Chapter 8

Correlational Research

8.1 INTRODUCTION

During the 1970s William Whyte's study of urban plazas in New York City became a driving force in the development of revised zoning codes regarding commercial high-rises.[1] At the time Whyte and his Street Life Project team began their research, New York City maintained a zoning ordinance by which developers could build more floor space into their buildings if they provided public plaza spaces. Yet many of these plazas were remarkably underutilized, while others seemed to be crowded with workers taking their lunch breaks in seasonable weather.

Whyte wanted to understand why and to suggest guidelines for the design of successful plazas. So, he and his team conducted six months of intensive observations of nearly 20 representative plazas, much of it with the aid of video film and basic people-counting at specified time intervals. Eventually, their charting of plaza use as a function of various plausible physical variables led them to identify the significance of several key design elements (see Figures 8.1, 8.2, 8.3, and 8.4). Chief among them is sitting space, a conclusion that Whyte acknowledges in hindsight should have been obvious, but was not when they first began the study. To support his analysis, Whyte presents charts that compare plaza use (numbers of people at the lunch hour) with the amount of open space available across all 18 plazas; there is no obvious relationship (see Figures 8.1 and 8.2). However, a similar chart comparing plaza use with the amount of sittable space demonstrates a much closer relationship between these two variables (see Figures 8.3 and 8.4).

Although Whyte and his team completed most of their data collection and analysis within about six months, their efforts to influence and modify New York

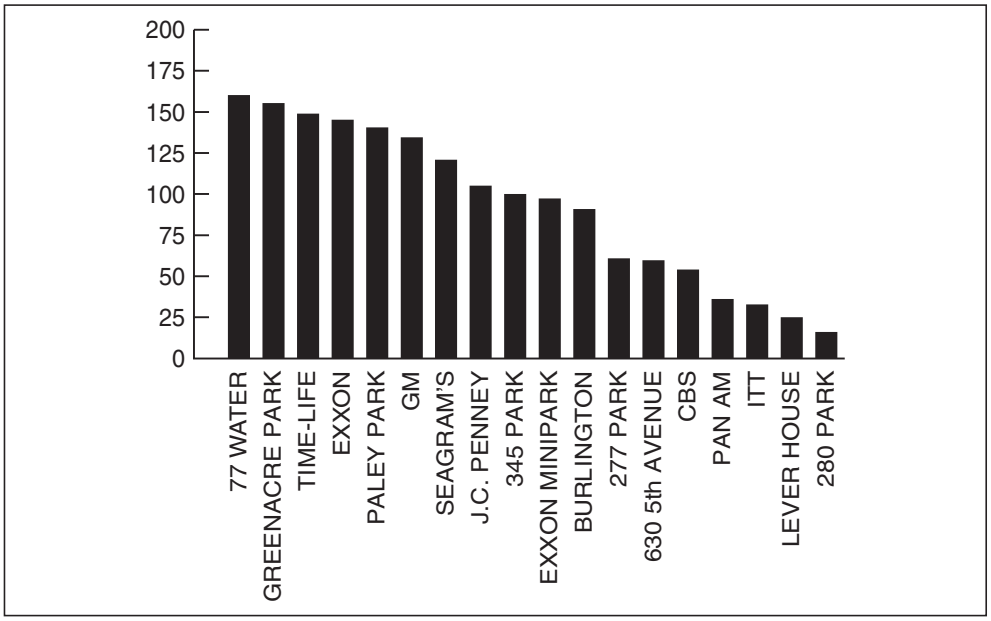

Figure 8.1 Plaza use: average number of people sitting at lunchtime in good weather. Courtesy of Project for Public Spaces, New York, New York.

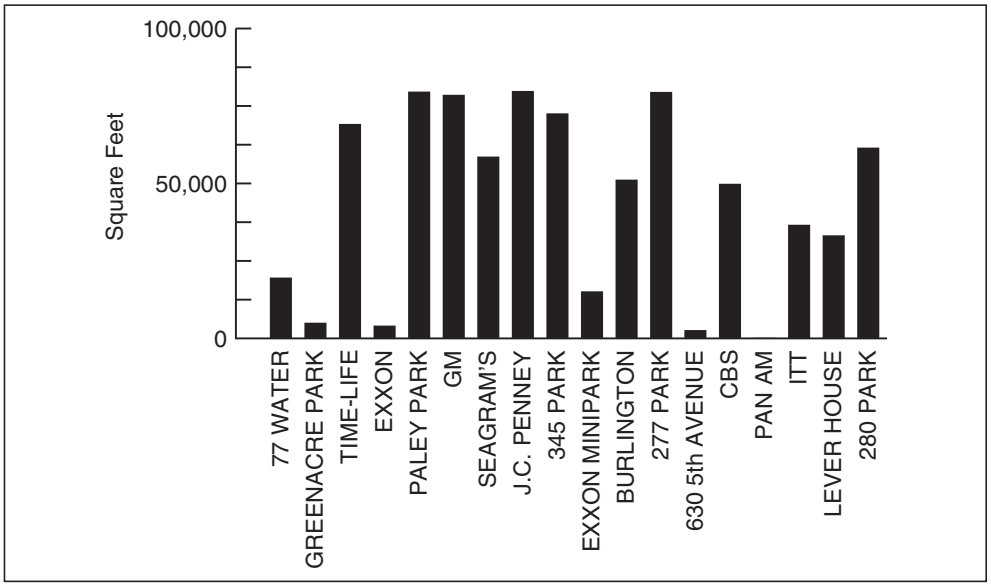

Figure 8.2 Amount of open space by lineal feet. Courtesy of Project for Public Spaces, New York, New York.

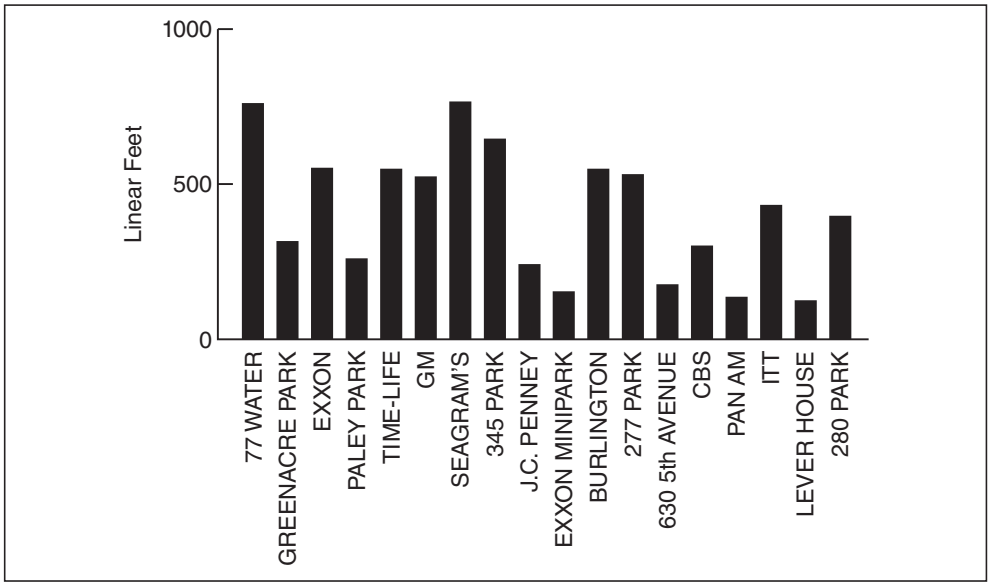

Figure 8.3 Amount of sittable space by lineal feet. Courtesy of Project for Public Spaces, New York, New York.

Figure 8.4 Sittable space at 345 Park Avenue. Courtesy of Project for Public Spaces, New York, New York.

City zoning ordinances took another two or more years. Happily, their proposed guidelines were eventually incorporated into a revised zoning code, with the result that new plazas were built to these guidelines and, just as important, many existing plazas were modified to meet the new zoning code.

In a notable study published in both scholarly and professional journals, Joongsub Kim sought to assess the perceived sense of community among residents of a "New Urbanist" neighborhood and a typical suburban development.[2] Indeed, since the mid-1980s considerable debate within both the professional and lay press has been generated by "New Urbanist" or "Neo-Traditional" neighborhood design. Although there are several variants to this approach, author Todd Bressi offers a general definition of this trend.[3] According to him, an underlying premise of New Urbanism is that "community planning and design must assert the importance of public over private values,"[4] or in other words, an enhanced sense of community. Among the several specific goals that New Urbanists seek to foster through design are social interaction and a greater sense of neighborhood attachment and identity, achieved in part through a more pedestrian-friendly layout.

To assess the extent to which these civic qualities are experienced in a New Urbanist community, Kim studied residents' reactions to their neighborhood both in Kentlands (a recently developed New Urbanist community in Gaithersburg, Maryland) and in a typical suburban neighborhood, comparable in demographic characteristics and located in the same town (see Figures 8.5, 8.6, 8.7, and 8.8).[5]

The principal tactic he employed was an extensive survey questionnaire that was distributed to every household in the two neighborhoods. In addition to some demographic and overview questions, Kim asked each resident to assess the extent to which specific physical features of the design facilitated their experience of the four key components of community identified in the literature: community attachment, pedestrianism, social interaction, and community identity. A 5-point scale from "not at all" to "very much" was used to measure residents' responses.

The results of Kim's research indicate that the Kentlands' residents consistently rated their community as promoting higher degrees of all four measures of sense of community. And within Kentlands, there was a relatively higher rating of these four components of community among the single-family house and townhomes residents. But even Kentlands apartment dwellers expressed a slightly greater sense of community than the suburban group's single-family house residents. Kim thus concludes that the relative success of the Kentlands community suggests that New Urbanist theory and practice deserve continued development and refinement.

Figure 8.5 A Kentlands street and park. Courtesy of Joongsub Kim.

Figure 8.6 A Kentlands street with no visible edges. Courtesy of Joongsub Kim.

Figure 8.7 Orchard Village housing. Courtesy of Joongsub Kim.

Figure 8.8 Orchard Village with typical street-access garages. Courtesy of Joongsub Kim.

8.2 THE STRATEGY OF CORRELATIONAL RESEARCH: GENERAL CHARACTERISTICS

The research strategy common to both the Whyte and the Kim studies is that of correlational research. Broadly speaking, each study sought to clarify patterns of relationships between two or more variables, that is, factors involved in the circumstances under study. Although details of two subtypes of the correlational strategy will be discussed in detail in section 8.3, it is useful first to clarify the overall characteristics of this research design. In the following subsections, we will review the following general characteristics: a focus on naturally occurring patterns; the measurement of specific variables; and the use of statistics to clarify patterns of relationships.

8.2.1 A Focus on Naturally Occurring Patterns

Both the Whyte and Kim studies sought to understand naturally occurring patterns of socio-physical relationships. For example, Whyte sought to understand the behavioral dynamics of plaza use, and in particular what physical features would encourage their use. Similarly, Kim sought to understand the patterns of relationship between the distinctly different physical attributes of two residential neighborhoods and the residents' behavior (pedestrianism, social interaction) and perceived meanings (attachment, identity).

In both cases, the researchers wanted to clarify the relationship among a complex set of real-world variables. By *variables* we mean the range of characteristics (of physical features, of people, of activities, or of meanings) that vary within the circumstance being studied and are also likely to affect the dynamics of socio-physical interaction. In its focus on real-world circumstances, correlational design is distinct from experimental design, the research strategy that will be discussed in Chapter 9. Whereas correlational design assumes that the researcher simply measures the variables of interest and analyzes the relations among them, experimental design depends on the researcher's active intervention in the form of a "treatment." (See Chapter 9 for details.)

8.2.2 The Measurement of Specific Variables

Second, both the Whyte and Kim studies focus on specific variables of interest that can be measured and quantified in some way. In this, correlational design is distinct from qualitative design. Although both strategies focus on naturally occurring patterns, qualitative research is more attentive to the holistic qualities of phenomena (see Chapter 7). As is typical for a correlational design, the researchers in Whyte's

study employed a number of observational tactics whereby the sheer numbers of people or their specific behaviors could be counted. Thus, Whyte's data documented exactly how many people were using a given plaza at particular times throughout the lunch hour. And once he identified "sittable space" as a key physical feature, he and his team could measure such attributes as the total lineal feet of sitting space, and its various dimensions.

In other instances of correlational research, however, the focus may be less on observable behaviors but on people's attitudes, ascribed meanings, or even their perceptions of others' behavior. Such is the case with Kim's use of a survey questionnaire in the New Urbanist and typical suburban neighborhoods.[6] Kim sought to measure the extent to which the patterns of residents' perceived sense of community might differ between the two neighborhoods.

Although on a superficial level the notion of measurement may seem to be a rather straightforward proposition, this is not necessarily the case. Researchers using the correlational research design must decide on and understand the implications of using different levels of measurement precision, including categorical, ordinal, interval, and ratio. (Although we will define these terms briefly here, readers who seek a more detailed discussion should refer to some of the works cited in the chapter endnotes.)

Categorical Measurement. This term simply indicates that the variable of interest is sorted into discrete categories, based on verbal or nominal terms. In Kim's study many of the demographic questions are based on nominal or categorical measurement. For example, one survey question asked residents what mode of transportation they used to get to work, and the categories provided for the answers were walk, car, metrobus, metrotrain, other, and not applicable (for those who worked in the home). Similarly, in Whyte's study, if he were concerned with specifying the kind of activities people were engaged in, the researchers' observations might include the categories sitting, standing, and walking.

