc.), however, Schon conceptualizes their role as making "physical objects that occupy space and have plastic or visual form. In a more general sense, a designer makes an image—a representation—of something to be brought to reality, whether conceived primarily in visual, spatial terms or not."[15]

Several established scholars on design thinking and practice echo Schon's characterization of what physical designers do. Nigel Cross, for instance, argues that "[T]he most essential thing that any designer does is to provide, for those who will make the new artefact, a description of what that artefact should be like. . . . When a client asks a designer for 'a design,' that is what they want—the description. The focus of all design activity is that end-point."[16] Similarly, Bryan Lawson and Kees Dorst, in their book *Design Expertise*, conclude that the "most obvious set of skills employed by all designers are those to do with *making design propositions* [emphasis ours]."[17]

In a similar vein, a characterization that is frequently used to describe design is embodied in one word—*generative.* So, for instance, Cross notes that more experienced designers tend to employ "generative reasoning"; rather than simply finding solutions, designers tend instead to *create* a "generative concept."[18] Likewise, Graeme Sullivan (a scholar of research in art) observes that the artist/scholar John Baldacchino contrasts research and art in the following epigrammatic way: research entails the "search for stuff," while the arts "generate it."[19]

Finally, although both design and research are activities that are typically initiated for a contextually situated purpose, the specific impetus for each is slightly different. In the case of design, the impetus is commonly referred to as a "problem" (e.g., an unmet need for a new building or product) that prompts the development of a designed artifact as a solution that can be achieved in the future. In research, the impetus is typically framed in terms of a "question" to be answered at least in part by examining current or past evidence.

The several themes woven through the commentaries quoted above are highlighted in Figure 2.1 as the primary distinguishing features of design, with the contrasting, but complementary, features of research indicated as well. By "complementary" we mean to emphasize the necessarily reciprocal nature of the design-research relationship. Research can inform design in many ways and at many times in the design process; and the design process and the eventual designed artifact can yield an abundance of questions that lend themselves to many forms of inquiry.

2.2.2 *Defining Research*

In Chapter 1, we briefly discussed some of the primary features of research. Quoting architectural educator James Snyder, who edited one of the first compendiums on

Facets of Difference	Design	Research
Contribution	Proposal for Artifact (from small-scale to large-scale interventions)	Knowledge and/or Application that Is Generalizable (in diverse epistemological terms)
Dominant Processes	Generative	Analytical & Systematic
Temporal Focus	Future	Past and/or Present
Impetus	Problem	Question

Figure 2.1 Matrix of the primary differences between design and research.

architectural research, we defined research as a "systematic inquiry directed toward the creation of knowledge."[20] Remarkably enough, this brief definition remains entirely consistent with characterizations of research in contemporary architectural discourse and academic parlance more generally.

In architecture, for example, Kazys Varnelis posits that "a shared idea of what scholarship is in the university . . . would be in terms of systematic research that produces a 'contribution to knowledge.'"[21] He then uses this definition as a foundation for proposing research studios that would generate "radical results" and help us "reimagine the world anew."[22] Although Varnelis's primary purpose is to apply this definition to the ongoing discourse on research studios, the essence of his definition nevertheless echoes that of Snyder almost 30 years ago.

In the broader academic realm, the definition that the University of Michigan currently provides on its online educational web site for "Responsible Research and Scholarship" also reflects the same two components of both Snyder's and Varnelis's definitions: "systematic investigation" that "contributes to generalizable knowledge." Of significance for our discussion in this book, the university explicitly notes that the term *generalizable knowledge* should *not* be understood as meaning only research that is "hypothesis driven, quantitative, and/or replicable." In other words, the terms *systematic* and *generalizable knowledge* are more broadly construed to apply to research conducted in multiple epistemological frameworks, or systems of inquiry.[23] This wider range of frameworks can be seen later in this chapter, as well as in other chapters of this book.

Similarly, in the architectural context, Salomon's previously cited analysis of research makes the case that research can be understood "as any 'systematic inquiry,' *or* as 'the close study' of something."[24] Just as design "can alternatively be understood as both a rational problem-solving technique or [sic] intuitive aesthetic act," research can be embodied in "multiple modes of inquiry."

Again, as readers will find throughout this book, our definition of research is likewise inclusive of multiple systems of inquiry and theoretical schools of thought. Indeed, we strongly believe that architecture—as well as most design and professional fields—entails such broad multidisciplinary qualities that any one epistemological framework would be inadequate to the task of addressing all the potential research questions within the fields.

2.3 THE COMPARABLE AND SHARED QUALITIES OF DESIGN AND RESEARCH

Having made the case that there are important, necessary, and valuable distinctions to be made between design and research, we now aim to demonstrate the many ways in which they embody comparable and/or shared qualities. By using the term *comparable,* we emphasize features of the two activities that serve similar roles but are not precisely equivalent. And in using the term *shared,* we highlight facets of design and research that maybe are more essentially equivalent but often different in prominence or emphasis. Figure 2.2 summarizes this comparison, and we will highlight them in sequence through this chapter section.

2.3.1 The Reconstructed Logics of Design and Research

Over recent decades, both design and research have been the subject of comparable attempts to characterize an idealized model of the sequence and qualities of the

Facets of Similarity	Design	Research
Models of Reconstructed Logic	Systematic Design Process	"Scientific" Method
Multiple Logics	Abductive Inductive Deductive	Abductive (Research Design/Hypothesis Formation) Inductive Deductive
Logics in Use	Generator/Conjecture Model Problem/Solution	Multiple Sequences of Logics, Dependent on Research Questions and Purposes
Scope	Macro/Micro and Mid-level in applied/clinical setting	Big/Medium/Small Theory
Social Context	Situated Practice	Situated Research

Figure 2.2 Comparable and shared qualities of design and research.

processes involved. To clarify the nature of these models, we adopt the term *reconstructed logic* initially proposed by Abraham Kaplan in his classic book, *The Conduct of Inquiry*.[25] Kaplan's purpose was to argue that the idealized notion of the scientific method was an often inaccurate reconstruction of what actually happens in research. Given that Kaplan was writing in the early 1960s, at a time when the positivist epistemological framework was predominant in the sciences and social sciences, his insights are all the more remarkable.

For our purposes in this book, Kaplan's general point is also relevant to comparably idealized notions of the design process that were proposed in the 1960s and 1970s. At that time there was a broad-based advocacy in academia for a more comprehensive design process that would incorporate computing technology, with at least some design theorists anticipating the possibility of essentially automating the entire design process. A related goal behind the proposed systematic model was to ensure that a more fine-grained analytical process would inform design and thereby respond to the increasingly complex nature of architectural projects in a postindustrial society.

In his concise chronicle of this remarkable period in design, Nigel Cross traces how tentatively offered proposals for conceptualizing design became an accepted model for design process that held sway for at least two decades or more. What became widely known as the "systematic design process" is still influential in practice, though much less so now in academia. Never mind that the authors of this model explicitly cautioned that it was *not* intended to replace intuition with logic, but rather incorporate a synthesis of the two.[26]

Nevertheless, in the emergent design methods movement that followed, the systematic design process was broadly accepted as an appropriate "reconstructed logic" consisting of a three-step, potentially iterative, sequence consisting of analysis-synthesis-evaluation (see Figure 2.3). The overall goal was to externalize the logical activities into charts, diagrams, and the like (especially in step 1) so that the designer would be left free to generate ideas and intuitive hunches during the synthesis step, 2. Finally, in step 3, several alternative design solutions would be evaluated according to an array of performance criteria, and the optimum solution selected.

This model of design also gave rise to the concept of "programming" (associated with the analysis step) as a professional niche in architectural practice, and to the "post-occupancy evaluation" (POE) of recently built projects, typically conducted in-house by the architectural firm that designed the project, or by external consultants/researchers. Both of these professional specialties remain important to contemporary architectural practice, but are not as universally employed as some proponents initially imagined.

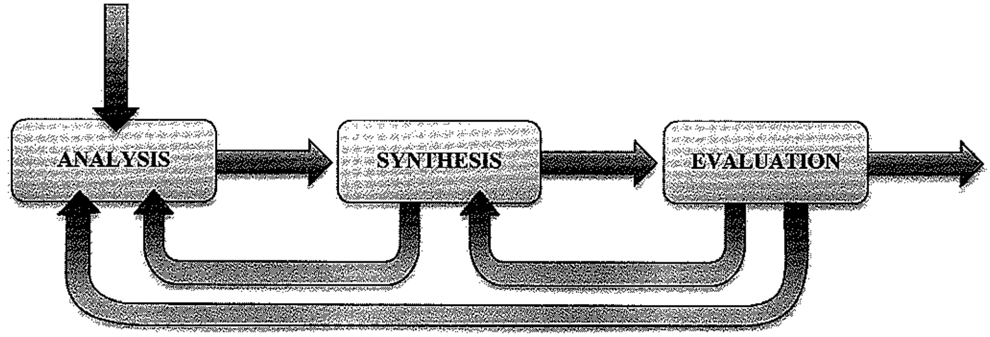

Figure 2.3 The Systematic Design Model. Courtesy of Taylor & Francis.

