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 revision of zoning codes for commercial high-rises.[1] When Whyte and his Street Life Project team began their research, New York City's zoning ordinance allowed developers to construct buildings with more floor space if they also provided public plazas. Some of the plazas that resulted were remarkably underutilized, while others seemed to be crowded with workers taking their lunch breaks.

Whyte wanted to understand why and to suggest guidelines for the design of successful plazas. So he and his team conducted a six-month study involving intensive observations of 18 representative plazas, counting the people using the space at specified time intervals with the aid of a video camera. By charting plaza use as a function of certain physical variables, they were able to identify several key design elements. Chief among them was the availability of sitting space. To support his analysis, Whyte presented charts that compared plaza use (number of people at the lunch hour) with the amount of open space available in each of the 18 plazas; there is no obvious relationship. However, a similar chart comparing plaza use with the amount of sittable space demonstrated that these two variables were more closely related.

Although Whyte and his team had completed most of their data collection and analysis within six months, their efforts to change New York City zoning ordinances took another two years. Happily, their proposed guidelines were eventually incorporated into a revised zoning code. New plazas were built to these guidelines, and just as important, many existing plazas were modified to meet the new zoning code.

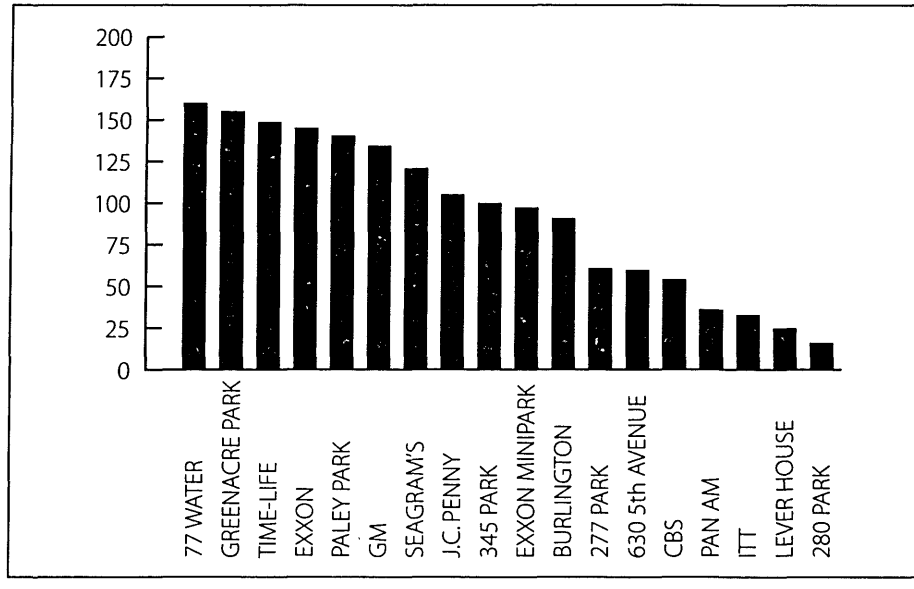


Figure 8.1 Plaza use: average number of people sitting at lunchtime in good weather. Courtesy of Project for Public Spaces, New York, New York.