Ordinal Scales. Ordinal measurement provides a greater degree of measurement precision than nominal classification in that the variable in question can be *ordered* on some basis. In Kim's survey, for instance, other demographic questions provide a set of ordered categories. This is the case with a question about household income; six separate income categories from (1) under $40,000 to (6) $150,000 or more are provided. Similarly, in a study of architects and nonarchitects' responses to a stylistic variety of buildings, Groat asked respondents to rank-order the 24 building photographs according to their personal preference.[7] In this case, although the results reveal an order of preference, no assumptions about the interval of difference between one building and another can be made. Indeed, it is possible that the top two or three buildings might be highly preferred, while the next building in order might be much less liked.

Interval and Ratio Scales. A more precise measure still is one that specifies the exact distances (or intervals) between one measurement and another. Any system that relies on an established and consistent unit of measurement—whether it is dollars, feet, or degrees of temperature—satisfies the criterion of an interval scale.

However, the validity of measuring attitudes and feelings on an interval scale is a topic of much discussion and some disagreement.[8] In the case of Kim's questionnaire, we might ask if it is legitimate to assume that respondents using the 5-point scale—from very important (5) to not at all (1)—are employing a consistent increment of difference between responses of 4 versus 5 or 3 versus 4. If we assume that they are not employing a consistent interval of difference, then the attitudinal scale is, in fact, functioning as an ordinal measurement.

A further level of measurement precision is achieved with a ratio scale, whereby an absolute zero point on the scale can be established. This means that something that measures 20 on a ratio scale is legitimately understood as constituting twice the quantity of 10. In practical terms, there are few interval scales that are not also ratio scales, but one exception is that of temperature. Indeed, we cannot claim that 72 degrees is twice as hot as 36 degrees. However, we can assume consistent measuring intervals; the difference between 5 and 10 degrees is the same as the difference between 20 and 25 degrees.[9]

These distinctions among types of measurement precision frequently come into play in correlational research because so many variables—from demographic characteristics, to attitudes and behaviors, to physical properties—must be measured. And because different variables lend themselves to varying levels of measurement precision, great attention is paid to establishing legitimate data collection instruments and appropriate modes of quantitative analysis.

8.2.3 The Use of Statistics to Clarify Patterns of Relationships

Another characteristic common to both the Whyte and Kim studies is their use of statistical measures to describe the relationships among variables. In his book, *The Social Life of Small Urban Spaces*, Whyte relies primarily on graphic charts to represent visually the use patterns of the plazas he studied. For example, Figure 8.1 shows the average number of people using each of 18 plazas in good weather; and we can see, for example, that the most used plaza averages around eight times more people than the least used. This use of statistics is called *descriptive* statistics because it simply presents, or describes, important relationships among variables.

Kim's study of residential developments employs, in addition to basic descriptive statistics, what are called correlational statistics. These statistical measures are used to describe "the magnitude of the relationship between two variables."[10] For

example, Kim presents the calculated correlations among all four of the measures of community, both for Kentlands and for Orchard Village (a pseudonym for the typical suburban development) (see Figure 8.9). As it turns out, all four measures of community are highly and positively correlated with each other, for each neighborhood development. So, for example, the Kentlands' ratings of the effect of various physical features on their sense of attachment have a similar pattern to their ratings for social interaction, and so on. In other words, in the perception of the residents, the role of the various physical features in achieving a sense of attachment, pedestrianism, social interaction, and sense of identity are quite similar. However, if the pattern of ratings on any two measures had been quite different, it would have been described as a negative correlation. All calculated correlation coefficients are indicated within a range of –1.00 (a negative correlation) to +1.00 (a positive correlation); and a correlation coefficient close to 0 indicates virtually no consistent relationship between variables.

8.3 STRATEGY: TWO TYPES OF CORRELATIONAL RESEARCH

Within the general framework of correlational research, as described in the previous section, two major subtypes can be identified: (1) relationship and (2) causal comparative.[11] While a number of research studies can be characterized as representing just one subtype, other correlational studies are multifaceted,

Relationship among Q1, Q2, Q4, Q7
(Orchard Village in parentheses)

Four Major Elements (K: based on 17 items only)
Q1: Community attachments
Q2: Pedestrianism
Q4: Social interaction
Q7: Community identity

	Q1 mean	Q2 mean	Q4 mean	Q7 mean
Q1 mean	1.000	.605 (.579)	.481 (.517)	.594 (.654)
Q2 mean	.605 (.579)	1.000	.639 (.662)	.514 (.530)
Q4 mean	.481 (.517)	.639 (.662)	1.000	.419 (.575)
Q7 mean	.594 (.654)	.514 (.530)	.491 (.575)	1.000

Findings:
Kentlands: Correlation is significant at the 0.01 level
Orchard Village: Correlation is significant at the 0.01 level

Figure 8.9 Relationship among questionnaire components. Courtesy of Joongsub Kim.

and as a consequence incorporate both of these subtypes. In the following paragraphs, we will describe and analyze examples of both relationship and causal comparative research.

8.3.1 Relationship Studies

Although all correlational studies, by definition, seek to describe the relationship between or among key variables, the term *relationship* study is meant to distinguish those studies—or components of larger studies—that focus specifically on both the nature and the potentially predictive power of those relationships.

A good example of an influential research study that sought to clarify relationships and predict outcomes is Oscar Newman's study of public housing in New York City, mentioned in Chapter 4.[12] To arrive at specific design guidelines for such housing, Newman's research team conducted an exhaustive investigation of the complex relationships between user demographics (including income and other socioeconomic factors), the physical variables of the housing/site design, and the incidence of crime. Newman's team examined the extensive existing records of the 169 public housing projects managed by the New York City Housing Authority. As Newman explains, this vast amount of data, combined with the immense variety of building types and site plans, made it possible to "determine exactly where the most dangerous areas of buildings are, as well as to compare crime rates in different building types and project layouts."[13]

As a consequence of this extensive analysis of these multiple variables, Newman and his team were able to identify consistent relationships and ultimately to propose a theory of "defensible space." Newman has defined the concept of defensible space as

> a model for residential environments which inhibits crime by creating the physical expression of a social fabric that defends itself. . . . [It] is a surrogate term for the range of mechanisms—real and symbolic barriers, strongly defined areas of influence, and improved opportunities for surveillance—that combine to bring an environment under the control of its residents.[14]

Not only does this theory of defensible space define a relationship between environmental variables and behavioral consequences (a decrease in crime), but it also offers a predictive capacity that can be articulated as design guidelines, specifically low-income housing that incorporates "real and symbolic barriers, defined areas of influence, and opportunities for surveillance" will be more likely to have lower crime rates (see Figure 8.10).

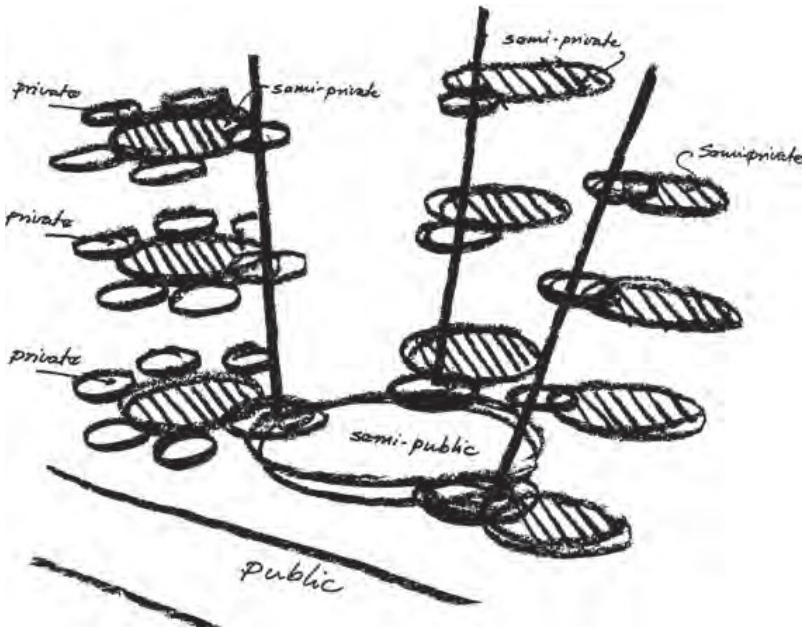

Figure 8.10 Newman's defensible space hierarchy in multilevel dwelling. Courtesy of Oscar Newman.

Similarly, in the case of Whyte's study, he concludes that higher levels of plaza utilization are associated with the combined presence of several variables, including sittable space, proximity to street life, sun, water/fountains, trees, and availability of food from street vendors or cafes. Notice that Whyte (like other researchers employing correlational research) stops short of saying that sittable space causes plaza utilization. Indeed, there may well be hidden or intervening third factors (such the experience of sociability) that explain the correlations Whyte found. Indeed, many high correlations—for example, between the number of ice cream cones consumed and deaths by drowning—can be explained by hidden third factors, in this case hot weather.[15]

However, although Whyte does not attribute direct cause, his research does enable him to *predict* the association of certain key variables (i.e., sittable space, proximity to street life) with higher levels of plaza use. Despite the lack of causal attribution, the predictive accuracy of Whyte's work is the foundation for providing design guidelines that were eventually embedded in new zoning codes and used by many architects and landscape architects.

Likewise, Kim seeks to understand and predict the relationship among the various component measures of community. As the correlations described in section 8.2 indicate, the patterns of ratings for each of the four measures of

community are predictive of each other. With a similar goal in mind, Kim also asked residents of each neighborhood development two overall questions about their sense of community. He first asked respondents to give their rating for "Living in Kentlands (or Orchard Village) gives me a sense of community." The second sought their rating for "The physical characteristics of Kentlands (or OV) give me a sense of community." Kim found that the answers to these two global questions were highly correlated with the ratings for each of the four component measures of community. In other words, the respondents' overall assessment of sense of community is predictive of their assessment of physical features for each separate component of community, and vice versa.

Finally, Kim assessed the strength of the correlations he found by using a test of statistical significance. Without going into great detail at this point, it is important to explain simply that such statistical tests—known by the general term *inferential* statistics—enable a researcher to determine how likely it is that the results are a consequence of a chance occurrence. In Kim's case, the correlations were found to be significant at the .01 level, meaning that there is only a 1 in 100 chance that the overall assessment of community is unrelated to the component measures.

8.3.2 Causal Comparative Studies

Causal comparative studies represent a type of correlational research that stakes out an intermediate position between the predictive orientation of relationship studies and the focus on causality that characterizes experimental research. In causal comparative studies, the researcher selects comparable groups of people or comparable physical environments and then collects data on a variety of relevant variables. The purpose of selecting comparable examples is to isolate the plausible relevant factor(s) that could reveal a "cause" for significant differences in the levels of measured variables.

Kim's study of Kentlands and Orchard Village serves as a good example of a causal comparative study. Although he was certainly interested in studying the relationships among variables (such as the predictive relationship between overall and component measures of sense of community), his primary purpose was to determine the extent to which the differences in the physical characteristics of Kentlands vs. Orchard Village might contribute to differences in the residents' perception of sense of community. Kim is, in effect, conceptualizing the multiple physical features of each neighborhood as independent variables and the residents' perceived sense of community as a dependent variable. In this regard, the research design has much in common with the experimental research strategy, in that the researcher is seeking to ascribe causal power to a variable (or set of variables) for the measured outcome.

However—and this is crucial—the causal comparative design can only ascribe cause in a provisional or hypothetical way. This is because causal comparative research (such as Kim's study) relies on studying naturally occurring variables (see section 8.2), as do all correlational studies. This is in direct contrast to experimental research (see Chapter 9), which characteristically involves a "treatment," which is an independent variable that is manipulated by the researcher. As a consequence, the causal comparative design depends on establishing the essential comparability between two examples that differ only in terms of the variable(s) to which cause can be ascribed. Unfortunately, there are many possible shortcomings in establishing the equivalence of the comparable examples/groups.

In the case of Kim's study of two housing developments, it is difficult to establish beyond doubt that the Kentlands and Orchard Village residents moved into their neighborhoods with equivalent attitudes towards sense of community. Indeed, a case could be made that future Kentlands residents were enticed to move there precisely because they already had a greater disposition toward community-oriented living; if that were the case, the higher levels of sense of community measured in Kentlands, as compared to Orchard Village, are simply a consequence of those initial attitudes. To counter such an argument, Kim can point to data gained from qualitative in-depth interviews and activity logs that suggest at least some residents either (1) changed their transportation patterns by walking more once they moved to Kentlands, and/or (2) became more socially interactive after living in Kentlands for some time. Even so, such a causal comparative study can only point to possible causation; it cannot establish cause with the same degree of rigor associated with experimental designs.

Similarly, Oscar Newman sought to bolster his study of New York City public housing by including a causal comparative component in his overall research design. Thus, Newman's team conducted in-depth analyses of housing project pairs, comparable in virtually every respect except the physical design variables. Newman's rationale for this is quite clear (see Figures 8.11 through 8.13).