BOX 2.1

Programming and Evaluation within the Systematic Design Model

J. Christopher Jones, one of the earliest and influential proponents of systematic design, employs the term *black box* to emphasize how the design process itself is often challenging for even a designer to analyze.[a] One way to reduce the mystery of the "black box" is to know as much as we can going into the project, and then evaluate the outcomes of the project after completion so that we can be more informed about the next design effort. The utility of programming is that it aims to maximize the amount of information about a project so that the figural concepts generated can optimally respond to those criteria. These can include an almost boundless list of factors, but much of the early work in programming concentrated on "user needs" as well as energy conservation.[b]

The idea of programming as an effort to maximize knowledge about the figural concepts of design may be seen in Donna Duerk's *Architectural Programming*, a text with the subtitle *Information Management for Design*. In Figure 2.4, Duerk incorporates the three phases of the systematic model of design process with two additional components: the

[a] J. C. Jones, *Design Methods*, 2nd ed. (New York: Van Nostrand Reinhold, 1992), 46–51.

[b] Gerald Weisman, "Environmental Programming and Action Research," *Environment and Behavior* 15(3) (May 1983): 383.

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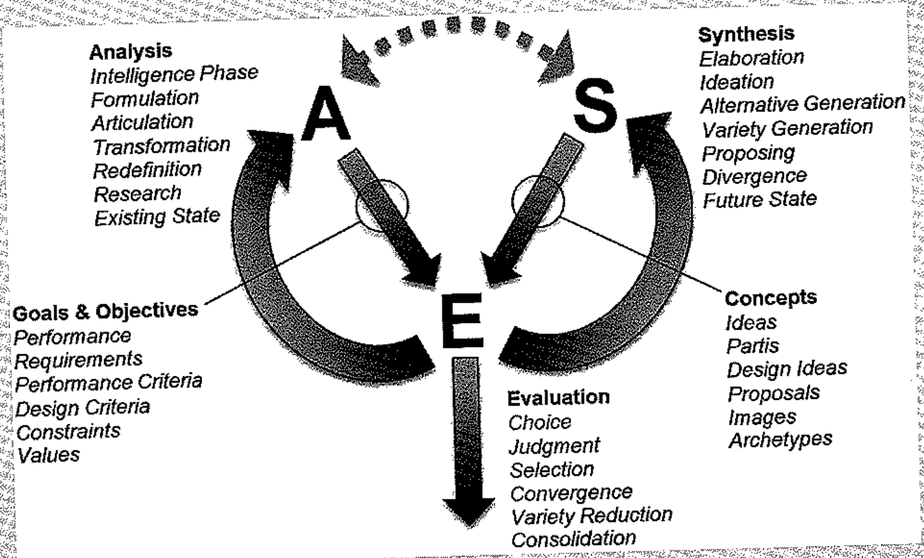

Figure 2.4 The Design Process: Analysis, Synthesis, and Evaluation. Reprinted with permission of Wiley.

performance objectives of the eventual design, and concepts "(design ideas) that develop from the synthesis activities." The same figure (Figure 2.4) also introduces another adaptation of the systematic model, in that "the line between analysis and synthesis is not solid. This is to emphasize that good design ideas do not automatically follow analysis."[c]

Although in-depth programming is most commonly advocated for complex projects with many key determinants unknown or ill defined, almost all design projects beyond ones that make use of existing prototypes (such as big-box stores) involve some programming. Across these variations in the scale and intensity of programming activities, there are multiple viewpoints concerning the extent to which programming is integrated with design development. On the one hand, many advocates for an expansive scope for programming insist that it occur as a separate phase before design activities are initiated.[d] On the other hand, Duerk suggests that for smaller projects and those for which the architect is conducting

[c] Donna P. Duerk, *Architectural Programming: Information Management for Design* (New York: John Wiley, 1993): 18–19.

[d] J. Harvey and J. Vischer, "Environmental Design Research in Canada: Innovative Governmental Intervention." In D. Duerk and D. Campbell (eds.), *EDRA 15, The Challenge of Diversity* (Washington, DC: EDRA, 1984); W. Pena, S. Parshall, and K. Kelly, *Problem Seeking: An Architectural Programming Primer*, 3rd ed. (Washington, DC: AIA Press, 1987).

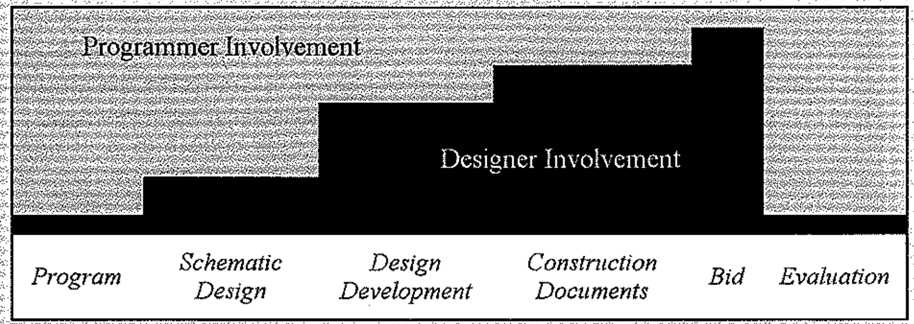

Figure 2.5 Programmer/Designer Involvement in the Design Process. Reprinted with permission of Wiley.

programming activities, there may considerable overlap in the programming and design processes (see Figure 2.5).[e]

At the other end of the design process is post-occupancy evaluation, or POE. After-the-fact data collection is another way of reducing the unknowns of the black box of the design process, at least for future projects. Three kinds of clients tend to commission POEs: those accustomed to developing a series of buildings, those venturing into a new situation with uncertainty, and organizations characterized by an openness to new information.[f] POE can lead to greater understanding of the existing design, with cost-savings ramifications. For example, a POE found that columns in a Phase I office building prevented optimal allocation of secretarial work stations, a problem alleviated in the Phase II design stage. POEs can even be coupled with simulation research. For example, a major engineering firm directed the architect to design their new facility with open office planning. However, the architect was able to persuade the client to first study this idea in a 30-person mock-up of such a space; the resulting noise levels changed the owner's mind back to enclosed office planning.

In a classic book on the methods and procedures of POE studies, Preiser et al. divide POEs into three levels of complexity.[g] An *indicative* POE is one that analyzes as-built drawings, indexing them to safety and security records, and employs interviews of building occupants to understand building performance. An *investigative* POE goes one step further by comparing the existing situation with other comparable facilities and with the

[e] Durek, *op. cit.*, p. 19.

[f] Craig Zimring and Polly Welch, "POE: Building 20-20 Hindsight," *Progressive Architecture* (1988): 60.

[g] W. F. E. Preiser, H. Rabinowitz, and E. T. White, *Post-Occupancy Evaluation* (New York: Van Nostrand Reinhold, 1988): 53–65.

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prescriptions of the current literature. A *diagnostic* POE involves multi-method tactics (surveys, observations, physical measurements, etc.), all conducted with comparison to other "state-of-the-art" facilities. Readers are referred to their work for more details of each POE type.

The problem with pre and post data collection is obviously that the "episodes" of research are limited to the introduction and the epilogue. The "middle zone," that is, the design process itself, is left unaddressed; a concern that has led other design scholars to propose alternative models.

These efforts to promote a more systematic, comprehensive, and clearly sequenced process were also seen as providing the design professions with a conceptual foundation more comparable to that which supported scientific research. Writing in 1972, Hillier et al. characterized the systematic design model as one that incorporated "as many factors as possible within the domain of the quantifiable" with the goal of replacing "intuition and rules of thumb with knowledge and methods of measurement."[27] They go on to suggest that the impetus for the problem-solving focus of the systematic model of design is based on the two outdated assumptions about the nature of science: "the notion that science can produce factual knowledge, which is superior to and independent of theory; and the notion of a logic of induction, by which theories may be derived logically from an analysis of facts."[28]

In many ways, Hillier et al.'s criticism of the design methods movement of the 1960s and early 1970s links this discussion back to Abraham Kaplan's 1964 book, *The Conduct of Inquiry*, mentioned earlier. Kaplan's critique of the dominant "reconstructed logic" of the social sciences of that era very much mirrors Hillier et al.'s critique of "systematic" design. As Kaplan puts it, "The hypothetico-deductive model reconstruction fails to do justice to some of the logic-in-use, and conversely, some of the reconstructed logic has no counterpart to what is actually in use."[29] In particular, he argues that in the hypothetico-deductive reconstruction "the most important incidents in the drama of science [the formation of hypotheses] are enacted somewhere behind the scenes."[30]

Kaplan then goes on to observe that while "everyone" recognizes that "imagination, inspiration, and the like are of enormous importance in science," the formation of hypotheses is treated as "an extralogical matter."[31] Rather, he argues, the intuition entailed in generating a hypothesis "has its own logic-in-use, and so must find its place in any adequate reconstructed logic." Furthermore, he argues: "To ask for a systematic procedure that guarantees the making of discoveries . . . is surely asking too much."[32] Indeed, the "logic of discovery" embodied in invention can be "cultivated."[33] In sum, Kaplan's stance—not unlike Hillier et al.'s viewpoint on the systematic design model—is challenging the rather limited model of reconstructed logic in science by arguing for an appreciation of the role of intuition in the logic-in-use of scientific discovery.