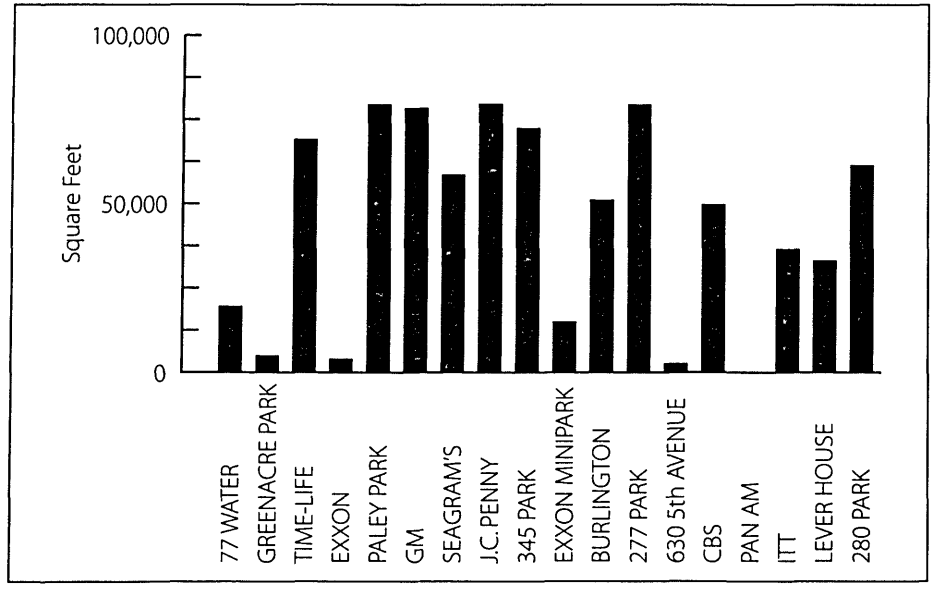


Figure 8.2 Amount of open space by square feet. Courtesy of Project for Public Spaces, New York, New York.

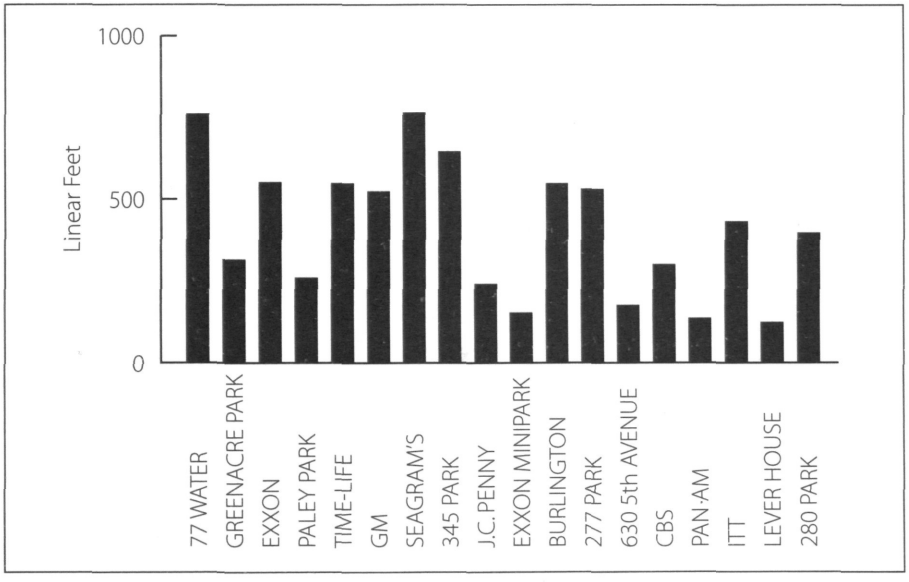


Figure 8.3 Amount of sittable space by linear feet. Courtesy of Project for Public Spaces, New York, New York.

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

Much more recently, Joongsub Kim conducted a study of the "new urbanist" model of housing and neighborhood design. This trend, which represents a significant departure from conventional suburban development, has been generating debate within both professional journals and the lay press since the mid-1980s.[2] According to Todd Bressi, an underlying premise of new urbanism is that "community planning and design must assert the importance of public over private values."[3] In other words, it must enhance the sense of community. Among the goals that new urbanists seek to reach 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 the attitude of residents in Kentlands (a recently developed new urban community in Gaithersburg, Maryland) and in a conventional suburban neighborhood with similar demographic characteristics and located in the same town.[4] (See Figures 8.5 to 8.8.)

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. Residents were asked to respond on a five-point scale from "not at all" to "very much."

The Kentlands residents consistently rated their neighborhood higher by all four measures of sense of community. Single-family house and townhome residents gave the neighborhood an especially high rating. But even apartment dwellers in Kentlands expressed a slightly greater sense of community than single-family house residents in the conventional suburban group did. Kim thus concludes that new urbanist theory and practice deserves continued development and refinement.

8.2 THE STRATEGY OF CORRELATIONAL RESEARCH: GENERAL CHARACTERISTICS

The strategy used by both Whyte and Kim is that of correlational research. Broadly speaking, each study sought to clarify patterns of relationships between two or more variables, i.e. factors involved in the circumstances under study. Although details of two sub-types 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 general characteristics of this strategy: a focus on naturally occurring patterns; the measurement of specific variables; and the use of statistics to clarify patterns of relationships.