A fair test of hypotheses concerning the impact of the physical environment on crime therefore requires comparison of communities in which the social characteristics of the population are as constant as possible—where the only variation is the physical form of the buildings.[16]

Although Newman argues as a consequence of the causal comparison study that the physical design unmistakably contributes to measured differences in crime rate between the two projects, he also acknowledges that his data cannot provide "final and definitive proof" of the effects of physical design.[17] In fact, Newman suggests that the negative image of criminal behavior in Van Dyke Houses (the design *without* defensible space) contributed to the police department's pessimism about the value of their presence, a factor which in and of itself could contribute to the

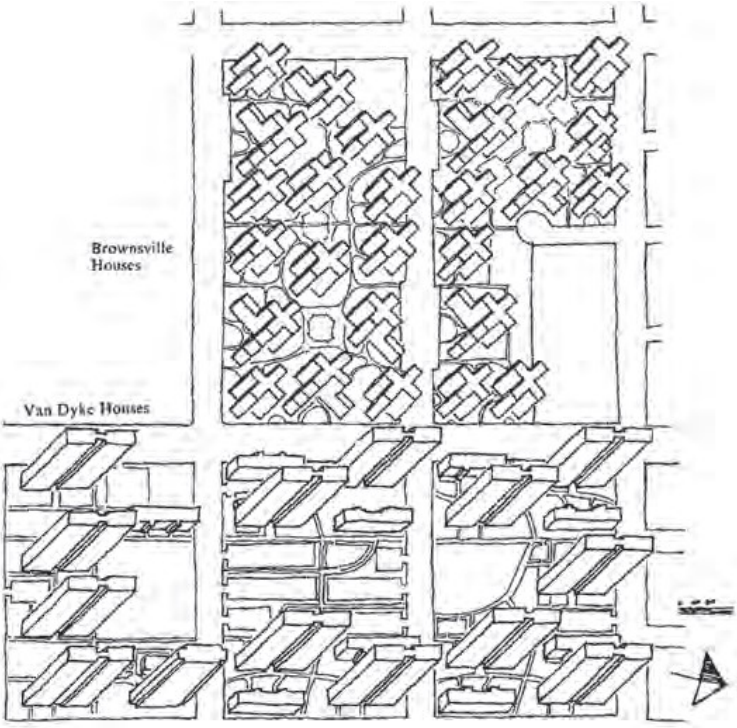

Figure 8.11 Plans of Brownsville and Van Dyke houses. Courtesy of Oscar Newman.

Figure 8.12 Van Dyke houses. Courtesy of Oscar Newman.

Figure 8.13 Brownsville houses. Courtesy of Oscar Newman.

recorded higher crime levels there. Thus, like Kim, Newman can point to cause in the form of physical variables (a strength of the research design), but cannot establish it beyond doubt (a weakness of the design).

8.4 TACTICS: COLLECTING DATA

Our intent in this discussion of tactics is to present a wide range of examples of data collection and analyses commonly used within a correlational research design. Four important issues relevant to this discussion are essential to acknowledge at the outset. First, because the range of both data collection and analyses is vast, we can only cite a few of the most common examples in the context of a single chapter. Second, a number of data collection tactics are frequently employed in other research designs as well; for example, observational techniques are common to qualitative research as well as to correlational research. And third, virtually every one of the tactics discussed here is likely to be the subject of entire chapters or even books. To provide readers with an entry point to these more focused sources, we will provide key excerpts and the relevant citations, so that

interested readers can pursue whichever of these topics seem particularly relevant to their work.

The fourth issue signals a vitally important consideration that must be addressed prior to any data collection for correlational research: sampling. On what basis does the researcher decide how many and which residents to interview about their satisfaction with a new building project in their city? Or how many and which museum visitors should be observed for their choice of route through a new exhibit area? Although sampling is also a significant issue in other research strategies, it is often a more significant issue for correlational research because the goal of many correlational studies is to predict as accurately as possible the response or behavior of a large group of people, based on the patterns established among a smaller subset (i.e., sample) of that group.

This principle of prediction from a sample of respondents is particularly familiar to most of us during election campaign seasons, or in discussion of commercial product development. During election season, poll results that predict election outcomes are based on surveys of a sample of likely voters, numbering perhaps a few hundred or several thousand. Similarly, manufacturers test out their products—whether vacuum cleaners or toothpaste—on a small sample of consumers with the hope that they can predict the ultimate success of their product. In architecture, a designer might be interested in sampling users of a new workstation configuration before recommending that the same configuration be introduced on the other floors about to be renovated.

Within the vast literature on sampling, the most important distinction of concern to the researcher is that between a *probabilistic* and *nonprobabilistic* sample. The goal of probabilistic sampling is to achieve a sample that is truly representative of the larger population. In practical terms, this usually means some form of *random* sampling (that can be achieved through a variety of procedural mechanisms), whereby each item or member of the population has an equal chance of being observed or interviewed. As a consequence, it is then possible to use inferential statistics to determine how likely it is that the results are a function of chance. Typically, researchers consider the .05 level of significance (i.e., a 5% likelihood of a chance occurrence) to be the minimum standard for generalization to a larger population. (See section 8.3.1 for additional discussion of inferential statistics.) Readers who wish to make use of a probabilistic sampling procedure and to use inferential statistics to gauge their results should refer to some of the vast number of texts on this topic; several are listed among the notes at the end of this chapter.

In a nonprobabilistic, or *purposive* sample, the researcher is less concerned about generalizing to the larger population and more concerned about discovering useful patterns of information about particular groups or subsets of the population. For example, the architect of the office building renovation (described earler) might find it more valuable to interview only those workers who had previously registered complaints about the new workstation. In this case, the architect is making a choice to discover the particular sources of dissatisfaction in the workstation design rather than to simply seek an overall level of satisfaction that fulfills the owner's general requirements for employee satisfaction. (Again, there are a variety of procedural mechanisms for deriving such samples; interested readers should review some of the focused texts on the subject.)

With the previous discussion of sampling as a prelude, we can now turn to the variety of ways in which a researcher might collect data for a correlational study. The range of data collection tactics discussed in this section is intended to introduce the beginning researcher to a broad range of techniques. In addition, architectural practitioners will also find this discussion of great value for deriving critical information from clients, users, and other individuals involved in and affected by the design process.

8.4.1 Surveys

Among the variety of data collection tactics for correlational research, the survey questionnaire is perhaps the most frequently employed. Indeed, it is so ubiquitous and well established that the term *survey research* is sometimes regarded as essentially equivalent to the term *correlational research*. Our position, however, is that the survey questionnaire is just one (although perhaps the most popular) of many possible data collection devices available for the correlational research design.

The great advantage of survey questionnaires is that they enable the researcher to cover an extensive amount of information—from demographic characteristics, to behavioral habits, to opinions or attitudes on a variety of topics—across a large number of people in a limited amount of time. The consequent disadvantage, however, is that achieving this breadth of information usually comes at the cost of in-depth understanding of the issues surveyed. For instance, depth of understanding is more likely to be achieved through a qualitative research strategy. (See Chapter 7 for more on qualitative research.) Nevertheless, the long-standing popularity of the survey tactic stands as a testimony to its usefulness in many circumstances.

Joongsub Kim's study of New Urbanism (to which we referred earlier in the chapter) represents a good example of the use of the survey as a tool to gather

broad—rather than in-depth—information.[18] Kim selected the survey as a tactic precisely because he wanted to compare the residents' *overall* assessments of the "sense of community," as achieved in a New Urbanist development and a typical suburban development. Within this overall goal, Kim also wanted to find out the extent to which a variety of specific design features contributed to this sense of community. As a consequence of his extensive literature review (see Chapter 5 for more on literature reviews), Kim determined that the notion of sense of community could be understood as having four relatively distinct components: sense of attachment, social interaction, pedestrianism, and sense of identity. Thus the bulk of his questionnaire asked the residents to rate the extent to which a set of design features (1–17) affected each of the four components of community (see Figure 8.14).

Additionally, Kim posed a number of demographic questions to each of the neighborhood's residents. The set of demographic questions achieved at least two purposes. First, it helped Kim establish the extent to which the populations of the neighborhoods were essentially equivalent; and, in fact, the two communities are quite similar in almost all demographic measures. Second, Kim sought to assess the extent to which key subgroups (i.e., residents of different housing types) responded differently to the four measures of community. As it turns out, single-family home and town-home residents indicate a higher level of sense of community than apartment and condominium residents. (See Figure 8.15 for a list of key issues a researcher must address in developing a survey questionnaire.)

Orchard Village Study

1. How important are these features to your feeling of attachment to Orchard Village

FEATURES of Orchard Village	very important	moderately important	some-what	minimally important	not at al
Residential density	(5)	(4)	(3)	(2)	(1)
Wetlands, public greens, tot lots, footpaths	(5)	(4)	(3)	(2)	(1)
Distance between sidewalks and houses	(5)	(4)	(3)	(2)	(1)
Architectural style	(5)	(4)	(3)	(2)	(1)
Block size	(5)	(4)	(3)	(2)	(1)
Club House-Recreation Complex	(5)	(4)	(3)	(2)	(1)
Overall layout of Washingtonian Woods	(5)	(4)	(3)	(2)	(1)
Street trees and other street landscaping	(5)	(4)	(3)	(2)	(1)
Overall size of Washingtonian Woods	(5)	(4)	(3)	(2)	(1)
Arrangement of houses on the block	(5)	(4)	(3)	(2)	(1)
Street width	(5)	(4)	(3)	(2)	(1)
Garage location	(5)	(4)	(3)	(2)	(1)
Onstreet parking	(5)	(4)	(3)	(2)	(1)
Lot size	(5)	(4)	(3)	(2)	(1)
Mixture of housing types	(5)	(4)	(3)	(2)	(1)
Overall design quality of housing	(5)	(4)	(3)	(2)	(1)
Street layout	(5)	(4)	(3)	(2)	(1)

Figure 8.14 Questionnaire segment of sense of community. Courtesy of Joongsub Kim.

General Considerations	Examples of New Urbanist Research
1. **Goals** Determine main topics to be covered Clarify the purpose of each question	Kim's topics were: overall sense of community 4 components of community demographic characteristics
2. **Response Formats** Evaluate advantages of closed vs. open-ended format	Sense of community questions used 5-pt. closed scale Demographic questions used combination of closed and open formats
3. **Clarity in Phrasing the Questions** Use short sentences Avoid making 2 queries in a single question Avoid framing questions in the negative (not, never) Avoid using ambiguous wording Employ non-threatening language	Reviewed question design with others knowledgeable in research and the respondent sample Piloted questionnaire with respondents
4. **Question Order** Use logical sequence of topics Start with interesting, nonchallenging issues Don't place important items at end of long survey	Survey starts with sense of community questions Full page demographic questions last
5. **Format** Use appealing, but simple graphics Avoid prominent or flashy design	Simple, understated graphics Though long, did not appear dense
6. **Instructions** Explain reason, context for survey Provide description(s) of what respondents expected to do Explain where respondents turn in survey	Introductory explanation provided Surveys were hand-delivered Provision for return mailing
7. **Ethics** State provisions for keeping individual responses confidential	Statement of confidentiality provided Survey submitted to university human subjects review board

Figure 8.15 Considerations in the design of a survey questionnaire. First column adapted from D. Mertens, *Research Methods in Education and Psychology,* SAGE Publications, 1998, pp. 115-117. Reprinted by permission of SAGE Publications.

BOX 8.1
Survey Tactics for Practice

As described in Chapter 7 (see Box. 7.3), the architecture firm Perkins + Will conducted a three-year pre-/post-occupancy evaluation on their move from their existing office space to a 1986 derelict office building which they rehabbed. In Box 7.3, we discussed their extensive use of

various qualitative tactics within the P/POE. Here we focus on their use of a Web survey, a tactic that enabled the firm to solicit opinions from a large cross-section of perspectives around focused questions.[a] The particulars of the survey are described as follows in the P/POE report:

In both the pre- and post-occupancy evaluation, an electronic survey was delivered to each of the employees in the Atlanta office. The questions in each survey were parallel to allow for comparative analysis, and the format of the questions included scales, ranking, and space for free-form responses. The questions addressed a range of topics, including the following:

- Overall Workstation Comfort
- Meeting Rooms
- Supporting Clients
- Brand Communication
- General Experience
- Change Management

Among these several topics, there was general appreciation of the improvements in supporting clients and brand communication. One post-occupancy outcome that prompted organizational learning is the importance of structured change management even when the users are experts in the area. This insight has now been incorporated into the firm's larger workplace strategy because it's a common issue among most clients. An area of primary concern for many respondents had to do with particular features of the individual workstation environments. Features that achieved increased and decreased levels of satisfaction are presented in Figure 8.16.

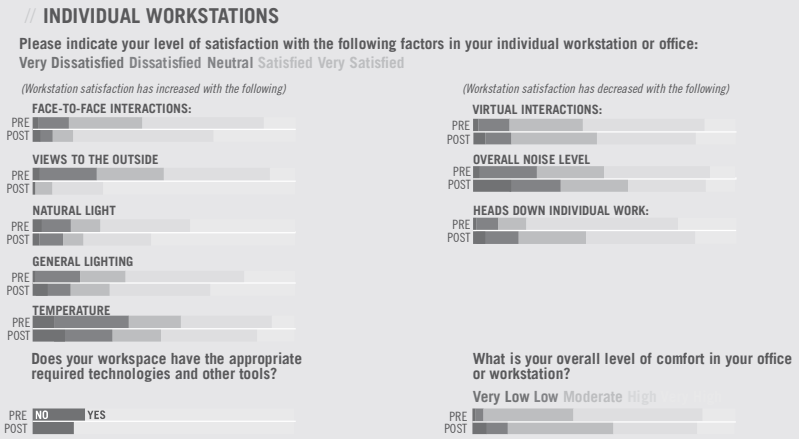

Figure 8.16 Web survey results of pre-/post-occupancy evaluation. Image courtesy of Perkins + Will, 2012.