2.3.2 *The Logics-in-Use in Design and Research*

Significantly, as we have noted in the previous chapter segment, the perspectives of both the design and research literature reveal an implicit convergence with respect to logics-in-use. Indeed, threads of arguments in both literatures draw on (sometimes explicitly, often implicitly) the insights of Charles Sanders Peirce, known as the "father" of the American tradition of philosophical Pragmatism in the late 19th century. Peirce was somewhat of a Renaissance man in that he was also a practitioner of multiple scientific disciplines.[34] Subsequent philosophers and scholars of philosophical Pragmatism include John Dewey and, more recently, Richard Rorty.

BOX 2.2

The Role of Deduction and Induction[a]

To build up a conceptual framework . . . to anchor the variety of approaches that designers take . . . it may be strategic to temporarily suspend the generation of "rich" descriptions of design and instead take a "sparse" account as our starting point. . . . A "sparse" description derived from logic will help us to explore whether design is actually very different from other fields—and should provide us with some insight on the potential value of introducing elements of design practice into other fields. . . . We will describe the basic reasoning patterns that humans use in problem solving by comparing different "settings" of the knowns and unknowns in the equation:

WHAT +	HOW	leads to	RESULT
(thing)	(working principle)		(observed)

In *Deduction*, we know the "what" (the "players" in a situation we need to attend to), and we know "how" they will operate together. This allows

[a] Reprinted from Design Studies, 32/6, K. Dorst, "The Core of 'Design Thinking' and Its Application," pp. 521-532, (2011), with permission from Elsevier.

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us to safely predict results. For instance, if we know that there are stars in the sky, and if we are aware of the natural laws that govern their movement, we can predict where a star will be at a certain point in time.

Deduction: **WHAT + HOW** leads to **???**

Alternatively, in Induction, we know the "what" in the situation (stars), and we can observe results (position changes across the sky). But we do not know the "how," the laws that govern these movements. The proposing of "working principles" that could explain the observed behavior (aka hypotheses) is a creative act.

Induction: **WHAT + ???** leads to **RESULT**

This form of reasoning is absolutely core to the "context of discovery" in the sciences: this is the way hypotheses are formed. Within the sciences, these hypotheses are then subjected to critical experiments in an effort to falsify them. These rigorous tests are driven by deduction. Thus, in the sciences, inductive reasoning informs "discovery," while deductive reasoning informs "justification." These two forms of analytical reasoning help us to predict and explain phenomena in the world. Indeed, though induction contributes to hypothesis generation, philosopher of science C. S. Peirce argues that induction is often an insufficient form of reasoning for hypothesis generation and that abduction is required.

For his part, Kaplan explicitly invokes the heritage of Peirce and Dewey, both of whom sought to explicate the *process* of science [emphasis ours]. Similarly, in a notable 1976 paper on the logic of design, Lionel March discusses the relevance of Peirce's analyses of different categories of inference: deductive, inductive, and especially abductive logic. More specifically, March elucidates Peirce's notion of abductive logic as a type of "synthetic" inference essential to hypothesis generation in science, or as Peirce phrased it: how hypotheses are "caught."[35] In elaborating this concept, March quotes Peirce as follows: "[A]bduction is the only logical operation which introduces new ideas; for induction does nothing but determine a value; and deduction merely evolves the consequences of a pure hypothesis."[36]

In light of Peirce's characterization of abductive logic, March suggests that another term for this type of inference is *productive reasoning*, and as such is an essential characteristic of design thinking. To be sure, March acknowledges the role of deduction and induction in design, summarizing the roles of the categories of inference in this way: "production [abduction] creates; deduction predicts; induction evaluates."[37]

In more recent years, a number of scholars of design studies have also written extensively about the significance of abductive thinking in design process. For one, Nigel Cross in his book, *Design Thinking*, observes that "intuition is a convenient, shorthand word for what really happens in design thinking. The more useful concept . . . used by design researchers is abductive: a type of reasoning . . . which is the necessary logic of design. It . . . provides the means to shift and transfer thought between the required purpose and function and appropriate forms for an object to satisfy that purpose."[38]

BOX 2.3

The Role of Abduction in Design[a]

But what if we want to create value for others, as in design and other productive professions? Then the equation changes subtly, in that the end now is not a statement of fact, but the attainment of a certain "value."

WHAT +	**HOW**	leads to **VALUE**
(thing)	(working principle)	(aspired)

The basic reasoning pattern in productive thinking is Abduction. Abduction comes in two forms—what they have in common is that the outcome of the process is conceived in terms of value.

The first form, Abduction-1, is often associated with conventional problem solving. Here we know both the value we wish to create, and the "how," a "working principle" that will help achieve the value we aim for. What is missing is a "what" (an object, a service, a system), that will give definition to both the problem and the potential solution space within which an answer can be sought.

Abduction-1: **??? + HOW** leads to **VALUE**

This is often what designers and engineers do—create a design that operates with a known working principle, and within a set scenario of value creation. This is a form of "closed" problem solving that organizations in many fields do on a daily basis.

The other form of productive reasoning, Abduction-2, is more complex because at the start of the problem solving process we ONLY know the end

[a] Reprinted from Design Studies, 32/6, K. Dorst, "The Core of 'Design Thinking' and Its Application," pp. 521-532, (2011), with permission from Elsevier.

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value we want to achieve. This "open" form of reasoning is more closely associated with (conceptual) design.

Abduction-2: ??? + ??? leads to **VALUE**
(thing) (working principle) (aspired)

So the challenge in Abduction-2 is to figure out "what" to create, while there is no known or chosen "working principle" that we can trust to lead to the aspired value. That means we have to create a "working principle" and a "thing" (object, service, system) in parallel. The need to establish the identity of two "unknowns" in the equation leads to design practices that are quite different from conventional problem solving (Abduction-1).

One well-known study of logics-in-use in architectural design was conducted by Jane Darke,[39] and has over the years achieved the status of classic study of design process and is now "well-embedded in the literature."[40] Working on her doctorate with established design researcher Bryan Lawson, Darke studied the process by which individual architects went about designing award-winning public housing projects in Britain. What she discovered is that these architects typically came up with a major design idea early on in the process, effectively narrowing down the range of potential solutions.

Based on the observed logics-in-use employed by these architects, Darke's proposed model of design process that has come to be known as the "primary generator" model (see Figure 2.6). The initial primary generator of design is the selection of a "guiding principle" that "enabled the designers to limit the problem to something manageable, to provide a narrower focus in which they could work."[41] This generative concept then serves as the basis of an initial conjecture of the actual design; and that conjecture in turn becomes the basis for evaluating how well the conjecture meets the myriad of detailed requirements of the project. This way of

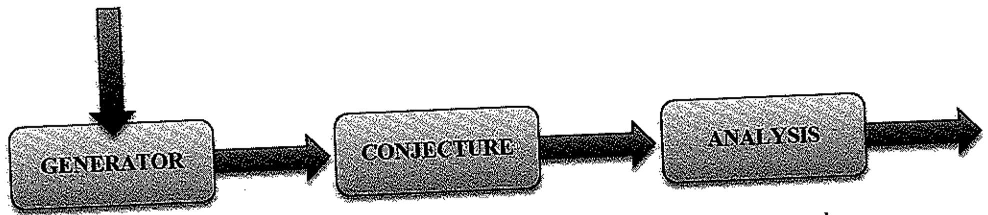

Figure 2.6 Darke's Primary Generator Model. Courtesy of Taylor & Francis.

designing is essentially consistent with Peirce's notion of abductive thinking as the creative force in reasoning.

Other design scholars also explicitly recognize the essential equivalence of Peirce's general categories of inference in both design and research, especially with reference to the significance of abductive logic. For example, Roozenburg concludes: "Innovative abduction is the key mode of reasoning in design and therefore highly characteristic for this activity. But it is not unique to design. In both science and technology, and in daily life, abductive steps are taken in the search for new ideas."[42] Roozenburg also notes, quoting Peirce, that abductions typically come to us "in a flash," a point that echoes both Kaplan's and Cross's recognition of the role of "intuition" in research and design respectively. Design scholar Panagiotis Louridas takes this line of argument a step farther by concluding that "good science is an art. . . ."[43]

Over the past decade, researchers in various professional fields and/or interdisciplinary areas of inquiry have written as well on the role of abductive reasoning in research. This seems especially true of researchers who identify themselves with either the Pragmatic school of thought (see Chapter 3) and the use of mixed methods in research[44] (see Chapter 12). Typically, researchers who seek to illuminate complex phenomena in real-life settings may not be able to rely on well-established research designs (strategies) and tactics to address the research questions of interest. In this relatively uncertain context, designing the most effective research protocol is not unlike the challenge architects and other designers face in approaching a novel project, and therefore the need to generate innovative hunches and conjectures will be greater.