Figure 8.5 A Kentlands street and park. Photo courtesy of Joongsub Kim.

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

Figure 8.7 Orchard Village housing. Photo courtesy of Joongsub Kim.

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

8.2.1 A Focus on Naturally Occurring Patterns

Both Whyte and Kim sought to understand naturally occurring patterns of socio-physical relationships. Whyte sought to understand the behavioral dynamics of plaza use, and in particular to find out what physical features would encourage their use. Similarly, Kim sought to understand the patterns of relationship between the physical attributes of two residential neighborhoods and 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 with the circumstance or setting 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.

8.2.2 The Measurement of Specific Variables

Both the Whyte and Kim studies focus on specific variables of interest that can be measured and quantified in some way. This is a feature that distinguishes correlational design 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 observational tactics whereby the sheer number of people or their specific behaviors could be counted. 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.

Other instances of correlational research, however, may focus less on observable behaviors than on people's attitudes, the meanings they ascribe to things, or even their perceptions of others' behavior. Such is the case with Kim's use of the survey questionnaire in the new urbanist and conventional suburban neighborhoods.[5] Kim sought to measure the extent to which the patterns of residents' sense of community might differ between the two neighborhoods.

Although the notion of measurement may seem straightforward, it can involve complex decisions. Researchers using the correlational research design must understand the implications of using different levels of measurement precision. Although

we will define the main levels briefly here, readers who seek a more detailed discussion should refer to the list of references at the end of this chapter.

Categorical Measurement. In categorical measurement, 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 designed for categorical measurement. For example, one survey question asked residents what mode of transportation they used to get to work; 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 had wanted to specify the kind of activities people were engaged in, the researchers' observations might have included the categories: sitting; standing; and walking.

Ordinal Scales. Ordinal measurement provides a greater degree of precision than categorical classification in that the variable in question, can, as the term implies, be *ordered* on some basis. In Kim's survey, for instance, some demographic questions provide a set of ordered categories. This is the case with a question about children's ages; six separate school-age categories from (1) preschool to (6) college are provided. Similarly, in a study of architects and nonarchitects' responses to a variety of building styles, Groat asked respondents to rank 24 building photographs according to their personal preference.[6] 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 are highly preferred, while the next building in order is much less favored.

Interval and Ratio Scales. A more precise measure still is one that specifies the exact distance (or interval) 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.

On the other hand, the validity of measuring attitudes and feelings on an interval scale is a topic of much discussion and some disagreement.[7] In the case of Kim's questionnaire, we might ask if it is legitimate to assume that respondents using the five-point scale—from very important (5) to not at all (1)—are employing a consistent increment of difference between responses of 4 and 5, for example. If we assume 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 a 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. We can not claim that 72 degrees is twice as hot as 36 degrees. On the other hand, we can assume consistent measuring intervals; the difference between 5 and 10 degrees is the same as the difference between 20 and 25 degrees.[8]

These distinctions among types of measurement frequently come into play in correlational research, because so many different 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 must be 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 the use patterns of the plazas he studied. For example, Figure 8.1 shows the average number of people using each of the 18 plazas in good weather; we can see that the most used plaza averages around 8 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 strength and direction of a relationship between two or more variables."[9] 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 conventional 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, in Kentlands, residents' 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. If the pattern of ratings on any two measures had been quite different, this would have been described as a negative correlation. All calculated correlation coefficients fall within a range of –1.00 (a negative correlation) to +1.00 (a positive correlation). A correlation coefficient close to 0 indicates no consistent linear relationship between variables, meaning the relationship cannot be graphed as a straight line.

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.

8.3 STRATEGY: TWO TYPES OF CORRELATIONAL RESEARCH

Within the general framework of correlational research, two major subtypes can be identified: 1) relationship and 2) causal-comparative.[10] Some correlational studies incorporate both of these subtypes. In the paragraphs below, we describe and analyze examples of both relationship and causal-comparative research.

8.3.1 Relationship Studies

Although all correlational studies seek to describe relationships among key variables, relationship studies focus more specifically on the nature and predictive power of such relationships.

One influential research project that sought to clarify relationships and predict outcomes is Oscar Newman's study of public housing in New York City.[11] 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 socio-economic factors), the physical variables of the housing/site design, and the incidence of crime. Newman's team examined the extensive 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."[12]

As a consequence of this extensive analysis, 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.[13]

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" is likely to have lower crime rates. (See Figure 8.10.)