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[a] J. Barnes and R. Burn, *Perkins + Will 1315 Peachtree Street Pre/Post-Occupancy* (Atlanta: Perkins + Will, 2012).

8.4.2 Observations

Various forms of observation represent another frequently used set of tactics for data collection. As the earlier discussion of William Whyte's study of urban plazas indicated, Whyte's primary tactic was time-lapse film.[19] At each plaza a camera was placed in a location that enabled filming of the pedestrian areas, usually from a second- or third-story window, or terrace perch. In an extensive appendix section to his book, Whyte describes, in much and useful detail, the equipment and procedures used in the plaza study. Perhaps the most insightful section deals with the question of figuring out what to look for. Indeed, the process of establishing the appropriate coding categories for activities recorded on film can be a painstaking task. However, the great advantage of observation tactics is that even a "simple" numbers count, such as represented in a day in the life of the ledge at Seagram's (see Figure 8.17), can provide a detailed and powerful view of the human ecology of a particular setting. Combined with other similar graphic and pictorial analyses, Whyte's research led directly to numerous design modifications and the revision of New York City's zoning regulations.

Whyte's study represents a common application of observational tactics in architectural and design research in two respects: (1) the observed behavior is in a relatively accessible public environment; and (2) the size of each plaza is largely visible from a

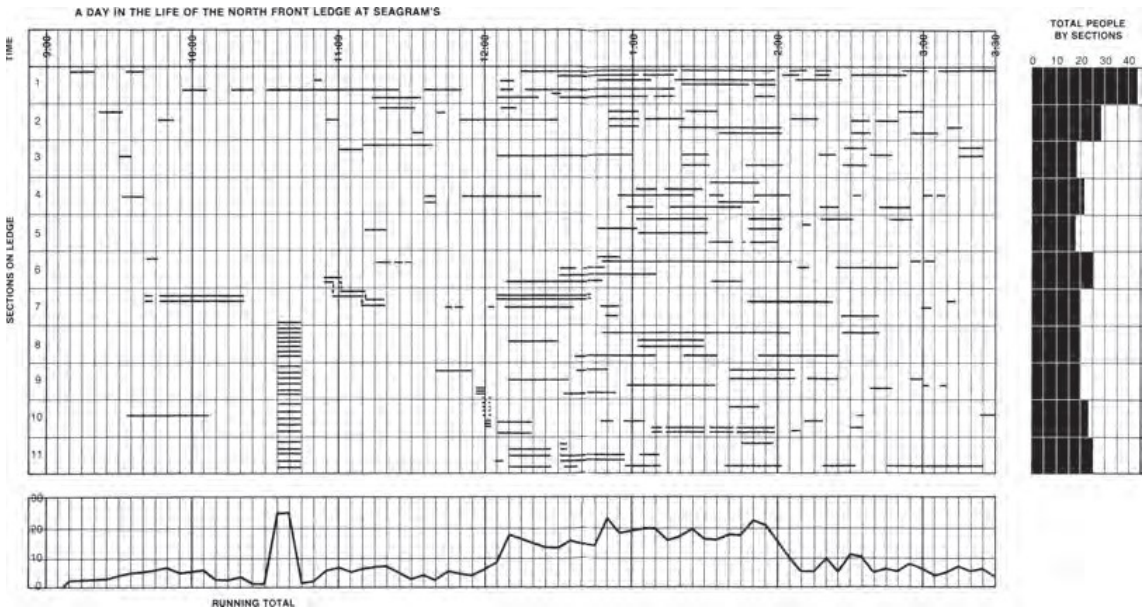

Figure 8.17 A day in the life of the north front edge at Seagram's. Courtesy of Project for Public Spaces, New York, New York.

BOX 8.2

Tactics for Correlational Research: Using Observations in Practice

In the realm of architectural practice, Harrigan and Neel in their book *The Executive Architect* clearly make the case for incorporating systematic observation techniques:

> [M]any design decisions . . . will be influenced by observation results, which makes it essential to devise a thorough observation program. The observer cannot simply follow his or her eye, for any observer may be overwhelmed by the complexity of the situation to such a degree that the approach becomes random and loses its representativeness. . . . A program of systematic observation is undertaken because it is possible to establish justified design objectives for a new facility by observing existing facilities and the activities of users. The time spent is . . . justified when one is confronted with a situation that is new, or one that is complex or highly variable.[a]

The authors go on to describe the range of variables that might be observed (including demographic characteristics, specific activities, and user reactions) and how they might be structured. In this regard, they address some of the issues of sampling and coding already discussed in this chapter. Figure 8.18 summarizes Harrigan and Neel's assessment steps for the preparation of systematic observation in architectural practice.

While preparing for a program of systematic observation, the critical questions to be asked are:

- ☐ Have we chosen a study site that will help achieve our informational objectives?
- ☐ Will the site be available to us?
- ☐ Under what restrictions will we be operating?
- ☐ Will we have to be on the site continually, or can we set up a sampling scheme?
- ☐ If so, should we observe activities every day, hourly, or at another time interval?
- ☐ Will the selected time periods be representative of the activities that occur at other times?
- ☐ To what degree will our presence affect the situation?
- ☐ Will there be uncertainty about what to observe?
- ☐ Will the observers be consistent in what they pay attention to and what they document?
- ☐ If it is anticipated that there will be a problem with consistency of observations, how much training should we give observers?
- ☐ Do our observational goals match up with the situation, or should more effort go into their development?

Figure 8.18 Assessment steps for systematic observation.
Courtesy of John Wiley & Sons.

[a] John Harrigan and Paul Neel, *The Executive Architect: Transforming Designers into Leaders* (New York: John Wiley & Sons, 1996), 311–312.

strategic vantage point. In comparison, Frederickson's study of design juries is notable because the observations entail: (1) categorization not only of actions but also of discourse; and (2) access to the juries requires the agreement of the participants involved.[20]

His goal was to study jury and student interactions, with a special focus on the possibility of gender and/or minority bias. To study these interactions, he videotaped a total of 112 juries at 3 architecture schools around the country (see Figure 8.19). Like Whyte, Frederickson should specify explicitly what activities and interactions of the jury process should be specified, coded, and measured. The variables identified by Frederickson included both time/frequency measures

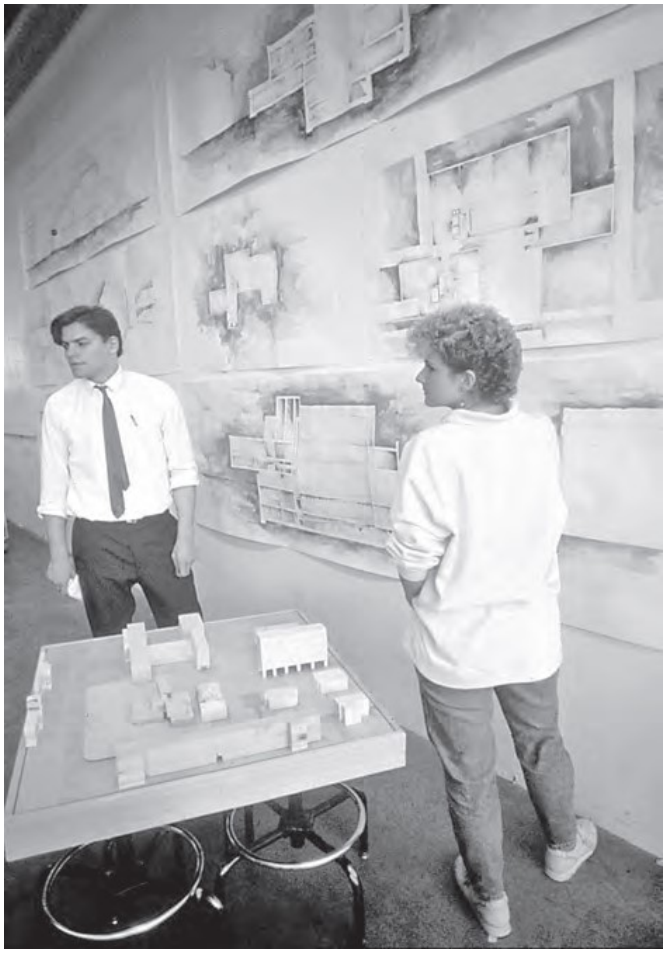

Figure 8.19 Gender and ethnic dynamics in juries were the subject of Fredrickson's research. Courtesy of Taubman College of Architecture and Urban Design. Photo by Christopher Campbell.

(such as length of each student's presentation, length of jury comments, etc.) and content/process categories (such as collaborative idea building, use of rhetorical questions, and interruptions).

One of Frederickson's key findings is that women students are more likely than male students to be put at a disadvantage during their juries. As Figure 8.20 indicates, women students are more likely to be interrupted during their initial presentations to juries, and they are also more likely to receives shorter jury sessions overall. These differences are statistically significant at the .05 level, meaning that there are only 5 chances out of 100 (or 1 out of 20) that these results are due to chance. In other words, shorter jury time is strongly correlated, overall, with female gender.

Another way that Frederickson analyzed the data can provide important, potentially useful feedback to the schools he studied. Figure 8.21 shows Frederickson's analysis of the content of jury comments at each of the three schools studied. In this regard, the contrast between schools #1 and #3 is particularly strong. At school #3, there is a much stronger student-centered focus, evidenced by the greater emphasis

Verbal Participation and Interruptions of Female and Male Students

	Interruptions to Student Introduction (Isp)	*Total Duration of Each Jury (Tottime)*
All Students	**0.61**	**19.60**
(N = 112)	(p < .05)	
Female	**0.76**	**17.50**
(N =34)	(p < .05)	(p < .05)
Male	**0.54**	**20.61**
(N =78)	(p < .05)	(p < .05)

Figure 8.20 Verbal participation and interruptions of female and male students. © ACSA Press. Washington, D.C., 1993.

Content Varibales

	Mean	*School 1*	*School 2*	*School 3*
Collaborative Idea Building per Min. (Ib)	.14	.08	.10	.25
Nonrhetorical Questions per Min. (Real)	19	.10	.14	.32
Rhetorical Questions per Min. (Rhet)	.05	.08	.02	.03

Figure 8.21 Content variables analyzed by school. © ACSA Press. Washington, D.C., 1993.

on collaborative idea building and associated questions; at school #1 there is a much higher incidence of rhetorical questions, suggesting that the jurors are relatively more inclined to ask questions to make a point rather than to initiate dialogue.

These and similar analyses form the basis for a variety of recommendations to architectural educators, including an overall suggestion that design educators and administrators participate in faculty seminars that focus on the development of leadership, interpersonal communications, educational goals, and research skills.

Finally, compared to the previous two examples, Diaan van der Westhuizen's study of pedestrian behavior in three Detroit neighborhoods represents a much larger scale of observations.[21] The larger purpose of the study was to investigate the extent to which either destinations and/or spatial properties of the neighborhood street systems are more predictive of pedestrian movement than commonly used urban planning measures. To answer this question, it was absolutely essential to systematically track pedestrian activity at the neighborhood scale, which is clearly not possible from a single or limited number of vantage points. The following passage recounts the logistical arrangement entailed in doing such large-scale observations:

> Arrangements were made with the . . . research team . . . and the police were alerted that data would be collected within their precincts. Three measurement days were taken for each of the three neighborhoods—two weekdays and one weekend per area. Each day consisted of 3 time segments (9:00–12:00; 12:30–3:30; 4:00–7:00). . . . The same 50 miles of each neighborhood street space was observed during each time segment; overall, a total of 1,350 miles of street space was covered across the area.[22]

Needless to say, these arrangements also required that a research colleague serve as driver for van der Westhuizen to accomplish this rigorous regimen of observations. Figure 8.22 is an exemplar summary map of the observations for one neighborhood.

8.4.3 Mapping

Probably the most well-known example of using a mapping technique is Kevin Lynch's study, *The Image of the City.*[23] In an effort to assess the way the physical characteristics of cities were experienced and understood by ordinary people, Lynch conducted interviews with study respondents of three U.S. cities—Boston, Jersey City, and Los Angeles—and asked them to draw sketch maps of their city. Figure 8.23 represents the composite maps derived from the interviews with Boston residents, while Figure 8.24 represents the composite map derived from the

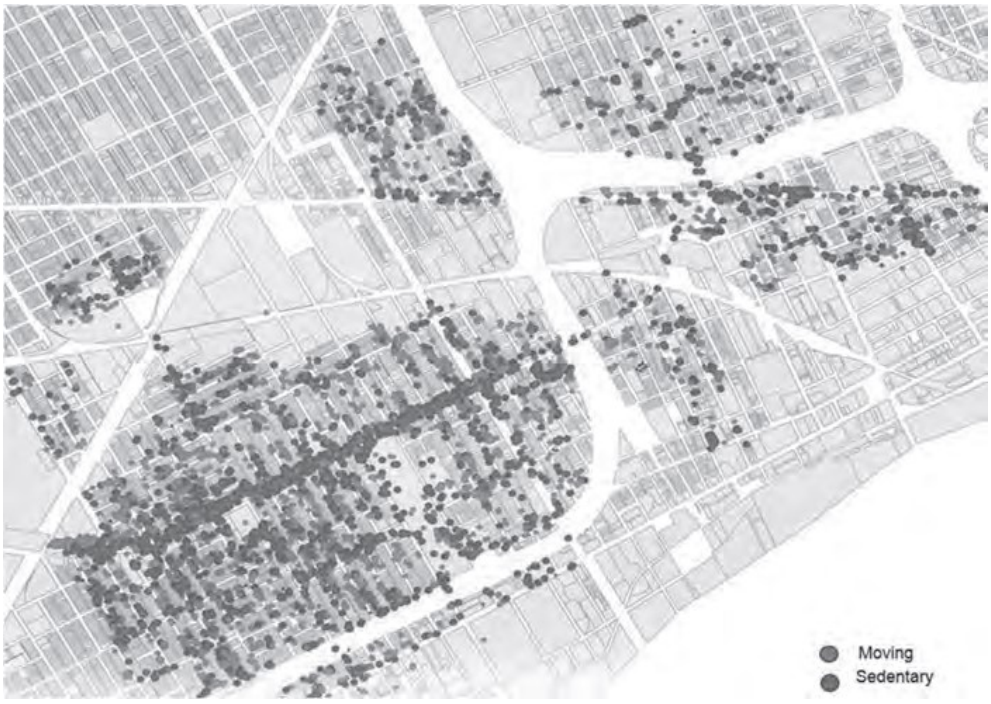

Figure 8.22 People counts for moving and sedentary behavior in the neighborhood in southwest Detroit. Courtesy of Diaan van der Westhuizen.

residents' sketch maps. Lynch concludes that overall there is a very high correlation between the two sets of maps for all three cities.