Nevertheless, as Figure 2.2 suggests, the relative predominance of abductive thinking in physical design is likely to be greater than in the development of a research design or hypothesis generation. Although designers must incorporate deductive and inductive thinking throughout the design process, at least through schematic or design development, abductive thinking is likely to predominate; whereas in research there is likely to be a relatively higher proportion of deductive and inductive thinking throughout the several phases of a study.

One way to understand the relative predominance of these reasoning types in design versus research is to consider the "episodic" nature of each activity. In his 1987 book, *Design Thinking*, Peter Rowe uses the term *episode* to analyze the segments of time and thought employed by the designers he observed as they generated their design schemes for architectural projects. Similarly, researchers typically move through different phases of thinking as they work through various phases of inquiry to discover the answer(s) to the research question(s) posed.

In general, then, designers may well incorporate "episodes" of research activity as they move forward in the more dominantly generative mode of design; and inversely, researchers may well incorporate episodes of "design" (abductive reasoning) in more predominantly analytical reasoning.

To the extent that the "primary generator model" and/or similar analyses of logics-in-use employed by designers are accurate representations of the design process, research episodes may well occur in the midst of evaluating various conjectures—whether a conjecture for the entire project or for segments of it. And what of the systematic design process, which we initially labeled as an idealized reconstructed logic?

To the extent that the model of analysis-synthesis-design is loosely associated in practice with the concepts of programming and post-occupancy evaluations, the model continues to maintain influence in architectural practice. Nigel Cross, among others, has argued that expert designers tend to prefer a breadth-first (as opposed to depth-first) design process, which is more consistent with the primary generator model. However, in "situations where their knowledge is stretched," designers are more inclined to go with a depth-first approach.[45] And this may mean that for novel, complex, and challenging design projects, architects may well find it important to incorporate an in-depth analysis phase at the outset, including multiple episodes of research.

Moreover, in practice, many design projects may be developed through a process that entails either a variation or a hybrid of the two models. A recent project by the architecture firm Perkins & Will demonstrates a more fluid and multifaceted design process than was originally proposed by proponents of the systematic design process. Faced with the need to update their Atlanta office, the firm decided to conceive of the challenge as a "living lab" project that included an extensive pre-/post-occupancy evaluation process. This process incorporated many facets of analysis—from technical performance criteria to operational and aspirational issues. Substantive details of the research conducted in this project are discussed in Chapters 7 and 8.[46]

BOX 2.4

Elaborations of the Primary Generator Model, Framing, and Schemata

Since the publication of Jane Darke's "primary generator" model[a] of 1979 challenged the previously proposed systematic design model, a

[a] Jane Darke, "The Primary Generator and the Design Process," *Design Studies* 1(1) (July 1979): 36–44.

number of other scholars have proposed other formulations that are essentially consistent with the premise of Darke's model. These more recent contributions nevertheless highlight somewhat different qualities or dynamics that may be entailed in the generator-conjecture formulation. They likewise serve as a counterpoint to Simon's "rational problem-solving" model.

Donald Schon's concept of "reflective practice" is described in detail elsewhere in this chapter. In brief, Schon aimed to elucidate how tacit knowledge is intuitively drawn upon by practitioners who must take action in a given situation. This leads Schon to propose a model of how "a reflective conversation with the situation" proceeds from "posing a problem frame and exploring its implications in 'moves' that investigate the arising solution possibilities"[b] (see Figure 2.7). The potential consequences of these moves are then evaluated and new frames or moves may be considered. This formulation of reflective practice is very much consistent with Darke's model, but is more generally applicable to professional practices beyond design.

In a similar vein, Peter Rowe's in-depth investigation of the design processes of three expert architects illuminated yet another implication of the generator model. Like Darke's interviewees, the three architects Rowe studied each in different ways adopted a primary generator as an organizing principle early on, but in some instances these designers also demonstrated a tendency to stick with their initial concept for too long. "Even when severe problems are encountered, a considerable effort is made to make the initial idea work, rather than stand back and adopt a fresh departure."[c] Rowe goes on to observe that in their "attempts to adhere to the 'big idea,'" designers sometimes seemed "to cram the building into the architectural object they were shaping." In other words, while the

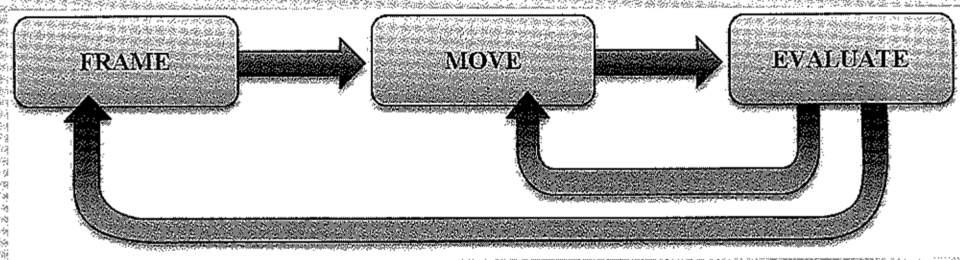

Figure 2.7 Schon's Model of Reflective Practice. Courtesy of Taylor & Francis.

[b] Nigel Cross, *Design Thinking* (Oxford, UK: Berg, 2011): 23.
[c] Peter Rowe, *Design Thinking* (Cambridge, MA: MIT Press, 1987): 36.

(Continued)

primary generator often seems to serve as an essential kick-start to the design process, it can occasionally delay effective or timely resolution of the design process.

Established scholars of design process Bryan Lawson and Kees Dorst point out the significance of how design students learn, and design experts are able, to "recognise [design] situations" and "draw parallels with situations from other contexts."[d] Drawing on terminology from cognitive psychology, the authors describe how design expertise must rely on the accumulation and cultivation of "schemata." They argue that "[b]ecause design is highly situated, generic solutions usually provide poor outcomes. . . . Designers thus depend on the ability to recognize parallels with well-known situations but also detect subtle variations."[e] The notion of schemata applies not only to individual designers but also to firms. Indeed, the community of professionals within a design firm may share "a common understanding of the relative importance (as the members of the practice see it) of various known schemata." The advantage of such collectively shared schemata is that a coherently conceived design is likely to result from these circumstances, but the downside reprises Rowe's conclusion that designers can stick with a guiding principle for too long or in the wrong circumstances.

Finally, Paton and Dorst's research study of expert designers' experience of briefing processes with their clients (their resulting typology of designer roles is discussed elsewhere in the chapter) returns us to Schon's concept of framing.[f] The authors' general conclusion is that when the designers' roles in the briefing phase are relatively more collaborative, this typically entails a mutual reframing process with the clients and overall the collaborative reframing process tends to yield more innovative design outcomes. Figure 2.8 highlights both the barriers and enablers of this reframing. The barriers include: *fixation* by the clients on their initial idea; a *problem-solving mental model* of design; and a *resistance to the journey* entailed in the design process. Although these barriers were primarily framed in terms of the client, designers may fall prey to these barriers as well. To counter these tendencies, the expert designers generally work to reframe the design "problem" by use of *metaphor or analogy*, *contextual engagement* (which entails exploring more about the situation with the client), and exploring possible abstract verbal or sketched *conjectures*.

[d] Bryan Lawson and Kees Dorst, *Design Expertise* (Oxford, UK: Elsevier, 2009): 148.
[e] Ibid., 164.
[f] Bec Paton and Kees Dorst, "Briefing and Reframing: A Situated Practice," *Design Studies* 32(6) (November 2011): 573–587.

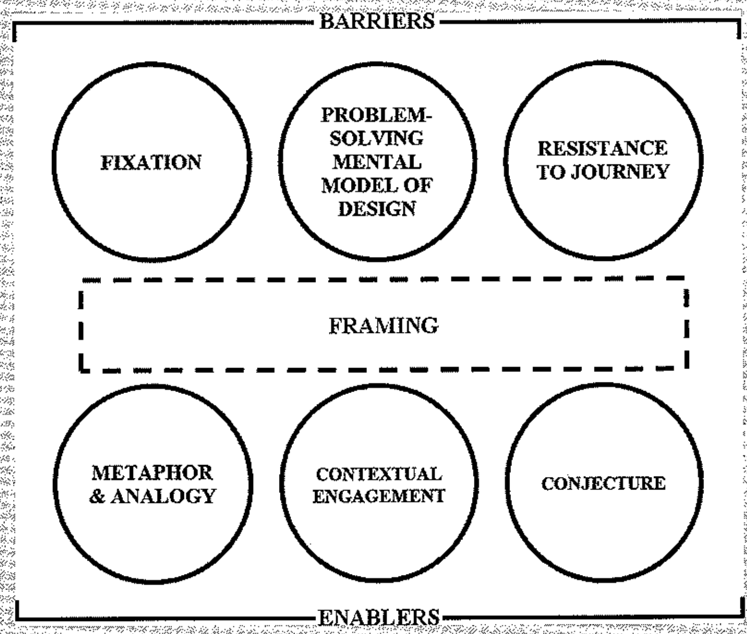

Figure 2.8 Barriers and Enablers to Reframing During Briefing. Redrawn from Bec Paton and Kees Dorst, "Briefing and Reframing: A Situated Practice," *Design Studies* 32(6) (November 2011): 585, with permission from Elsevier.