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 factors (such the experience of sociability) that explain the correlations Whyte found. Many high correlations—for example, between the number of ice cream cones and deaths by drowning—can be explained by hidden third factors, in this case hot weather.[14]

On the other hand, Whyte's research does enable him to *predict* the association of certain key variables (i.e. sittable space, proximity to street life, etc.) with higher levels of plaza use. The predictive accuracy of Whyte's work was the foundation for the design guidelines that were eventually embedded in new zoning codes and used by many architects and landscape architects.

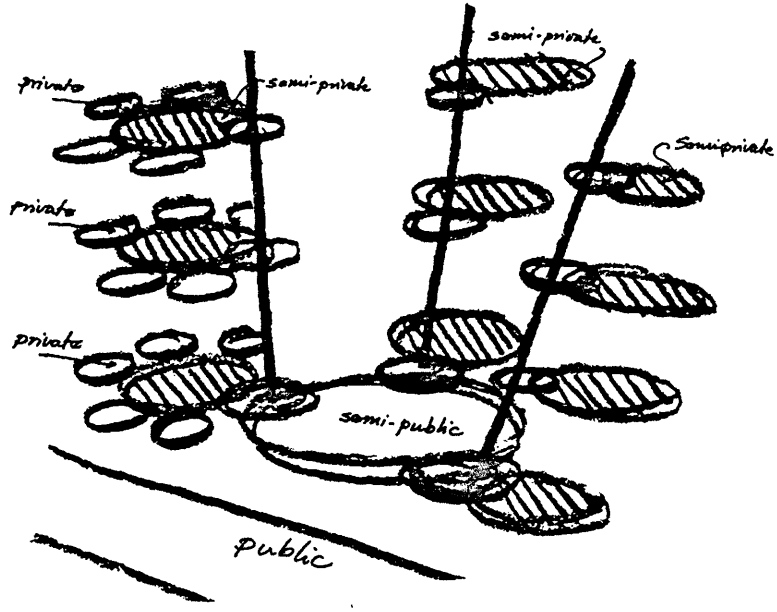


Figure 8.10 Newman's defensible space hierarchy in multilevel dwelling. Courtesy of Oscar Newman.

Likewise, Kim sought to understand and predict the relationship among various measures of community. As the correlations described in section 8.2.3 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 general 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." He then sought their rating for: "The physical characteristics of Kentlands (or OV) give me a sense of community." Kim found 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 using a test of statistical significance. Such tests—based on what is known as *inferential* statistics—enable a researcher to determine how likely it is that 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 stake 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 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 between the physical characteristics of Kentlands and Orchard Village might contribute to differences in the residents' sense of community. In effect, Kim conceptualized the multiple physical features of each neighborhood as "independent" variables and the residents' perceived sense of community as a "dependent" variable. His research design has much in common with the experimental research strategy in that it seeks 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 relies on naturally occurring variables (see section 8.2.1), as do all correlational studies. This is where it differs from experimental research (see Chapter 9), which characteristically involves a "treatment"—an independent variable that is manipulated by the researcher. To make the causal-comparative design persuasive, the researcher must establish the essential comparability of the examples studied. Unfortunately, there are often many obstacles to establishing the equivalence of the examples/groups in naturally occurring circumstances.

In the case of Kim's study, it would be hard to prove that the Kentlands and Orchard Village residents moved into their neighborhoods with equivalent attitudes toward sense of community. Indeed, a case could be made the Kentlands residents were enticed to move there precisely because they already had a greater affinity for community-oriented living; and if that is 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 offset this argument at least in part, Kim can point to data gained from qualitative in-depth interviews and activity logs that suggest at least some residents' behaviors changed after moving to Kentlands including, their transportation patterns (more walking) and/or the quantity of social interaction. Even so, such a causal comparative study can only point to possible causation. It can not 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 research design.