Based on these sets of mappings from the three cities, Lynch was able to derive his now famous five general categories of urban features: path, edge, node, landmark, and district. In other words, all five types of features were delineated in each of the three cities. However, the density of these imageable features varied from city to city. Figure 8.25 shows the relative impoverishment of the composite Jersey City sketch map, compared to that of Boston.

Over the years since Lynch's study, researchers have effectively adapted mapping to a variety of research purposes and contexts. Anne Lusk's study of greenway bicycle paths demonstrates particularly innovative adaption of mapping.[24] A longtime volunteer and activist in the greenway movement, Lusk's goal was to discover the frequency of and distance between "destination" places along the greenway path. Recognizing that there might be important differences between different types of bikeways, she selected for study a total of six greenways that were nationally recognized for their aesthetic qualities.

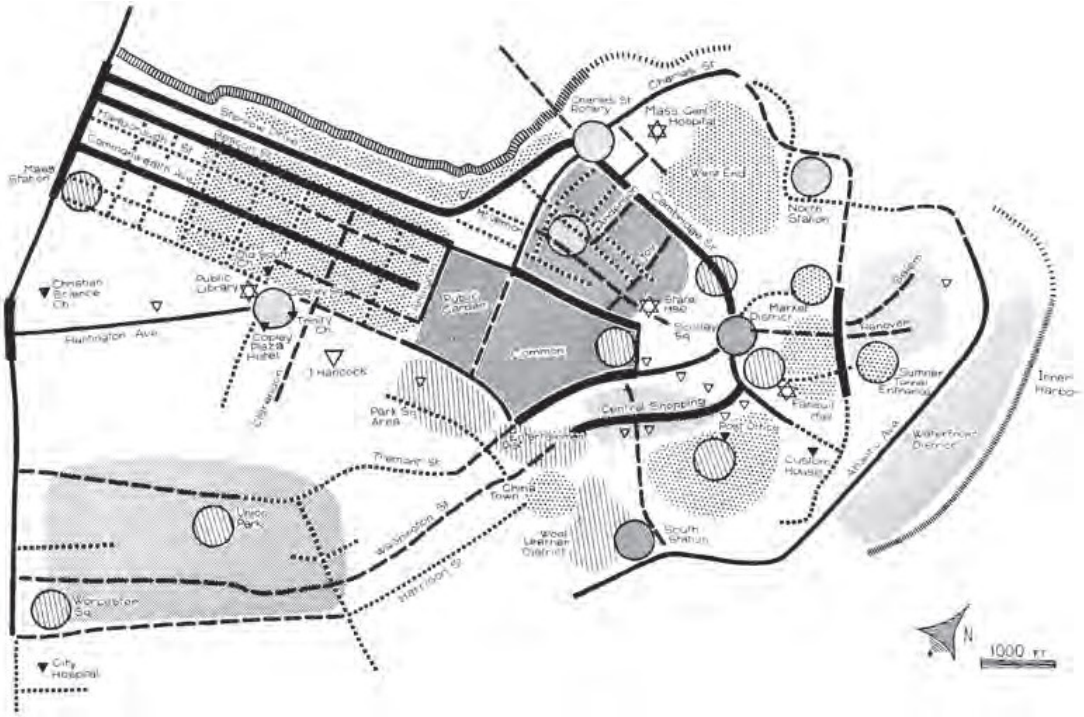

Figure 8.23 The Boston image as derived from verbal interviews. Courtesy of MIT Press.

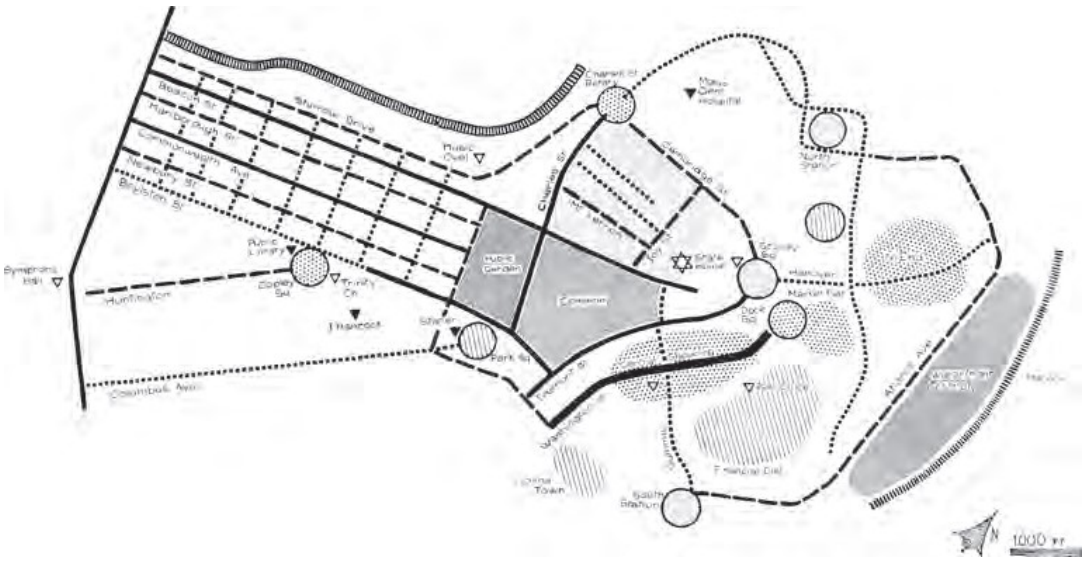

Figure 8.24 The Boston image as derived from sketch maps. Courtesy of MIT Press.

Figure 8.25 The Jersey City image as derived from sketch maps. Courtesy of MIT Press.

At each site, Lusk asked greenway users to apply stickers representing different qualities of physical features to greenway maps she provided to them. Figure 8.26 provides the mapping instructions, and Figure 8.27 represents a composite map for one of the greenways. Lusk was then able to measure distances between collectively established destination points using an odometer. Distances for each greenway were established and then general patterns for each greenway type were identified. Figure 8.28 represents a typical destination along the Stowe VT greenway; it is a place where multiple features converge, including cows (animals or people) to watch, a shady glen as a place to rest, a picturesque view of the mountains, and a lay-by large enough for people to interact with each other. Lusk was also able to determine that major destination points along the greenway occur about every two miles. These findings are comparable (i.e., correlated) to those of destination points on the other greenways studied.

More recently, Kush Patel adapted the sticker mapping technique developed by Lusk for his study of two iconic European projects: Bernard Tschumi's Parc de La Villette in Paris, and Lucien Kroll's medical student residence for L'Université Catholique de Louvain in Woluwé-Saint-Lambert, on the outskirts of Brussels.[25] As described in Chapter 4, Patel's purpose was to investigate the material implications of Henri Lefebvre's seminal work, *The Production of Space* (1974), and examine connections between Lefebvre's critical formulations of space and the built works

Bicycle Path/Greenway Survey

This voluntary survey is being conducted through the University of Michigan for a Ph.D. dissertation on the determination of attractive destinations and their features on a multi-use path. We would like you to help us identify the locations of these destinations and to also list the elements that make that destination preferred. Please use the attached stickers on the survey. Out of a trial of 6 survey techniques, use of the stickers emerged as the most effective technique.

First, use the following code for the stickers, placing them as appropriate, on the map. You do not have to use all of the categories of stickers and you can use as many or as few stickers as you like.

Second, beside the spangley star sticker for the destination or destinations, please describe the area or features so that the destinations can be located. Also, please assign a number in order of preference to the destinations with #1 being the most preferred destination. You can have as many or as few destinations as you like.

Third, on the additional sheet of paper, please list the destinations located by you on the map according to the rank order with #1 being listed first. Below each destination, please list the preferred features at this destination and identify with a check, the top three or four features at each destination.

1. Put a plain star by one or more areas that serve as the place or places you start on the path.

2. Put a spangley star by one or more areas that serve as destinations or places, which even though you may pass by, you feel you have "arrived."

3. Put a smiley face circle by the places which you particularly enjoy and/or look forward to.

4. Put squares by places that serve primarily as way-finders (visible cues about your location) that might be attractive or unattractive.

5. Put a line of small dots by stretches that you find appealing.

6. Put a long bar or many bars at the places or stretches where you are bored.

7. Put bugs/ants by individual places or things that you find unappealing.

8. Put an arrow/pointer indicating the direction where you enjoy a view.

Figure 8.26 Mapping instructions for Lusk's greenway study. Courtesy of Anne Lusk.

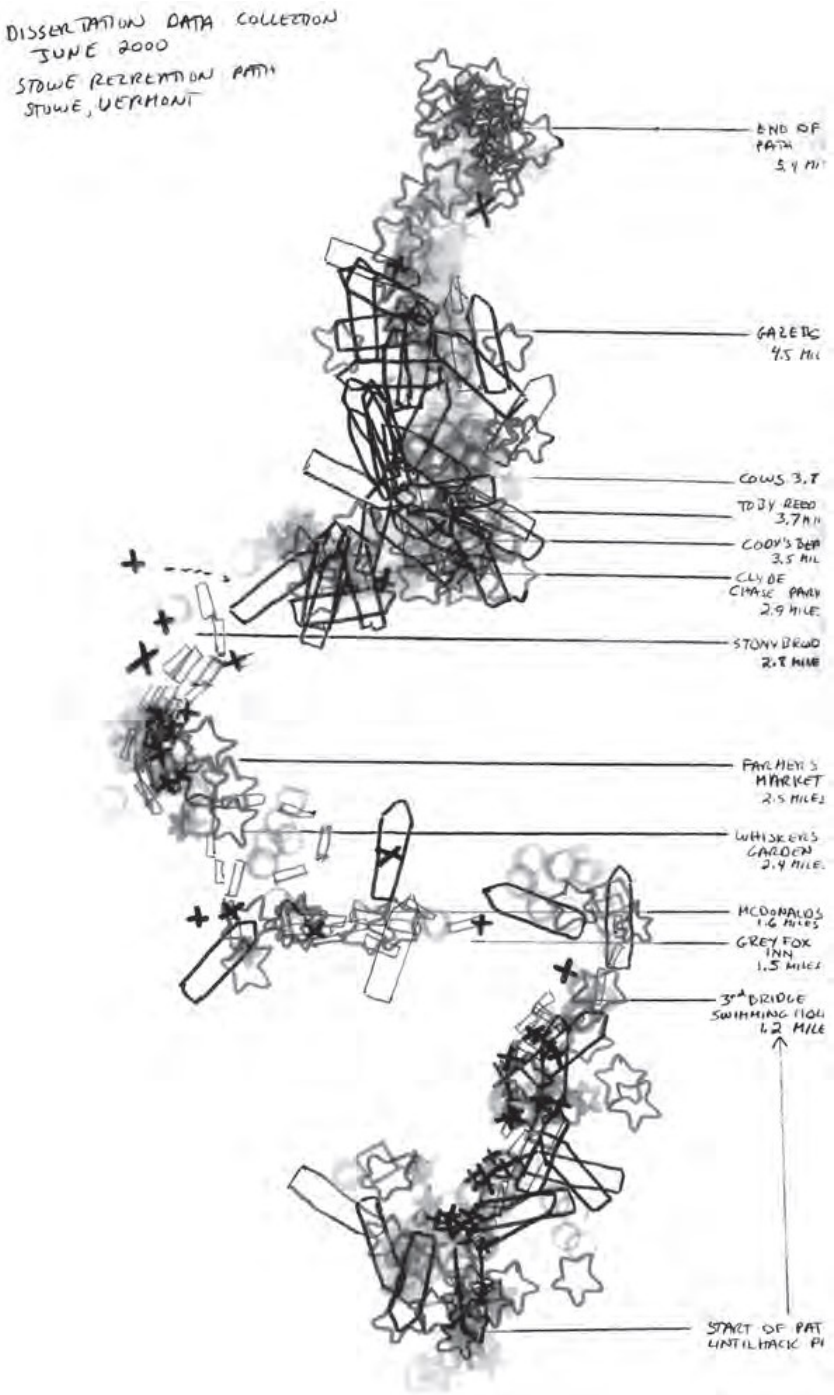

Figure 8.27 Composite map of Stowe, Vermont, greenway. Courtesy of Anne Lusk.