2.3.3 *The Scope of Design and Research*

Multiple scholars of research and design have conceptualized the variations in the scope and application of each activity by employing terminologies of scale. In the research domain, Gary Moore has employed the terms *big*, *middle range*, and *small*. So, for example, at the "big" end of the scale are very ambitious theories that explain a large scope of reality. The theory of gravity, which explains both the drop of a coin and the movement of planets, is such a theory. Relativity theory is also such a theory. Truly a large scope of coverage is envisioned by Stephen Hawking's references to GUT ("grand unified theory"). Hawking aims to unify the various fundamental forces in the cosmos (the strong nuclear force, the weak nuclear force, and the electromagnetic force) into a single explanatory framework.[47]

At the other extreme are small, localized explanations for things. "I get depressed when the sky is overcast" may be a kind of small theory. It explains a very localized reality that by definition has no larger application. It meets all of the requirements of a theory, but the explanatory utility in terms of scope is very limited. At this scale, as Moore points out, there may be little functional difference between theory and fact gathering. In other words, if I get depressed when the sky is overcast, the localized domain of applicability (in other words, me) does not require systematic theorizing or, for that matter, research. If the phenomenon is consistent, the relationship between overcast sky and how I feel is sufficient as a set of related facts, and can be simply relied on as a working hypothesis.[48]

Following R. K. Merton, Moore then suggests theories of the "middle range," that is, ones with a scope not grand but also not small. These will not have wide applicability across disciplines; but they do have sufficient applicability to make their claims useful in a scope that is applicable within a discipline. Because of this larger scope, they cannot simply remain as working hypotheses or conjectures; the demand is greater that they be tested and either affirmed or rejected. Some examples of middle-range theory that have been established in architectural research include "defensible space" (see Chapter 8) or the primary generator model of design process discussed in this chapter.

In principle, all research may generate theory across these scales, but in architecture and allied fields, the likelihood is that research will more likely generate middle-range theory than big theory. This is the case for at least two reasons. First, since architecture is a professional field, much of the thrust of inquiry is directed to applied or situated contexts. Second, compared to the research traditions of "purer" academic disciplines, research in architecture and related design and professional fields is relatively newer, and therefore less developed. So, in that sense, there has been less opportunity to refine broader levels of theory that would apply across the multiple threads of architectural research.

More recently, Ken Friedman, a scholar of design process, has similarly described the comparability of research and practice in terms of the scale of application using the terms *macro, midlevel,* and *micro.*[49] In this framework, Friedman argues that "basic" research by definition involves "a search for general principles," which are then "abstracted and generalized to cover a variety of situations and cases."[50] And although basic research may address all three levels of scope, from micro to macro, he argues that applied research tends to be midlevel or micro. Nevertheless, he argues, "applied research may develop or generate questions that become the subject of basic research." Design practice, he asserts, is usually restricted to clinical (or micro-level) research and "generally involves specific forms of professional engagement. . . . In the flow of daily activity . . . , [t]here isn't time for anything else."[51]

In contrast to Friedman's analysis, much of what is often recognized in academia as architectural design theory is envisioned as "big" theory (e.g.,

Le Corbusier's "A house is a machine for living"; or the Modernist "form follows function"); yet we argue that such examples are more properly understood as polemic theory. Since their purpose is to spur the use of a particular generative principle in design, such theories are essentially speculative. To be sure, speculative theory is well recognized in basic research disciplines as a generative instigation for hypothesis testing in subsequent research[52]; yet further research on the viability of speculative design theories in architecture is rare (see Chapter 4).

However, what is commonly referred to as theory in the realm of architectural history is often the application of what we have termed broad cross-disciplinary *schools of thought,* such as critical theory or poststructuralism (see Chapter 3).

In summary, to reference Friedman's position again, any of the three scales of research may generate questions at one or more of the other scales, so in essence each "may test the theories and findings of other kinds of research."[53]

2.3.4 *Situated Design and Research in Action and Collaboration*

Over recent decades, many scholars have written about how the practices of both design and research must be fundamentally understood as activities situated within the social context. In the academic setting, for instance, even students working on individual design projects are engaged within the larger culture of studio practices. And as Dana Cuff's classic book, *Architecture: The Story of Practice,* reaffirmed, the practice of architecture is of necessity a social one, requiring effective engagement with design team members, consultants, and an array of clients and other stakeholders.[54]

Perhaps the most well-known and highly regarded example of this perspective in design practice is Donald Schon's concept of *reflection-in-action.* The term denotes the *actual* need in the professions to solve problems arising out of practical life-contexts.[55] Schon proposes that design activity is a particular instance of reflection-in-action.[56] Schon looks for patterns within context-specific design venues (e.g., a project in a design office, the history of interactions between instructor and student in the studio and its effect on the design). The emphasis is upon the specific design venue as a kind of microculture, complete with ways of doing, implicit understandings, technical terms, and so on, that all arise in the midst of creating a design. What results is a product that is the sum of the reflective actions taken in response to the factors unique to the concrete context.

In research, there has been a long-standing recognition of the importance of research that engages the specificity of real-life situations. *Action research* is a term given to studies that examine a concrete situation, particularly the logic of how factors within that situation relate to each other as the process moves toward a specific empirical goal. The emphasis is on knowledge emerging from localized settings, as opposed to abstract knowledge applicable for many settings. Action research arises out of the social sciences; it has roots in the work of sociologist Kurt Lewin's notion of *field theory*, which basically holds that theoretical knowledge and practical knowledge must inform each other in a concrete context for the establishment of a true domain (field) of endeavor.[57] The applicability of this notion to the generative design process is quite evident.

A more focused version of action research is *design-decision research*, proposed by Jay Farbstein and Min Kantrowitz.[58] In action research, the researcher is still outside of the concrete situation as he or she examines the iterative cycles of actions taken. Design-decision research embeds the researcher more into the actual concrete process; indeed, the authors underline the point that the "researcher" in their model can be the various players of a process themselves. In this sense, "researchers" and "designers" are "one community" and not two: facility programmers, architects, market analysts, communications consultants—in short, any player—can be a kind of "new practitioner" that not only makes decisions but also assesses those decisions from the perspective of research.[59] Farbstein and Kantrowitz give the example of a bank that wished to build a wing outfitted appropriately for its "high-value" customers. But in-depth interviews and focus group discussions revealed that the better approach would be to provide spaces for individualized personal contact, thus avoiding alienating other customers while providing the personal attention the management wanted for the elite clients. It is easy to see how these interventions can aid in the overall design process in an episodic fashion. It is also easy to see how, when design incorporates these approaches, research strategies addressed elsewhere in this book (for instance, in Chapter 7 on qualitative research) can be harnessed for design decisions. Farbstein and Kantrowitz themselves list many "phases" of a building's life cycle to which this approach can be applied: "planning, programming, feasibility studies, design, construction, operation, fine tuning, renovation, maintenance, repair and so forth."[60]

Earlier in this chapter, many of the examples we highlighted regarding the coexistence of design with episodic instances of research implicitly emphasize the single designer. Much has been written recently on the alternative to this paradigm, namely, collaborative design. It is in recognition, at least in part, of the fact that much of architecture emerges as a result of team effort, as opposed to the efforts of a single "star" architect.

Yet more than ever, especially in projects that are increasingly complex, the design process necessarily calls upon the expertise of a wide variety of disciplines. How does this work? And in what ways? How do we understand the role of the architect? Or design team consultants? Or the client? Or the users? Even though much has been written

regarding this topic, it is an area that is wide open for more in-depth research. Here, we summarize an exemplar of design process, a theoretical model, and recent research.