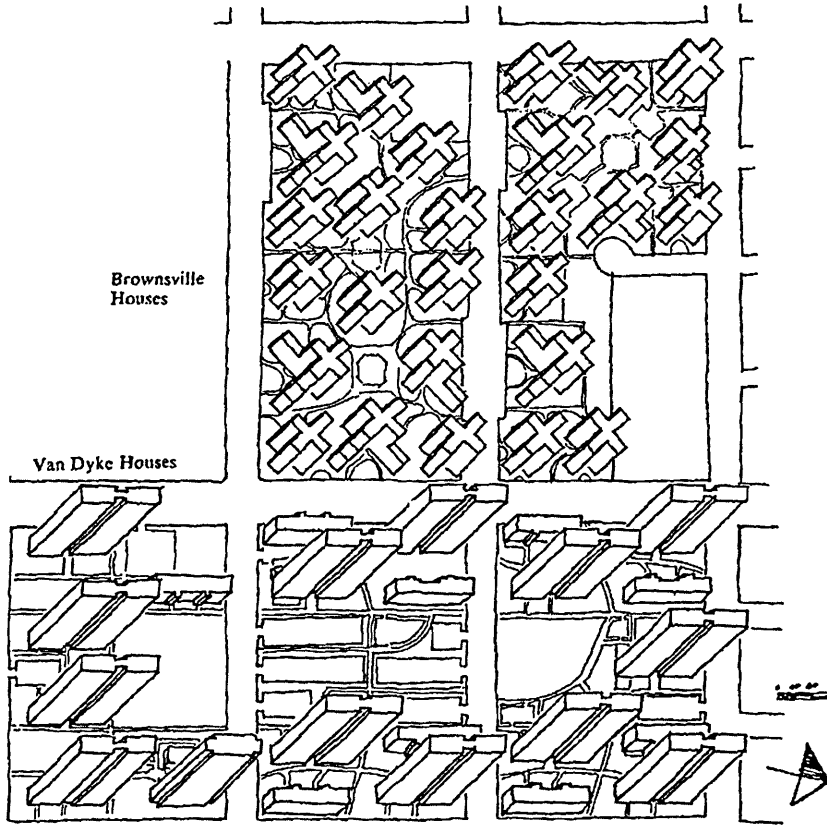


Figure 8.11 Plans of Brownsville and Van Dyke houses. Courtesy of Oscar Newman.

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:

> 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.[15]

Although Newman argues that the physical design unmistakably contributes to measured differences in crime rate between the two projects, he also acknowledges that his data can not provide "final and definitive proof" of the effects of physical design.[16] In fact, Newman suggests that the negative image of criminal behavior in Van Dyke

Figure 8.12 Van Dyke houses. Courtesy of Oscar Newman.

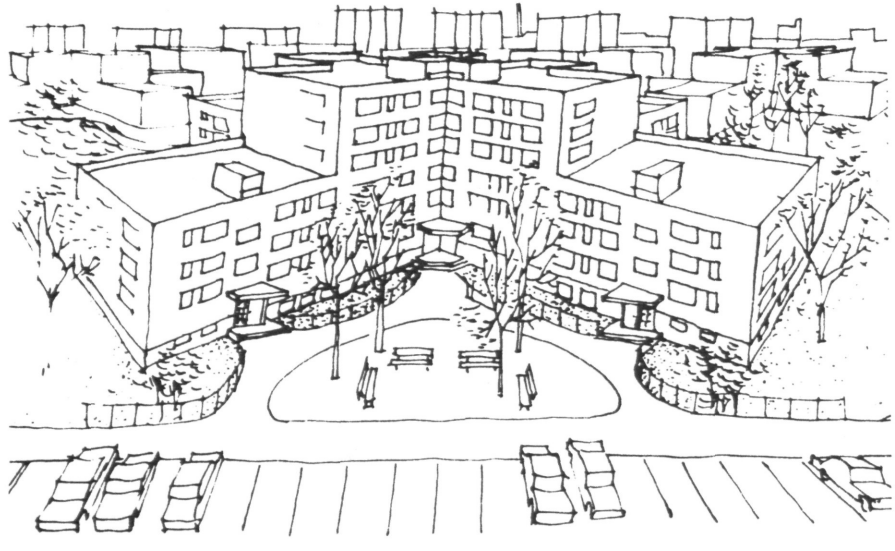


Figure 8.13 Brownsville houses. Courtesy of Oscar Newman.