Figure 8.28 Typical greenway destination. Courtesy of Anne Lusk; photo by Jeff Turnaw.

of Kroll and Tschumi. Lefebvre's theoretical project offered a rethinking of the relationship between space and society, arguing for the presence of lived experience in spatial discourse. Within this theoretical framework, mapping spatial practices and symbolic associations specific to the two projects represents an essential tactic for the study.

8.4.4 Sorting

Another tactic that can be highly effective in both research and practice situations is the sorting task. This typically involves asking a respondent to sort a set of cards (usually between 20 and 30) with either words or pictures represented on them (see Figure 8.29).[26] In a directed sort, the researcher specifies a set of categories into which the cards must be sorted, such as a 5- or 7-point rating scale from highly preferred to least preferred. In an open sort, the respondent can establish whatever categories make sense to him or her; so, for example, the respondent might choose to sort a set of buildings into functional types, including houses, commercial buildings, churches, and so on. Or the respondent might choose to sort a set of houses by categories of traditional versus modern styles.

In a seminar/workshop class for architectural students, Groat has used the sorting task to clarify the design dialogue between the architect-student and a

Figure 8.29 A respondent beginning the sorting task.

friend who serves as the client. The student is asked first to do several sortings of the 20 photos of houses both to familiarize herself or himself with the sorting process and to elicit his/her own categorizations of the houses. Next, the student conducts an interview with the "client" who does his/her sortings of the houses. There is also a column at one edge of the sortings record sheet (see Figures 8.30 and 8.31) for both student and "client" to indicate a rank order of preference. Finally, the student is urged to discuss the similarities and differences in the sorting categories and the ranked preferences with the "client." So, for example, if both architect and client sort according to building materials, but the client prefers wood shingles while the architect prefers expansive glass with steel, there is a clear difference of approach to work out. Or perhaps, if both architect and client sort the houses on the degree of exposure to landscape and sunlight, it may be that this agreement can serve as a device for resolving the conflict over materials.

In a research context, both the preference rankings (an example of ordinal measurement as described in section 8.2) and the nominal sorting category designations can be subjected to statistical measures such that correlations between

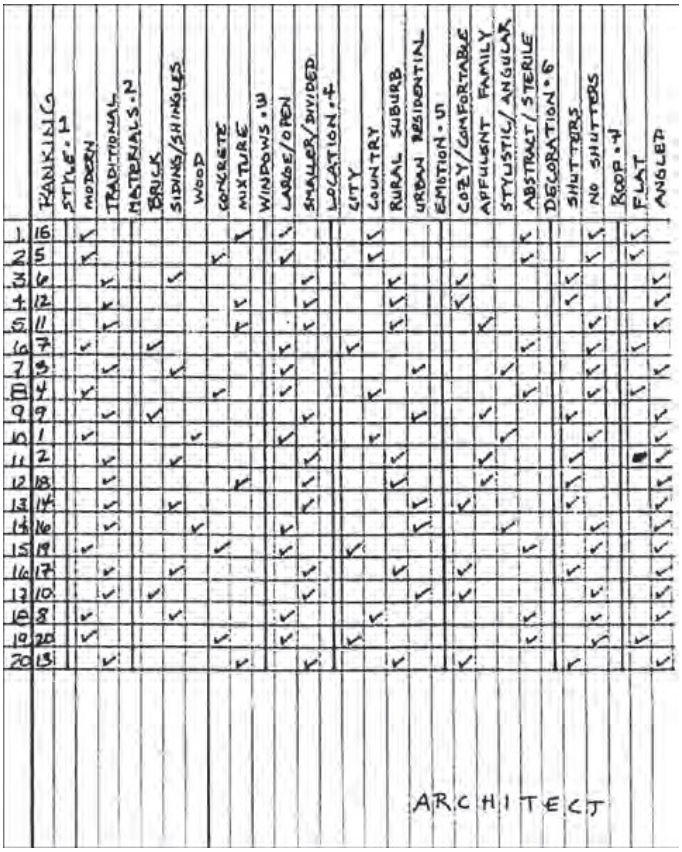

Figure 8.30 Student "architects" sorting. Courtesy of Sara Stucky.

rankings and sortings can be investigated. However, the use of the sorting task in a practice setting—between client and architect, or among a small number of client/users—can often serve as an effective and creative foundation for dialogue at the outset of a project.

In the essays that students have written about this experience, it is clear that a visual exercise such as the sorting task can be a very effective alternative to simply asking clients to state their preferences in a conversation or verbally oriented interview. Indeed, it is through the process of actually sorting out alternative design elements, and articulating the categories that come to mind, that many non-architects can begin to articulate important ways of experiencing architecture—experiences that they might not otherwise be aware of or know how to express.

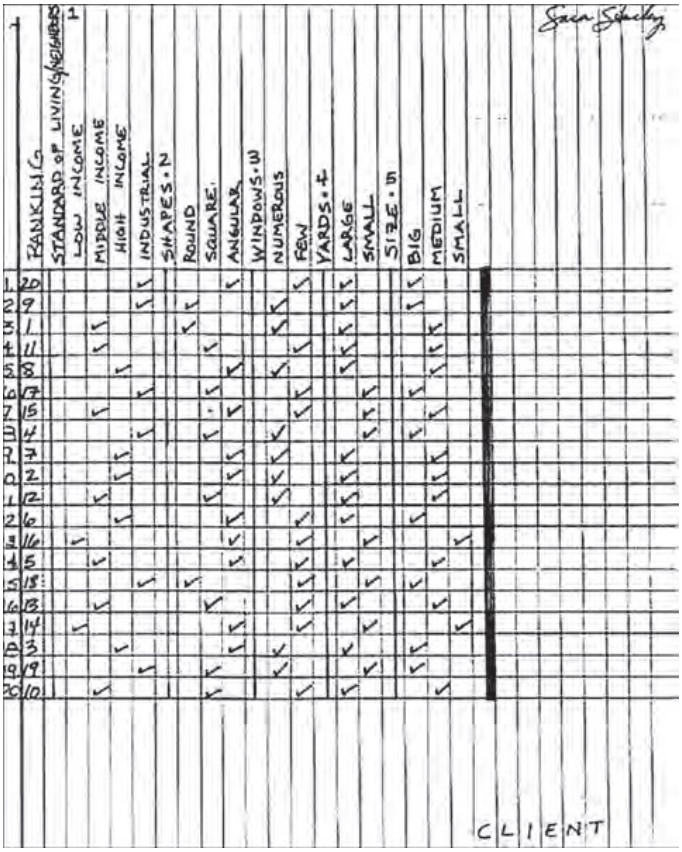

Figure 8.31 "Client" sorting. Courtesy of Sara Stucky.

BOX 8.3

Tactics for Correlational Research: The Sorting Task

Frances Downing has used the sorting task to great effect in uncovering architectural designers' use of image banks in their design process.[a] Downing was interested in finding out the extent to which beginning architectural students, graduating architectural students, and practicing architects differed in the way they thought about and used design imagery in their work. Her procedure involved asking her respondents a series

[a] Frances Downing, "Image Banks: Dialogs between the Past and the Future," *Environment and Behavior* 24(4) (July 1992): 441–470.

(*Continued*)

of evocative questions (e.g., As a child, what places did you live in that remain particularly memorable?) to elicit meaningful place images (see Figure 8.32). As respondents named these images, the name of each image was recorded on a small card for use in the sorting task. Once all the images evoked by the questions had been recorded, the respondents carried out as many *free* sorts as possible.

Figure 8.32 A memorable image that might be experienced in youth.

Figure 8.33 A memorable image that might be experienced during professional education.

Downing actually conducted her study at two different architecture schools, and included practicing professionals from the schools' respective regions. In this regard, Downing found some intriguing differences of emphases among the two groups of students and the professionals. Using a combination of inferential statistics for nominal data (see sections 8.3 and 8.4) and multivariate statistics (see section 8.5), Downing was able to discover that, in general, the more experienced architects (especially the practicing professionals) were more inclined to integrate or combine vernacular images from prearchitectural experiences with the more high-style images from their professional education and experience (see Figure 8.33). Entering students, by contrast, were less able to integrate the two types of images. Downing concludes that this is potentially problematic because architecture programs may be failing to help students make sense of their own experience of place in relation to the challenge of creating place in their professional roles.

Reflecting on the use of the sorting task tactic itself, Frances Downing found that her respondents—even the very busy professionals—quickly became captivated by the sorting process. (See Box 8.3 for an account of this award-winning study.) As Downing recounts:

> The memories that participants related were generally characterized by profound personal involvement. Soon it was evident that the information collected was central to the life of a designer: the reason why so many had made their career choices seemed bound up in the small white card with names of a history of places written on them.[27]

Taken together, Downing's experience with both students and practitioners, as well as Groat's experience with both designers and nondesigners, suggests that an interactive data collection device such as the sorting task can be a very effective tactic for both research and practice.

8.4.5 Archives

Yet another, though certainly less frequently used, tool for data collection is provided by archives. Newman's study of defensible space, in fact, put an existing database to extremely effective use. In this regard, Newman is quite explicit about how the precision and wealth of data kept by the New York Housing Authority contributed to the quality and successful outcome of his study. To be specific, Newman explains that the wealth of demographic variables measured by the Housing Authority included data on age, income, years of residence, previous backgrounds, and history of family pathology. Similarly, the Housing Authority's own police force maintained extensive records that included not only the nature of the crime and complaint, but also the precise location of the crime in the particular housing project.

These data on both demographic characteristics and the presence/location of criminal behavior could then be correlated with data on the physical properties of the various housing projects. Indeed, the physical quality of the housing projects was measured in terms of a great range of variables, including numbers of residents, size of housing site, population density, number of housing stories, plan type, and the like. As Newman explains: "With this data it has been possible to determine exactly where the most dangerous areas of buildings are, as well as to compare crime rates in different building types and project layouts."[28]

One particularly influential and notable correlation discovered by Newman is that of the relationship between crime rate and building height. As Newman concludes: "Crime rate has been found to increase almost proportionately with

building height" for the projects administered by the New York Housing Authority.[29]

8.5 TACTICS: READING ABOUT AND UNDERSTANDING MULTIVARIATE ANALYSES

Up to this point in the chapter, our discussions have touched on some of the most typical descriptive and inferential statistical analyses entailed in doing correlational research. In this section, we will briefly describe a few examples of some of the more complex data analyses that can be deployed. We do *not* assume that either students or professionals at the beginning stages of learning about or doing research will employ these complex analytical techniques; rather, we do anticipate that both students and practitioners who choose *to read about* research findings during the conduct of a literature review may well find it useful to understand the intent of such procedures. To this end, we will describe in the chapter segments that follow four types of multivariate procedures: typological analyses, multiple regression, factor analysis, and multidimensional scaling. More experienced researchers who wish to actually employ such statistical tactics may want to refer to some of the detailed texts listed in the notes at the end of the chapter.

8.5.1 Typological Analyses

By the term *typological* we mean to include studies that incorporate analyses of multiple complex variables in order to illuminate broad categories of spatial relationships and formal attributes from the scale of building interiors to neighborhoods, and the like. In this case, rather than focusing on the analysis on each individual variable, the aim is to identify the presence and convergence of variables that, when taken together, define broad categories or types.

Fernando Lara and Youngchul Kim's study of modernist apartment buildings in Brazil and Korea is an example of this typological focus.[30] Broadly speaking, the authors' goal is to tease out the globalizing modernist influence on multifamily residential buildings in relation to the localizing influence of housing traditions in each country. Theoretically, this research purpose is informed by Kenneth Frampton's classic essay in which he proposes the concept of "critical regionalism," in response to hegemonic internationalization.[31] To address their research question, Lara and Kim reviewed a representative sample of 20 Brazilian and 20 Korean apartments, selected from a larger sample of about 100 apartments (see Figures 8.34 and 8.35). From a broadly qualitative perspective, the authors discovered that after reviewing 20 to 25

plans, the array of spatial variations had reached a saturation point, such that adding in more plans for analysis would provide no new information.

Having selected these sets of apartment plans, the authors undertook what is termed a "mean depth" analysis within the Space Syntax suite of computer programs. This measure calculates how many layers of space (or rooms) must be entered to move through the overall plan. Remarkably, as the authors note, the space syntax calculations provided numerical verification for what was already obvious from visual inspection: the Brazilian and Korean apartment plans represented two distinct spatial typologies. In general, the Korean apartment plans were characterized by greater spatial depth than the Brazilian plans.

One of the most important differences between the two apartments is revealed in the spatial arrangement of private versus social space:

> While Brazilian apartments show a striking differentiation between private areas and social/service areas . . . , the Korean apartments present a large social area as a middle ground with private areas split between two regular bedrooms on one side and one master bedroom on the opposite side.[32]

In light of the evident continuity of each culture's long-standing spatial traditions in housing, the authors conclude that global impact of modernist architecture is not so thoroughly "homogenizing" as it might first appear. Indeed, they find it remarkable "how flexible the modernist structural grammar has proven to be."[33]

A research study on the walkability of three Detroit neighborhoods represents the application of typological analyses at the neighborhood scale.[34] The research, funded by the National Institute of Environmental Health Sciences, sought to understand the design components that contribute to healthy neighborhoods, and more specifically to identify specific characteristics of the physical environment that contribute to localized physical activity. Although other more recent studies have identified several notable contributing physical features, the Wineman et al. study is important because it addresses walkability in less affluent neighborhoods that may lack the amenities that typically support walking, especially so in a classic exemplar of the "shrinking city" phenomenon.