In a classic example of collaborative design and research, Charles Moore provides an illuminating account of the work in his St. Matthew's Church project in a suburb of Los Angeles (see Figure 2.9); this is recounted in Andy Pressman's *The Fountainache: The Politics of Architect-Client Relations*.[61] The original church was destroyed by fire, and Moore's firm was hired by the parish with the requirement that any design proposal must be approved by two-thirds of the congregation—one that may have trouble agreeing "what day it was." Moore's solution was to allow the design to emerge by means of collaborating with the congregation in four "open design charrettes" over a period of four months. During this participatory process, many different tactics were used to arrive at a design consensus. These included "awareness walks" of the site, jotting down feelings and observations. Following this, the congregation used found objects (Froot Loops, cellophane, scissors, paper, even parsley) and made various configurations. In the

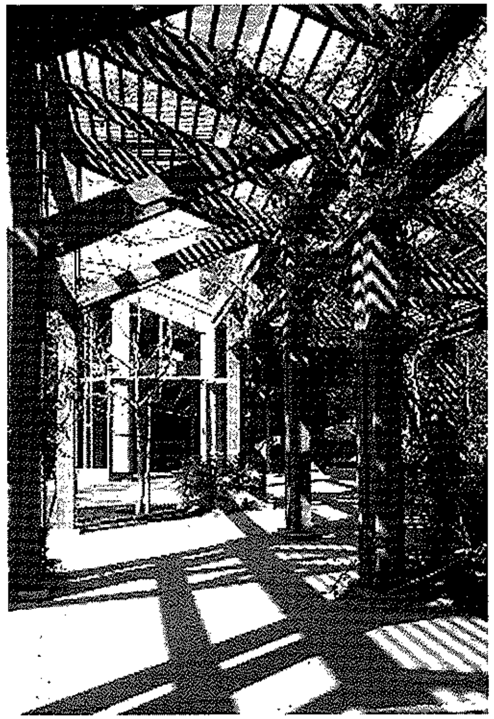

Figure 2.9 The pergola at St. Matthew's Church, Los Angeles. Designed by Charles Moore. Photograph courtesy of Linda Groat.

second charrette, Moore's team show slides of other church buildings; even though a dark wood building was a pre-charrette favorite, images of a white church by Aalto received many positive votes. During the third charrette, the congregation was given building shapes to work with to express their wishes. The team then took all of these inputs and developed some drawings and a model, all of which they left with the people for a month. In the end, 87% of the congregation approved the design.

Moore's approach reflects many of the characteristics of qualitative research, such as having no preset theory of design strategy going into a research venue, and "living" with the people to develop "thick" accounts of how they perceive things. Moore recalls: "Being a part of making that church was an opportunity to work toward an architecture filled with the energies not only of architects but of inhabitants as well, and helping people to find something to which they can belong. . . ."[62]

Groat has pointed out that traditional images of the architect have often been one of either the architect-as-technician, or the architect-as-artist. Both of these models not only set apart the architect in an individual role (hence perhaps encouraging a "star" quality), they also bring about disjunctures between what architects design and what everyday clients may want. Groat's alternative proposal is that of the architect as a cultivator. Cultivator of what? Says Groat:

> Once we . . . foster environmental values that focus on the common good and reinforce the connectedness of people within an organization, a community, or society as a whole, we are then confronting the essence of cultural life. It is (at this point) that the model of the "designer-as-cultivator" comes into its own.[63]

Groat means to shift the attention from the architect as sole technician or sole artist to a role that is sensitive to a larger communal mission of well-being. She structures her argument by borrowing seven categories of values from organizational theory.[64] The author, Richard Barrett, suggests that, in good organizations, individuals are cultivated to rise above self-interest to take on communal and ultimately global interests of well-being. Groat adapts this model for her proposed paradigm of the architect-as-cultivator (see Figure 2.10). In short, the architect as cultivator encourages three things. He or she emphasizes process, by which Groat means a collaborative and participatory spirit on the part of the architect. Second, the architect as cultivator is one who encourages interdisciplinary design, where different disciplines contribute in concert to a solution; community is inherent in this process. Third, borrowing from the title of Barrett's book, Groat's architect-as-cultivator is one that has "a sensitivity for the cultural as the soul of design."[65] By this is meant a vision for the mission of the common good, with the architect motivating

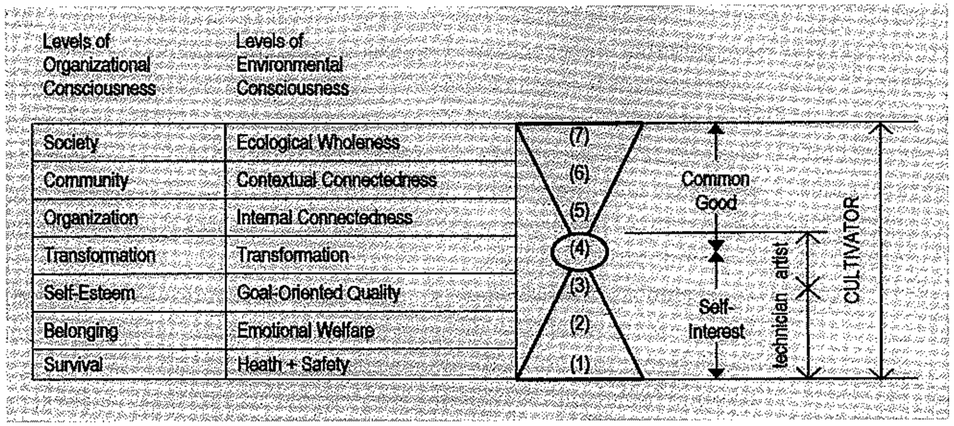

Figure 2.10 Groat's adaptation of Barrett's levels of "consciousness" (from self-interest to global concern) for the architect-as-cultivator's design agenda. Use of original Barrett diagram courtesy of John Wiley & Sons.

his/her team to recognize that quality environments "can only be realized by fully engaging the social and cultural milieu in which it is embedded."

In some organizational situations, however, the collaborative process may occur *only* between the client organization's leader and the designer or design team, thereby not permeating the larger organizational context. There is, for example, a well-documented case of an advertising agency executive collaborating with a well-regarded designer to create a transformative virtual office environment. Although the design goal was to encourage more innovative work and to engender a more communal environment, the employee response was overwhelmingly negative; many struggled to get work done in an environment that felt like a "a cocktail party," fought over too few desks, and desperately tried to define a personal space by displaying family photos.[66] In other words, despite what appeared to be effective collaboration at the top, the design process did not engage the situated organizational context. A similar dynamic seems to have occurred with the design of the Seattle Public Library project, where there appeared to be an effective collaboration between the library leaders and Rem Koolhaas, but much less so with the community at large (see Box 12.2 in Chapter 12).

Just as there needs to be an alignment of organizational values, environmental values, and the architect/designer's role (see again Figure 2.10), there is additionally an essential alignment to the briefing and ongoing design process. Indeed, the entire design engagement process is also influenced by an organization's underlying values, which in turn affects the nature of user participation, how information is to be gathered, and even how design decisions are made.[67]

A research study of expert designers by Paten and Dorst demonstrates a remarkable convergence with Groat's cultivator model.[68] The authors' purpose was to investigate the variety of ways in which designers worked through the project briefing phase with their clients. In their interviews with 15 designers, they asked about the nature of the briefing processes for what the designers deemed to be "typical" and "innovative" projects.

Paten and Dorst's in-depth analysis of these interviews revealed a typology of four designer roles. The designer's least-favored role is that of *technician*, whereby the designer is presented with a well-defined brief and is simply expected to carry this out. In the role of facilitator, the designer accepts the client's established criteria for the project, but is able to devise an appropriate solution for the problem as given. In the third role as expert/artist, the "client is accepted as knowing what they need and the designer is responsible for framing the project with them to achieve a workable outcome." Finally, for all but 4 of the 15 respondents (for whom the expert/artist role was preferred), the designers found the role of the collaborator to be the most satisfying. In this role, "both the client and the designer mutually work on framing the project, in terms of both problem and solution spaces."[69]

This typology is represented in Figure 2.11 and shows that the technician role is characterized by either limited or virtually no collaborative engagement in problem definition, solution formulation, or iterative refinement of the design. By contrast, at the other end of the scale, the collaborator role entails the full engagement of the designer in all three categories of involvement. Interestingly, though some architects or designers may see advantages in the expert/artist role, it actually entails only partial or medium levels of involvement in two of the three categories.

Mode	Point of Entry to Project	Involvement in Problem Space Formulation	Involvement in Solution Space Formulation	Amount of Iteration
Technician	End of planning	No	No	Low
Facilitator	Near end of planning	No	Partial	Low
Expert/Artist	Mid-planning	Partial	Yes	Med
Collaborator	Beginning of planning	Yes	Yes	High

Figure 2.11 Matrix of designer roles. Redrawn from Bec Paton and Kees Dorst, "Briefing and Reframing: A Situated Practice," *Design Studies* 32(6) (November 2011): 583, with permission from Elsevier.

Equally important from the designer's perspective, the examples of projects that entailed the collaborative mode were seen as more diverse and innovative. And the interactions between designer and client were experienced as "highly iterative, transparent and playful." The authors then go on to analyze the type of conversation that occurs between client and designer working in the collaborative mode. In these cases, "*[e]ngineering a dialogical approach*, using a *context-specific language framework* and asking *leading questions* [authors' emphasis] were . . . identified as means to de-structure a situation through language co-creation."[70] The authors also argue that, in addition, employing a "co-created language" serves to establish a level of trust between client and designer.