Houses (the design *without* defensible space) contributed to the police department's pessimism about the value of their presence, a factor that in and of itself could contribute to the 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

A wide range of data collection and analyses techniques are used in correlational research. Before we discuss them, four important issues must be acknowledged at the outset. First, we can only cite a few of the most common examples in the context of this chapter. Second, a number of data collection tactics are frequently employed in other research designs as well; for example, observational techniques are common in qualitative research as well as in correlational research. And third, virtually all of the tactics discussed here are described at length in other sources. 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 seems particularly relevant to their work.

The fourth issue concerns a consideration that must be addressed prior to any data collection for correlational research, and that is 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 especially vital in 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 by a smaller subset (i.e. sample) of that group.

We see this principle of prediction from a sample of respondents at work during election campaign, and in the development of commercial products. 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 their products—whether vacuum cleaners or toothpaste—on a small sample of consumers in 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 it be introduced on the other floors about to be renovated.

Within the vast literature on sampling, the most important concern to the researcher is the distinction 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 in-

terviewed. 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 an 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 references 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 above) 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 texts focused on the subject.)

We now turn to the variety of ways that a researcher might collect data for a correlational study. The range of data collection tactics discussed below is intended to introduce the beginning researcher to a broad range of techniques. Architectural practitioners will also find this discussion of value when soliciting 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 used in correlational research, the survey questionnaire is perhaps the most frequently employed. Indeed, its ubiquity is so well established that the terms *survey research* and *correlational research* are sometimes considered interchangeable. Our position, however, is that the survey questionnaire is just one 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. However, achieving this breadth of information usually comes at the cost of in-depth understanding of the issues surveyed. Depth of understanding is more likely to be achieved through a qualitative research strategy for instance. (See Chapter 7 for more on qualitative research.) Nevertheless, the longstanding popularity of the survey tactic stands as a testimony to its usefulness in many circumstances.

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	somewhat	minimally important	not at all
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.

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.[17] Kim selected the survey as a tactic precisely because he wanted to compare residents' *overall* assessment of the "sense of community" achieved in a new urbanist development and a conventional suburban development. Kim also wanted to find out the extent to which a variety of specific design features contributed to this sense of community. After an extensive literature review (see Chapter 3 for more on literature reviews), Kim concluded that 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 seventeen design features affected each component. (See Fig. 8.14)

Kim also posed a number of demographic questions to each of the neighborhood's residents. These questions achieved at least two purposes. First, they helped Kim establish the extent to which the populations of the neighborhoods were essentially equivalent; and in fact, the two communities are quite similar by almost all demographic measures. And second, they helped him 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 townhome residents indicate a higher level of sense of community than either apartment or condominium residents. (See Figure 8.15 for a list of key issues a researcher must address in developing a survey questionnaire.)

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

Tactics for Correlational Research: Using Surveys in Practice

In architectural practice, survey questionnaires can provide important information for ongoing projects. In his facility planning and predesign consulting service, architect Lawrence Stern frequently develops questionnaires to assess how physical design can support both individual and work group practices. For a recent planning project for an expanding Internet solutions organization, Stern developed a questionnaire to help the client organization wrestle with competing notions of appropriate work spaces; some employees envisioned a lively, free-flowing space evocative of the open-ended and fast-paced economic environment of dot-coms; while others envisioned more conventional individual workspaces that would provide privacy and respite from distracting activity. (See Figure 8.16 for Stern's individual preference questionnaire.)

Individual Name: ________________________________

1. For each of the following attributes, indicate your preferences on the accompanying scale:
   - Physical Order (the need to feel your physical surroundings are predictable and ordered)
     Ordered - Free-flowing
   - Ambient noise (the preferred noise level of your work environment)
     Quiet (calm) - Loud (very active)
   - Distractibility (how your concentration is affected by nearby people and activities)
     Easily distracted - Not easily distracted
   - Sociability (how much you like to chat with co-workers while at your individual workplace)
     Introverted - Extroverted
   - Connectedness (what type of physical environment do you need to do your work)
     Exposed - Secluded

2. Overhearing co-worker telephone conversations or discussions may be beneficial. Indicate how frequently you would like to be able to hear the following:

	Always	Sometimes	Rarely	Never
• Your projects' requirements	______	______	______	______
• Other projects' requirements	______	______	______	______
• Informal information about your client	______	______	______	______
• Informal information about other clients	______	______	______	______
• Work group practices and methodology	______	______	______	______
• Company procedures	______	______	______	______
• Social event planning with co-workers	______	______	______	______

Figure 8.16 Sample survey in project planning phase. Courtesy of Lawrence Stern.