As part of this larger study, the authors investigated the specific role of density and land use mix, both of which have been identified in previous studies as predictive of walking activity. However, rather than consider these two variables separately, the authors developed a typology of neighborhood types based on the *combination* of density and land use (see Figure 8.36). Their intent was "to identify a reasonable number (<10) of neighborhood types that shared readily observable differences that might be easily adopted by planners and designers."[35]

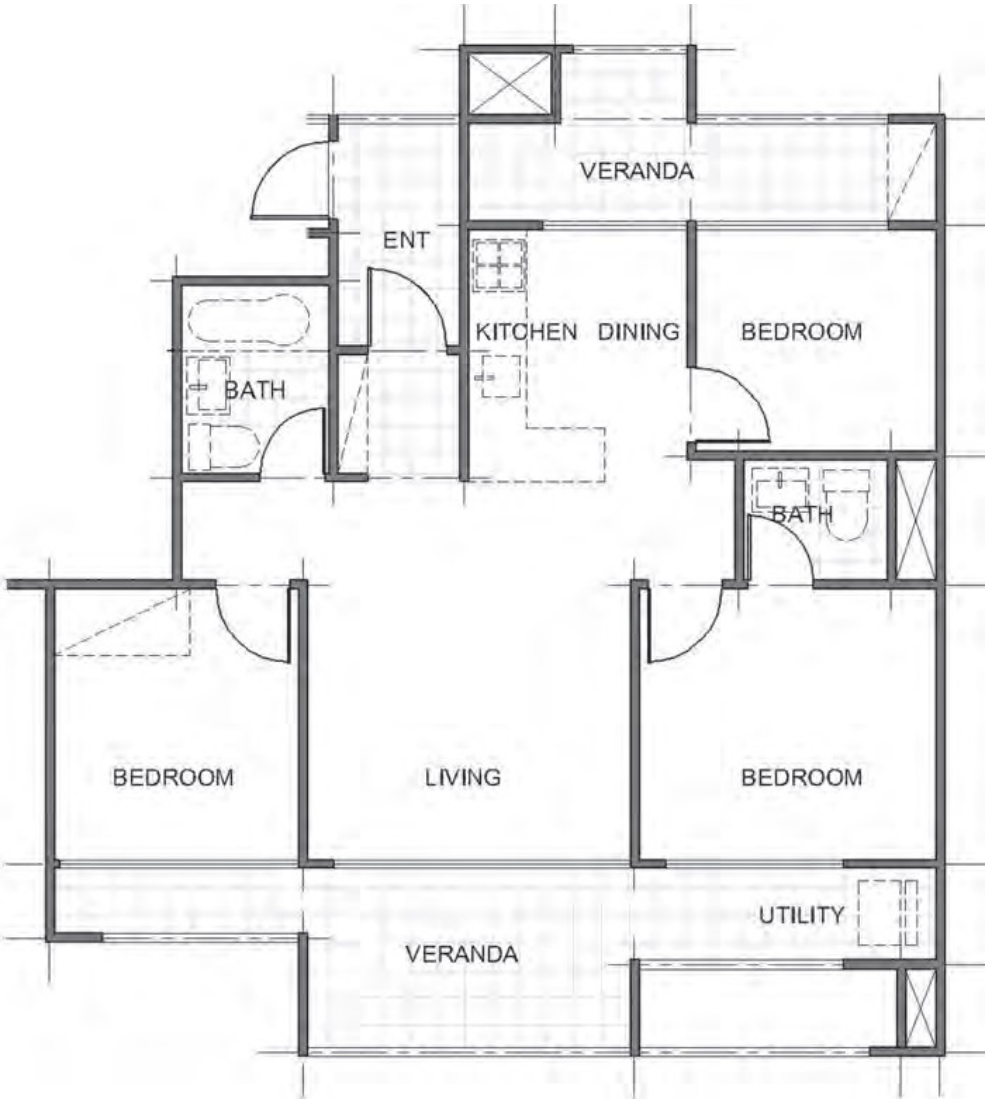

Figure 8.34 An example of Korean architecture with a social area as middle ground. Copyright Locke Science Publishing Co., Inc. Reproduced with permission. Lara F, Kim Y (2010) Built global, lived local: A study of how two diametrically opposed cultures reacted to similar modern housing solutions. *Journal of Architectural and Planning Research* 27(2): 91–106.

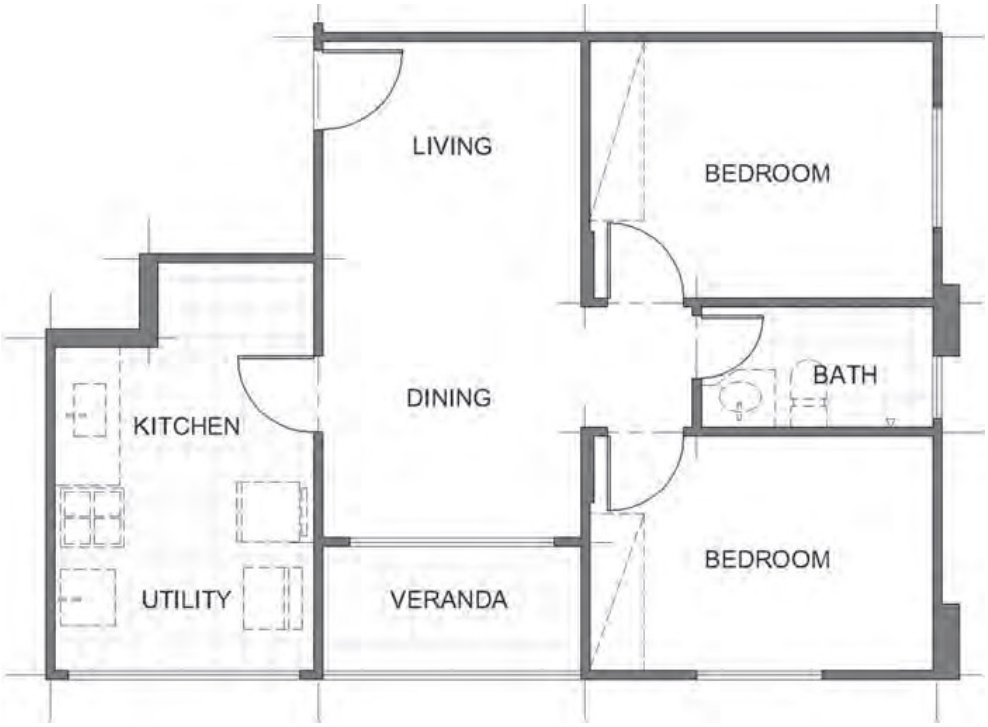

Figure 8.35 An example of Brazilian architecture with a clear distinction between social and private areas. Copyright Locke Science Publishing Co., Inc. Reproduced with permission. Lara F, Kim Y (2010) Built global, lived local: A study of how two diametrically opposed cultures reacted to similar modern housing solutions. *Journal of Architectural and Planning Research* 27(2): 91–106.

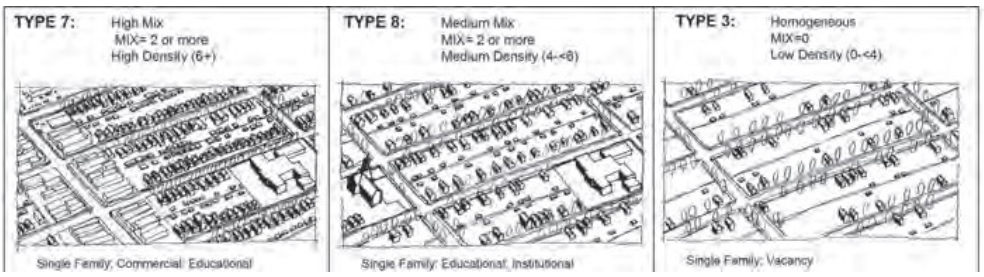

Figure 8.36 Examples of low-mix, medium-mix, and high-mix neighborhood types. Courtesy of Diaan van der Westhuizen.

The results of previous research had suggested that density and land use mix—when taken separately—were actually associated with lower levels of physical activity. However, the analyses from the Detroit study using the neighborhood typologies (based on categorical measures of density and land use) demonstrated an association with *more* physical activity. In this case, neighborhoods characterized by *both* higher density and higher land use mix report higher levels of localized physical activity. These results suggest that such typological analyses offer the potential for providing illuminating insights on the constellation of neighborhood design features that contribute to walkability.

8.5.2 Multiple Regression

In correlational research that seeks primarily to understand and predict relationships among several variables, multiple regression is frequently employed as an analytical tool. It is one of several devices that can be used to describe the strength and direction of relationships among two or more variables. More specifically, it is appropriate for interval or ratio data where the researcher has hypothesized several independent variables that can predict the value, or measured outcome, of another variable. In such cases multiple regression can provide a mathematical equation that indicates the amount of variance contributed by each of these independent (or predictor) variables.

An example of how multiple regression might work in environmental research is provided by Ewing and Handy's investigation of urban design qualities that promote walkability in urban communities.[36] One challenge in this area of urban design research is that many qualitatively understood qualities of urban design are very difficult to measure and operationalize in actual practice. Thus, the goal of this research was to test the extent to which over a hundred specific physical features could be predictive of the experience of five broadly defined urban qualities: imageability, enclosure, human scale, transparency, and complexity.

To measure the presence of specific physical features, the two researchers first analyzed the content of all 48 video clips of urban scenes used in the study. To assure the accuracy of the physical features ratings, commonly accepted procedures for assessing interrater reliability were employed. Next, a team of 10 panelists, experts in urban design and environmental research, rated each urban scene on each of the five broad urban design qualities. The conceptual framework for the study is represented in Figure 8.37. The physical features are conceptualized as independent variables that are hypothesized as being predictive of the expert panel's ratings (the dependent variables).

The purpose of the subsequent regression analyses is to identify the independent variables (the physical features) that are most predictive of the urban design

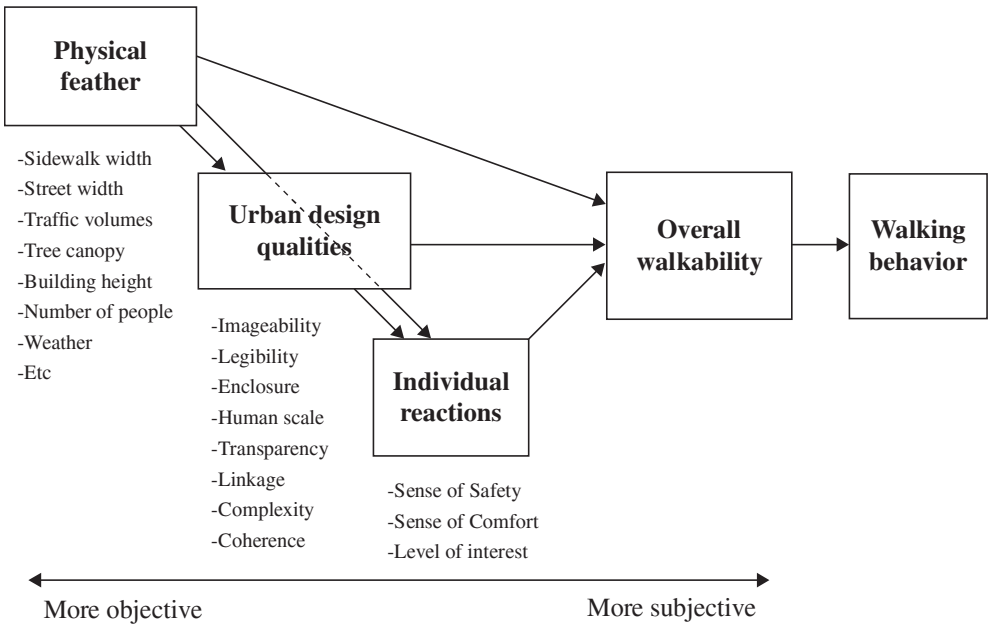

Figure 8.37 Conceptual framework for urban design qualities related to walkability. Courtesy of Reid Ewing.

qualities. For example, the quality of imageability is best predicted by the presence of people, proportion of historic buildings, courtyards/plazas/parks, outdoor dining, and major landscape features, among other physical properties. Regression also provides the researcher with measures of the overall predictive strength of the identified physical features variables, and the predictive strength of each variable individually. Many researchers find the use of regression useful because the apparent predictive precision is often interpreted as lending support to hypothesized causal links.

8.5.3 Factor Analysis

Like multiple regression, factor analysis also depends on interval or ratio data. But instead of multiple regression's focus on the relative salience of key variables for predicting the outcomes of other variables, factor analysis aims to articulate an overall structure or pattern among the variables. More particularly, factor analysis enables the researcher to identify thematic clusters of variables known as *factors.* Each factor is comprised of several variables that share similar patterns of responses or observations.

A good example of the use of factor analysis to uncover the underlying structure among a set of environmental design variables is provided by Kim's research on New Urbanist and conventional suburban developments.[37] As described in earlier segments of this chapter, Kim used a survey questionnaire to clarify the impact of a variety of physical features on residents' perceived sense of community in the two neighborhood developments.