This dialogic engagement may well lead the client and designer to mutually reframe the nature of the design project, often involving "research on behalf of, and with, the client to reframe the situation (e.g., user-centered design techniques revealing the situation, rather than conforming to a list of functional requirements)."[71] The authors observe that their interviewees expressed curiosity "to find out about the client's world and incorporate that into the situation being framed."[72] Finally, they conclude that such "[s]ituated framing and reframing practices" should be cultivated among expert designers and students alike. "The design professions would do well to collectively reflect on these practices in order to . . . cultivate innovative projects."[73]

2.4 RESEARCH, DESIGN, SCHOLARSHIP, AND SCHOLARSHIP-IN-PRACTICE

There are many external forces driving the interest in relating the domains of research and design. One is the academic environment. Some 20 years ago, Boyer and Mitgang's important work, *Building Community: A New Future for Architecture Education and Practice*, called for a more diverse approach to defining research. They noted that because the academy places more emphasis on traditional research, some architectural faculty felt that design activity is considered less scholarly.[74] In an earlier work, *Scholarship Reconsidered*, they suggested that the traditional model of research as discovery be supplemented by added categories of scholarship in integration, application, and teaching.[75] We agree with Boyer and Mitgang's intent that different categories of intellectual contribution are equivalent, not in kind but in import and value. We noted this in passing in the first edition of this book, but developments since 2002 make this matter more important for this present edition, as will be evident in the following.

Another impetus for relating design to research comes from the profession. The American Institute of Architects now offers considerably more resources for research to its members in comparison to 10 years ago.[76] For example, in 2001, the Latrobe Fellowship, awarded biennially, was instituted by the AIA College of Fellows as a substantial research grant. The 2011 program (for instance) focused on public interest practices, and asked these succinct research questions: What are the needs that can be addressed by public interest practices? How are current public interest practices operating? What is necessary for public interest work to become a significant segment of architectural practice?[77] In 2004, the Research for Practice (RFP) program was instituted, which led to the 2007 Research Summit in Seattle, Washington.[78] It was at this summit that the profession started to develop—in logical argumentation terms—an overall research agenda for the AIA, complete with a set of technical categories for research, e.g., pure basic research, use-inspired basic research, pure applied research and development.[79] It is not clear what these categories exactly mean; the noteworthy point is the effort itself to frame a research agenda.

Also noteworthy is to "increase university research capacity and funding opportunities" as one of the organization's long-range goals.[80] In 2006, the AIA added the Upjohn Research Initiative, encouraging members to submit grant proposals dovetailing research with practice. In 2012, Wang contributed the section on research methods for the *AIA Handbook*, 15th edition. One of the exemplars featured in this article underlines how the Upjohn Initiative brings together practitioners with academic faculty for joint research projects.[81] All of this emphasizes how overlaps between research and design have increased even since the publication of the first edition of this book in 2002.

To return to the academy: the interest in coupling design with research is also driven by institutional pressures. At the university level, there is an increasing trend for architecture faculty to hold the PhD research degree, as distinguished from the practice degrees, the MArch or BArch. (This relates to the second issue that we suggested, at the outset of Section 2.2, to be considered along with technical distinctions between design and research.) A search of the documents of the National Architectural Accreditation Board (NAAB)[82] indicates that the percentage of architectural faculty holding PhD degrees was not even a measure until the 2010 report (at which point it was roughly 17%; the 2011 report has it at 28.5%, although the difference in the reported total number of full-time faculty between the two years is considerable, so the percentage increase is probably not as significant as the numbers suggest).

More anecdotal but probably more indicative evidence of pressure that some design faculty experience can be found on the online NAAB forums. The following example raises a good point: that sometimes the interdisciplinary programs within which architectural faculty reside often do not recognize anything but the PhD.

Thus, the NAAB, according to this individual, should simply convert bachelor's and master's degrees into doctoral degrees retroactively:

> There are several programs throughout the country (and world) where architecture, landscape architecture, planning or design related courses and/or programs are offered under the umbrella of another college. . . . These other departments are not familiar with the architecture structure of "terminal master degrees" . . . . Many M.Arch/B.Arch graduates have lost jobs due to this. Solution: retroactively change the titles to D.Arch.[83]

We certainly do not endorse this suggestion; our task here is to highlight the increasing pressure to recognize research rigor in design inquiry, as evidenced by the increased demand for doctoral degrees, and also to highlight the good work being done to recognize broader definitions of research in relation to design.

To this end, Ellison and Eatman's 2008 report, *Scholarship in Public: Knowledge Creation and Tenure Policy in the Engaged University*,[84] offers good criteria for measuring research rigor of the work of faculty housed within departments that conduct nontraditional research. Based on structured interviews with a wide sampling of U.S. faculty in the arts, humanities, and design, Ellison and Eatman propose several "continuum structures" for accommodating research activity: from scholarship to public engagement, from scholarly to creative acts, a range of choices for being a "civic professional," and a "continuum of actions for institutional change.[85] The authors say this (the italics are theirs):

> The term continuum has become pervasive because . . . it is *inclusive* of many sorts and conditions of knowledge. It resists embedded hierarchies by assigning *equal value* to inquiry of different kinds. Inclusiveness implies *choice*: once a continuum is established a faculty member may, without penalty, locate herself or himself at any point.[86]

Most notable about *Scholarship in Public* is the title itself: it casts public and civic engagement as a mode of research and, among other things, faculty work in theater, art and civic dialogues, historical preservation, urban design, and community development are all offered as examples. The authors define publicly engaged academic work as

> . . . scholarly or creative activity integral to a faculty member's academic area. It encompasses different forms of making knowledge about, for, and with diverse publics and communities. Through a coherent, purposeful sequence of activities, it contributes to the public good and yields artifacts of public and intellectual value.[87]

Key terms and phrases here indicate departure from traditional modalities of scientific inquiry. Most obvious is the word *artifacts.* Ellison and Eatman are explicit in holding that outcomes of research need not be concepts communicated by writing or nomenclature; they can be artifacts such as performances, exhibitions, certainly buildings. "Making knowledge about, for or with" suggests situated and contextual outcomes that do not promise universal applicability, but rather find relevance in particular social-cultural venues. However, even as these modes of research are new, the terms "coherent," "purposeful sequence of activities," and "contributes to the public good" all echo well-known measures of research quality: for example, validity, verifiability, even that elusive word that nevertheless crops up in all discussions about research quality: *robust.* Thus, Ellison and Eatman make clear that these new modes of research should exhibit "relationships of resemblance and unlikeness." By this they seem to mean that, even in their "unlikeness," these new forms of research must be "judged by common principles, standards to which all academic scholarly and creative work is held."[88] They specifically state what these standards ought to be: (1) clear goals; (2) adequate preparation; (3) appropriate methods; (4) significant results; (5) effective presentation; and (6) reflective critique.[89]

BOX 2.5
Public Scholarship in Ritzville, Washington

Since 2005, Professor Janetta McCoy and her students have engaged in interdisciplinary work with the community of Ritzville, Washington (see Figure 2.12). Once a thriving place, this town in rural central Washington has seen a decline in its fortunes since Interstate 90 was gradually completed over the course of the latter half of the last century, reducing Ritzville to no more than an exit off the highway. With state and local funding, McCoy began her work by asking her design students to work with the community in conceptualizing alternatives for an abandoned high school in town. The solutions: a conference center to attract visitors, a microbrewery, a farming museum, and a trade school as a "laboratory for learning about historic preservation." The collaboration stirred considerable interest from the Ritzville community. Says McCoy: "It gets students involved with folks in a rural community who don't look like them, and the process also educates the community about design." Over the years, McCoy's efforts have gone beyond the limitations of semester schedules.

Various funding sources, such as the Ritzville Public Development Authority, have enabled McCoy to run summer studios, hire outside consultants, and pay student workers, all for promoting economic growth through enhancement of the built environment of Ritzville. McCoy's students have conducted feasibility studies, documented the built inventory of the town, and continued to do design projects. One of these involved designs for converting an empty hotel into housing for the elderly; this project generated huge support from the citizens. McCoy and several other faculty now have in place the Rural Communities Design Initiative, which seeks funding sources to support academic design collaboration with rural communities.

McCoy's work, as an example of public scholarship as defined by Ellison and Eatman, can be assessed by the criteria the authors provide: (1) clear goals; (2) adequate preparation; (3) appropriate methods; (4) significant results; (5) effective presentation; and (6) reflective critique.

Figure 2.12 Professor Janetta McCoy (standing in the background, facing left) in her work with the community of Ritzville, Washington. This particular project was for the design of an interactive structure representing the history of Ritzville. Photograph courtesy of Isil Oygur.