As it turned out, Stern was able to identify the clearly different sentiments of two groups of employees: the more creative software designers and the more technically oriented staff. The design-oriented staff considered themselves to be "not easily distracted" and were inclined to want more exposed, free-flowing spaces; whereas the technical staff considered themselves more "easily distracted," requiring more ordered and secluded space. As is often the case with small-scale projects with a limited number of users, Stern did not apply statistical measures of significance to his results, which demonstrated divergent tendencies between the two employee groups on several scales of the questionnaire.

Although surveys are most frequently used by researchers investigating social-cultural interactions or perceived meanings of environments, they can also be very effective tactics for a variety of other architectural research topics. A good example of correlational research in the environmental technology area is Raja et al's study of thermal comfort.[18] The goal of this research team was to investigate the use of various control mechanisms by workers in naturally ventilated office buildings. More specifically, the researchers sought to explore the effect of outdoor temperatures on indoor temperatures, especially the effect of office workers' use of environmental controls during peak summer months. To investigate this phenomenon, the researchers used the survey tactic for obtaining information from over 900 office workers in 15 buildings in two cities in Great Britain. Subjects were asked to report on thermal sensation and preference, clothing, activity, and use of controls (such as windows, fans, etc.); researchers also recorded the thermal environment close to each subject, as well as the outdoor temperature. The results of the study are based chiefly on an array of correlational analyses of the numerous variables. In general, the authors find that the availability of controls is key both to better building performance (i.e., the modification of indoor thermal conditions) and user satisfaction. They also make specific recommendations for the calculation of simulation models for naturally ventilated buildings.

8.4.2 Observation

Various forms of observation represent another frequently used set of tactics for data collection. In Whyte's study of urban plazas, the primary observation tactic was time-lapse film. At each plaza a camera was placed in a location that enabled filming of the pedestrian areas, usually a second- or third-story window or terrace perch. In an extensive appendix to his book, Whyte describes in useful detail the equipment and procedures used in the plaza study. Perhaps the most insightful section deals with figuring out what to look for. Indeed, establishing appropriate coding categories for

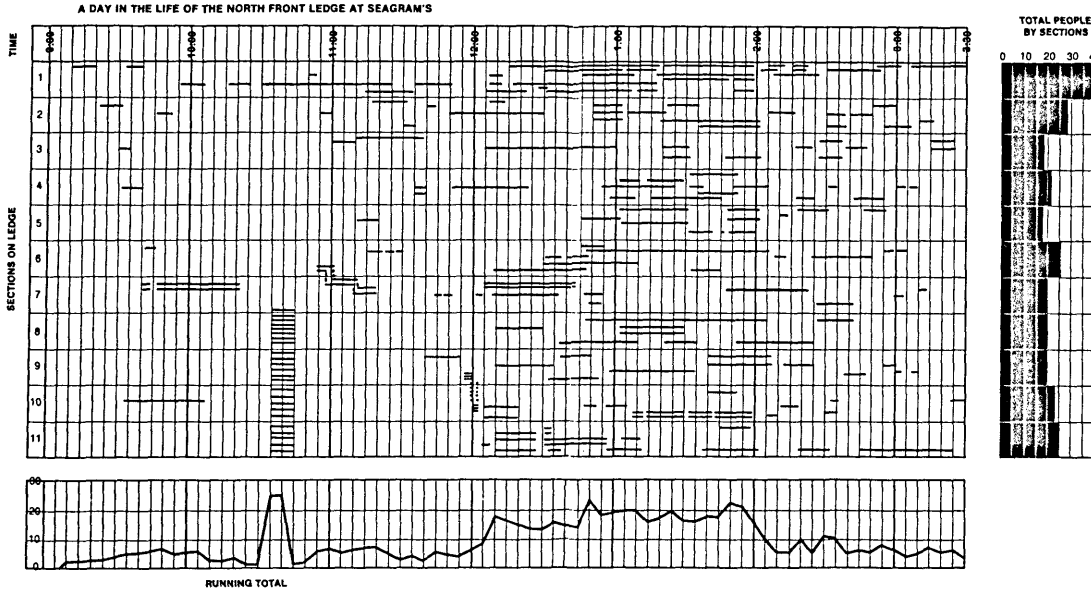


Figure 8.17 A day in the life of the north front edge at Seagrams. Courtesy of Project for Public Spaces, New York, New York.

activities recorded on film can be a painstaking task. On the other hand, 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 (see Figure 8.17), can provide a detailed and powerful view of the human ecology of a particular setting.