What Kim discovered is that, even though the New Urbanist residents rated their perceived sense of community more highly than the residents of the conventional suburb, the underlying factors influencing the two groups' assessments were remarkably similar. For example, in the residents' evaluation of the community identity component of sense of community, the same three factors were identified for both neighborhood developments: community plan, community appearance, and amenities. In Figure 8.38, the relevant physical variables associated with each factor are indicated. However, the relative salience of the three factors and the specific variables associated with them are somewhat different. Whereas the community appearance factor was most salient for the Kentlands residents (see mean score in bold), the amenities factor was more salient to the Orchard Village residents' sense of community.

Q7: Distinctive Character		Factor group themes					
		Kentlands			Orchard Village		
Q7	Physical features	Com. Plan	Com App.	Ame.	Com. Plan	Com. App.	Ame.
11	Street width	.77			.70		
14	Lot size	.76			.62		
5	Block size	.75			.62		
3	Distance between sidewalks and houses	.73			.65		
10	Arrangement of houses on the block	.71				.72	
12	Garage location	.69			.82		
1	Residential density	.66				.51	
17	Street layout	.59				.67	
16	Overall design quality of housing		.78			.86	
4	Architectural style		.71			.72	
15	Mixture of housing types		.70			.63	
7	Overall layout of Kentlands (or W.W)		.46			.67	
6	Club house-recreation complex			.75			.74
8	Street trees and other street landscaping			.63		.59	
9	Overall size of Kentlands (or W.W)					.59	
13	On street parking				.81		
2	Lakes (or Wetlands), public greens, tot lots, footpaths						.85
	Mean	4.20	**4.70**	4.27	3.45	4.02	**4.21**
	Alpha	.89	.77	.43	.89	.92	.62

Figure 8.38 Factor analysis of community identity. Courtesy of Joongsub Kim.

8.5.4 Multidimensional Scaling

The use of multidimensional scaling analysis offers relatively more flexibility than either factor analysis or multiple regression. Depending on the particular computer program used, it is possible to make use of nominal data as well as interval or ratio data. In addition, because the outcome of the analysis is a graphically represented spatial plot, it may also hold some inherent appeal for architectural researchers.

The overall goal of multidimensional scaling is similar to that of factor analysis in that it reveals an underlying pattern or structure among the variables analyzed. However, some multidimensional scaling programs allow a greater degree of interpretive flexibility than is the case with factor analysis. Whereas factor analysis typically results in numerical designations for the degree of salience of each variable within a factor, multidimensional scaling results in a graphic plot that locates spatially the relationship among all variables. In such a plot, two points (variables) in close proximity mean that these variables represent a similar pattern of responses; distant points (variables) on the plot represent a dissimilar pattern of responses or observations.

Linda Groat's research on architects' and laypeople's understanding of architectural style employs a form of multidimensional scaling that accepts the nominal data derived from a sorting task. Groat was interested in investigating the extent to which architects and laypeople (in this case a group of accountants) responded differently to modern versus postmodern styles.[38] Some architectural theorists and proponents of postmodernism had speculated that laypeople would find postmodern buildings more appealing and meaningful than modern buildings. So Groat asked her respondents to carry out a set of free sorts of building photographs that represented a range of modern to transitional to postmodern styles.

Figure 8.39 represents the multidimensional scalogram analysis plot of a typical architect's set of sortings. Groat's interpretation of the plot reveals that basis stylistic categorizations underlie the architect's sortings, regardless of whether the architect had consciously sorted according to materials, geometric form, preference, or any other criteria. Lines have been drawn to indicate that the plot can be understood in terms of three stylistic regions that, with minor exceptions, correspond to the designations employed by architectural critics of the time.

However, Figure 8.40 represents a typical accountant's set of sortings. In this case, it is not possible to find distinctive stylistic regions. Groat interprets this result to mean that the accountant's sortings do *not* reveal an underlying stylistic conceptualization in the way the architect's plot does.

The sorting a of all 20 architects and 20 accountants were subjected to the same multidimensional analysis procedures. Groat was able to determine that while *no* accountant's plot revealed a postmodern stylistic region, the plots of 10 architects

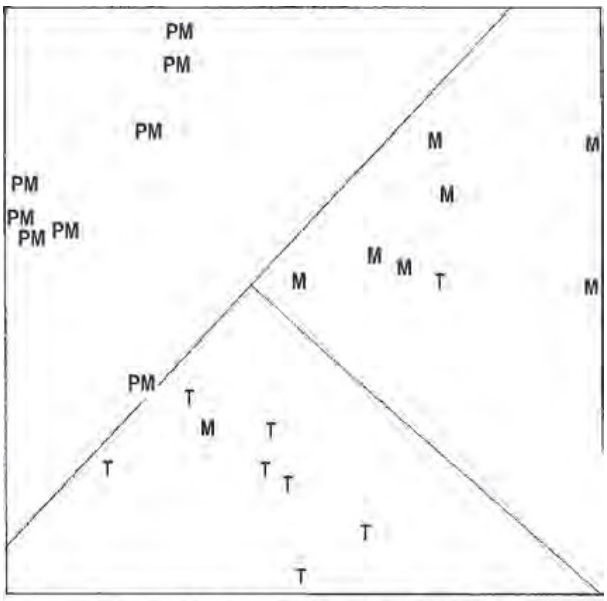

Figure 8.39 Underlying structure of an architect's sorting.

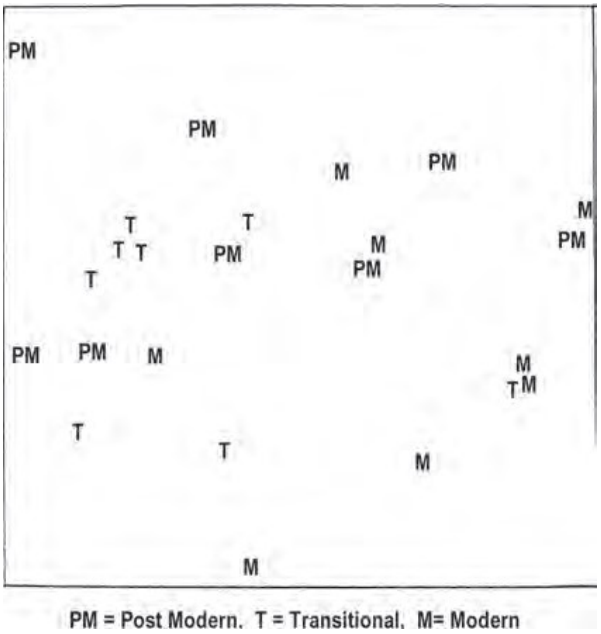

Figure 8.40 Underlying structure of an accountant's sorting.

did reveal a postmodern region. Further statistical analyses confirmed that this difference in response rate between the architects and accountants was significant at the .001 level, meaning that there is only one chance in a thousand that these results would be a chance occurrence.

As a result of this study, Groat concluded that the argument put forward by postmodern proponents at that time—that laypeople would respond more favorably to postmodern buildings, thereby distinguishing them from the modern buildings—was flawed.

8.6 CONCLUSIONS: STRENGTHS AND WEAKNESSES

As the many research examples described in this chapter demonstrate, the correlational strategy is well suited for exploring the relationship among two or more variables of interest. Unlike experimental research in which a variable is purposefully manipulated by the researcher, correlational research seeks to document the naturally occurring relationships among variables. This characteristic means that it is particularly appropriate in circumstances when variables either *can't* be manipulated for practical reasons or *shouldn't* be manipulated for ethical reasons (see Figure 8.41).

Second, because correlational research can accommodate the study of many variables measured in a variety of instances, the strategy is especially appropriate when the researcher seeks to understand a situation or circumstance *broadly*, rather than *in depth.*

In other words, one of the strategy's great advantages is its potential for studying the range and extent of multiple variables. However, its consequent disadvantage is that a robust and deep understanding of that circumstance may not be revealed.

Finally, researchers who choose to employ a correlational strategy will have to bear in mind the distinction between causality and prediction. By revealing

Strengths	Weaknesses
Can clarify the relationships among two or more naturally occuring variables	Researcher cannot control the levels or degrees of variables
Well suited to studying the breadth of a setting or a phenomenon	Less well suited to exploring the setting or phenomenon in depth
Can establish predictive relationships	Cannot establish causality

Figure 8.41 Strengths and weaknesses of correlational research.

consistent patterns of relationships among variables, correlational research can predict whether certain physical features may be associated with certain desired social outcomes. But that is not the same thing as establishing the physical variables as the cause of that outcome. Researchers who seek to establish direct causality between variables will need to turn to experimental and quasi-experimental strategies. And they are the subject of the next chapter.

NOTES

1. William Whyte, *The Social Life of Small Urban Spaces* (Washington, DC: The Conservation Foundation, 1980).
2. Joongsub Kim, "Creating Community: Does Kentlands Live Up to Its Goals?" *Places* 13(2) (2000): 48–55; Joongsub Kim, "Perceiving and Valuing Sense of Community in a New Urbanist Development: A Case Study of Kentlands," *Journal of Urban Design* 12(2) (2007): 203–230.
3. Todd Bressi, "Planning the American Dream," in Peter Katz (ed.), *The New Urbanism: Toward an Architecture of Community* (New York: McGraw-Hill, 1994).
4. Ibid., xxx.
5. Joongsub Kim, *Sense of Community in Neo-Traditional and Conventional Suburban Developments,* PhD dissertation, University of Michigan, Ann Arbor, MI, 2001.
6. Although the survey questionnaire may be the most common tactic for gaining an understanding of people's opinions and perceived meanings, a great many other response formats—such as mapping, the sorting task, and the like—are also possible. See section 8.4 later in this chapter for a more complete discussion of these tactics.
7. Linda N. Groat, "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task," *Journal of Environmental Psychology* 2(1) (1982): 3–22.
8. H. Blalock, *Social Statistics* (New York: McGraw-Hill, 1960), 12–18.
9. Ibid., 15.
10. Donna M. Mertens, *Research and Evaluation in Education and Psychology,* 3rd ed. (Thousand Oaks, CA: Sage, 2010), 152.
11. Mertens presents a more hierarchically structured typology. She uses the terms *causal comparative* and *correlational* to designate two primary categories. Then, within correlational, she includes both relationship and prediction subtypes. We have chosen to simplify Mertens's hierarchy in part because pure "prediction" studies (which typically involve the study of a theorized outcome some months or years after the initial measurement of key variables) are relatively rare in architectural research. D. Mertens, *Research Methods in Education and Psychology* (Thousand Oaks, CA: Sage, 1998).
12. Oscar Newman, *Defensible Space: Crime Prevention through Urban Design* (New York: Macmillan, 1972).
13. Ibid., xiv.
14. Ibid., 3.
15. Mertens, 94.

16. Newman, xv.
17. Ibid., 48.
18. Kim, "Perceiving and Valuing Sense of Community."
19. Whyte, 102.
20. Mark Frederickson, "Gender and Racial Bias in Design Juries," *Journal of Architectural Education* 47(1) (1993): 38–48.
21. Diaan van der Westhuizen, *Concepts of Space and Place—Neighborhood Access, Pedestrian Movement, and Physical Activity in Detroit: Implications for Urban Design and Research*, PhD dissertation, University of Michigan, Ann Arbor, MI, 2010.
22. Ibid., 134.
23. Kevin Lynch, *The Image of the City* (Cambridge, MA: MIT Press, 1960).
24. Anne Lusk, *Greenways' Places of the Heart: Aesthetic Guidelines for Bicycle Paths*, PhD dissertation, University of Michigan, Ann Arbor, MI, 2001.
25. Kush Patel, *Practicing Lefebvre: How Ideas of Social Space Are Realized in the Works of Lucien Kroll and Bernard Tschumi*, PhD dissertation, University of Michigan, Ann Arbor, MI, 2013.
26. David Canter, J. Brown, and Linda Groat, "The Multiple Sorting Procedure," in Michael Brenner and David Canter (eds.), *The Research Interview* (London: Academic Press, 1985), 79–114.
27. Frances Downing, "Conversations in Imagery," *Design Studies* 13(3) (1992): 297. Downing's study was recognized by the 1992 Design Studies Award for the best paper published in the journal.
28. Newman, xiv.
29. Ibid., 27.
30. Fernando Lara and Youngchul Kim, "Built Global, Lived Local: A Study of How Two Diametrically Opposed Cultures Reacted to Similar Modern Housing Solutions," *Journal of Architectural and Planning Research* 27(2) (2010): 91–106.
31. Kenneth Frampton, "Towards a Critical Regionalism: Six Points for an Architecture of Resistance," in Hal Foster (ed.), *The Anti-Aesthetic Essays on Postmodern Culture* (Seattle: Bay Press, 1983).
32. Ibid., 100.
33. Ibid., 104.
34. Jean Wineman, Robert Marans, Amy Schulz, Diaan van der Westhuizen, Graciela Mentz, and Paul Max, "Designing Healthy Urban Environments: Neighborhood Design and Health-Related Outcomes for Residents of Detroit." Paper presentation, Environmental Design Research Association 43, Seattle, WA, 2012.
35. Ibid., 6.
36. Reid Ewing and Susan Handy, "Measuring the Unmeasurable: Urban Design Qualities Related to Walkability," *Journal of Urban Design* 14(1) (2009): 65–84.
37. Joongsub Kim and Rachel Kaplan, "Physical and Psychological Factors in Sense of Community: New Urbanist Kentlands and Nearby Orchard Village," *Environment & Behavior* 36(3) (2004): 313–340.
38. Groat, 3.