Turning to the European scene, in their article "Building a Culture of Doctoral Scholarship in Architecture and Design: A Belgian-Scandinavian Case," Halina Dunin-Woyseth (from the Oslo School of Architecture) and Fredrik Nilsson (from the Chalmers School of Architecture in Sweden) report:

> In September 2003, the Bologna-Berlin policies recognized doctoral studies as the third cycle in European higher education. For the Sint-Lucas School of Architecture (Belgium), this meant developing a new culture, a culture of research and doctoral scholarship. The intentions of the school were to develop experimental, practice-based concepts for this research, rather than to attempt to emulate the discipline-based research that is characteristic of the academic fields.[90]

To this end, Dunin-Woyseth and Nilsson were engaged by Sint-Lucas to develop an eight-module (over two years) curriculum in which practitioners pursue doctoral-level studies in "research by design." This program was implemented in 2006. The eight modules bore these titles: (1) Research Methodologies and Communication; (2) Knowledge; (3) Reflection; (4) Design Cognition; (5) Why/How Design Research?; (6) Artifact, Action and Observation; (7) PhD by Practice; (8) By Design for Design. Based on the "Roskilde Model" for doctoral education developed in Denmark in the 1990s, the approach "consisted of short periods of concentrated . . . teaching by international lecturers, preceded by intense literature studies, and followed by practical exercises such as the writing of essays."[91]

In June 2012, Wang served as the opponent for the public defense of the first doctoral candidate to go through the St-Lucas doctoral system (in collaboration with Chalmers University in Gothenburg, Sweden). The successful candidate, Nel Janssens, is both a practitioner and instructor at St-Lucas. Her dissertation, entitled *Utopia-Driven Projective Research*,[92] takes four conceptual projects—one taking eight years to complete—and derives principles that philosophically advance Cross's theory of "designerly thinking" as well as Lang's work on the deontological nature of much of architectural practice, to wit, that design decisions are made in accordance with the designer's "value-laden" commitments[93] (deontology is discussed in Chapter 4). Although it does not neatly fit into the research strategies addressed in this book, Janssens's approach clearly involves qualitative ethnography and logical argumentation, employing critical theory as a school of thought. The point, however, is that the ethnography is of her own experiences in the practice venues that produced the conceptual projects. Through the lens of standard discipline-based doctorates, Janssens can be (and was) questioned about the circularity of using her own practices as her "samples." But Janssens' work fits all the criteria of Ellison and Eatman's

study: its goals were clear; the literature and practice preparation were extensive; appropriate methods were used; the results were significant both in its intended consequence (as a theory of deontological practice that engages and includes the public) and in its unintended consequence (as a pedagogical method for teaching design studios); the presentation was effective; and her work amounted to an engaging critique of design process (as well as itself undergoing reflective critique in the public defense).

Figure 2.13 is a PowerPoint slide used in a seminar for doctoral students Wang conducted at Chalmers University in June 2012.[94] The slide situates the first edition of this Groat-Wang research methods text as one heading of a heuristic matrix

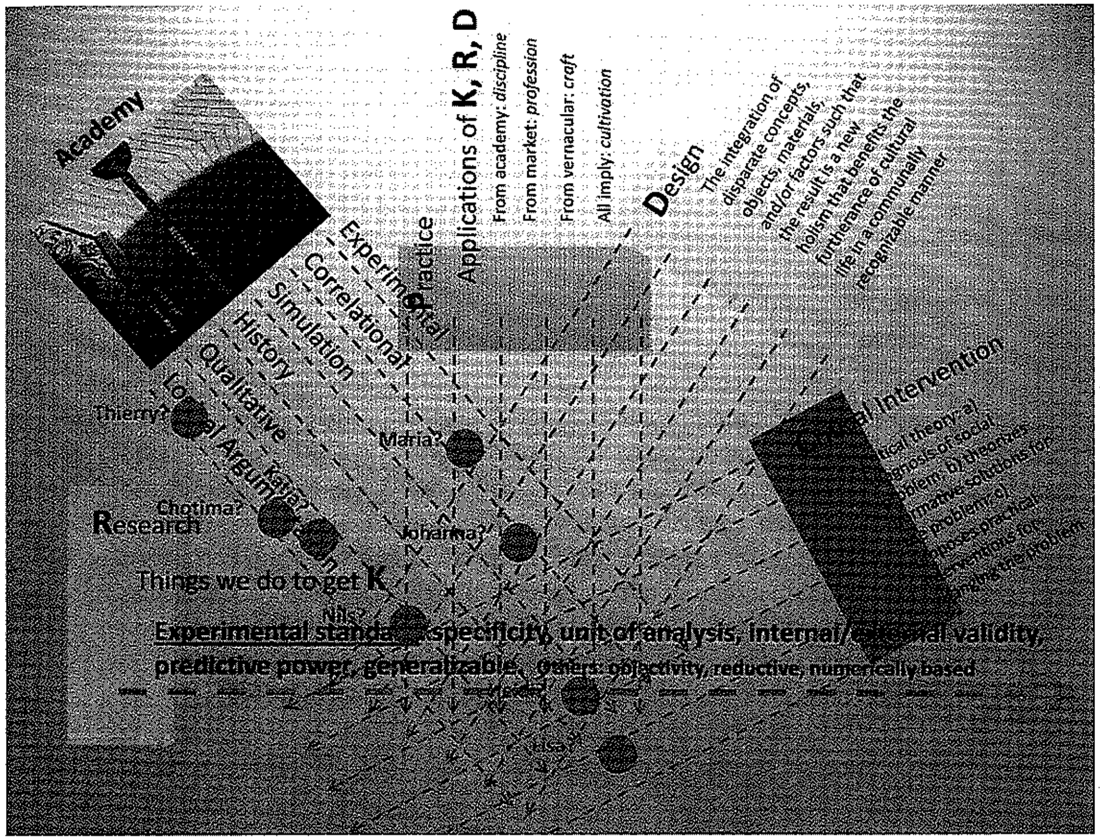

Figure 2.13 A heuristic matrix of different domains of research—including design—with "relationships of resemblance" to standard measures for research quality. The dots represent proposed locations on the matrix where various student dissertation proposals can be situated. Diagram by David Wang.

that includes Practice, Design, and Critical Intervention as the other heads. On the slide, the Groat-Wang book is labeled "Academy," in that the first edition has been primarily used in academic venues for architectural research (among them Chalmers). Readers will recognize the chapter headings covered in the book. The point of the slide is that activity in the Practice, Design, and Critical Intervention domains can also echo—in the vein of Ellison and Eatman's "relationships of resemblance and unlikeness"—the measures for robustness for the research measures outlined in the Groat-Wang strategy chapters. All of this activity, in turn, still harkens back to standards initially established by the positivist tradition, as indicated by the baseline of the heuristic matrix. Finally, the slide then maps the various students' research proposals (the dots) at various points on the matrix. The dot at the far left side represents a project in which the student wishes to frame a broad explanatory theory of how built environments are experienced through time; this can probably be done with logical argumentation strategy as outlined in the Groat-Wang text. But the dot on the far right side represents a topic in which the student wishes to actively alter citizen participation processes in municipal planning venues in Sweden. In other words, at this stage in her development, the application of critical theory—in the sense of the Frankfurt School's formulation of (a) identifying a social problem; (b) proposing normative solutions for the problem; and (c) intervening to change the problem—to a design venue figures prominently in this student's research design. The challenge for her, then, is to achieve robustness in demonstrating "relationships of resemblance" to the measures of research quality found in neighboring domains. We note this European example to underline the rich developments in integrating design inquiry with "research" going on today.

We might also add this: To come full circle back to discussions among U.S. design faculty vis-à-vis academic qualifications, the developments in Europe for bridging design with research bear watching. Ellison and Eatman's new criteria for evaluating rigor in nontraditional public research resonate well with standards being established in Europe. Built or designed work (Ellison and Eatman: portfolios)[95] fits, for example, what Janssens submitted for her doctoral defense. In addition, although Janssens's doctoral committee was comprised of three academic faculty, those faculty came from different schools (in addition to the external "opponent," Wang, from the United States). But the number of players directly involved in her work included practicing architects, two of whom come from architecture firms with in-house research departments. All of this is consonant with Ellison and Eatman's suggestion to "expand who counts . . . in broadening the community of review."[96]

2.5 CONCLUSION

Architectural research, then—and we can be more general to say this about all design research—is experiencing an exciting time of development. Since the first edition of this book, much has emerged in attempts to bridge the gap between design and research as these terms have been conventionally understood. This bears out our view, which, again, is that design and research are neither polar opposites nor equivalent domains of activity; instead, subtle nuances and complementarities exist between the two. At their respective poles, yes, research tends to be more conceptually systematic, whereas design activity makes episodic uses of research (more examples of this are covered in Chapter 4). But as the developments in Europe are beginning to suggest, the "episodic" moniker for research in design is itself increasing in sophistication, as the domains of design and research achieve more nuanced complementarities.

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