In the realm of architectural education, Mark Frederickson's study of design juries is also notable for its extensive use of observations.[19] His goal was to monitor jury and student interactions, with a special focus on the possibility of gender and/or minority bias. Frederickson videotaped a total of 112 juries at three architecture schools. Like Whyte, he needed to decide explicitly what activities and interactions of the jury process needed to be specified, coded, and measured. The variables identified by Frederickson included both time/frequency measures (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).

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:

> Many 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 it 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.*

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. They also 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.

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

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 8.19 indicates, women students are more likely to be interrupted during their initial presentations to juries; and they are also more likely to receive 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, interruptions and shorter jury time are strongly correlated, overall, with female gender.

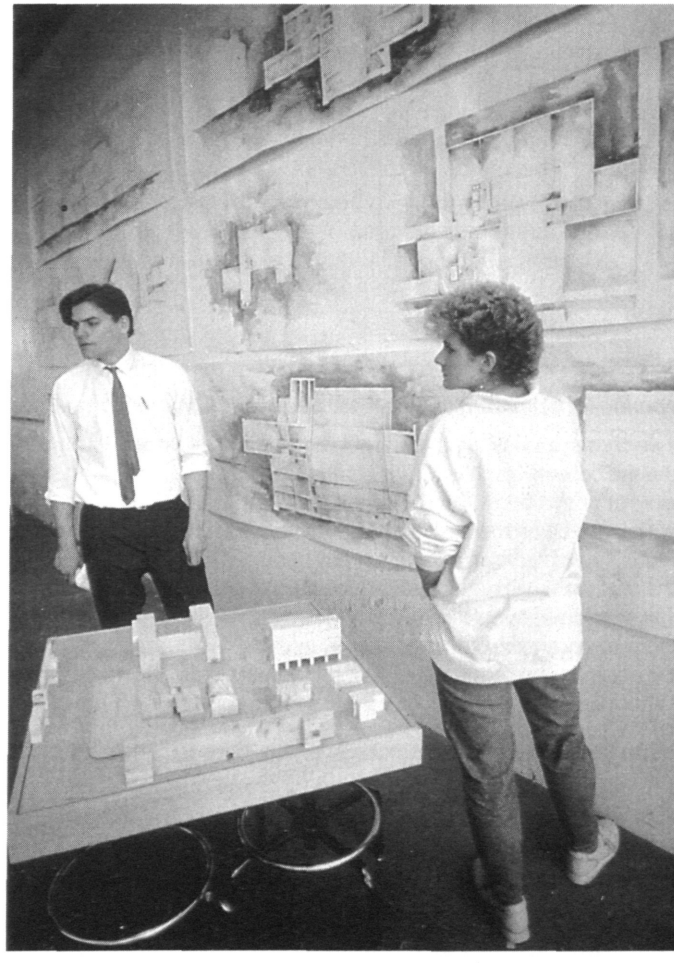


Figure 8.19 Gender and ethnic dynamics in juries were the subject of Frederickson's research. Courtesy of Taubman College of Architecture and Urban Planning, University of Michigan.

Verbal Participation and Interruptions of Female and Male Students

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

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

Content Variables

	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. © 1993 ACSA Press, Washington, D.C.

Another way that Frederickson analyzed the data can provide useful feedback to the schools he studied. Figure 8.20 shows his analysis of the content of jury comments at each of the three schools. 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 on collaborative idea building and associated questions; whereas at school #1 there is a much higher incidence of rhetorical questions, suggesting that the jurors are more inclined to ask questions to make a point rather than to initiate dialogue.

8.4.3 Mapping

Probably the best-known example of the use of a "mapping" technique is Kevin Lynch's study *The Image of the City*.[20] In an effort to assess the way the physical characteristics of cities were experienced and understood by ordinary people, Lynch conducted interviews with residents of three U.S. cities—Boston, Jersey City, and Los Angeles—and asked them to sketch maps of their city. Figure 8.22 represents the

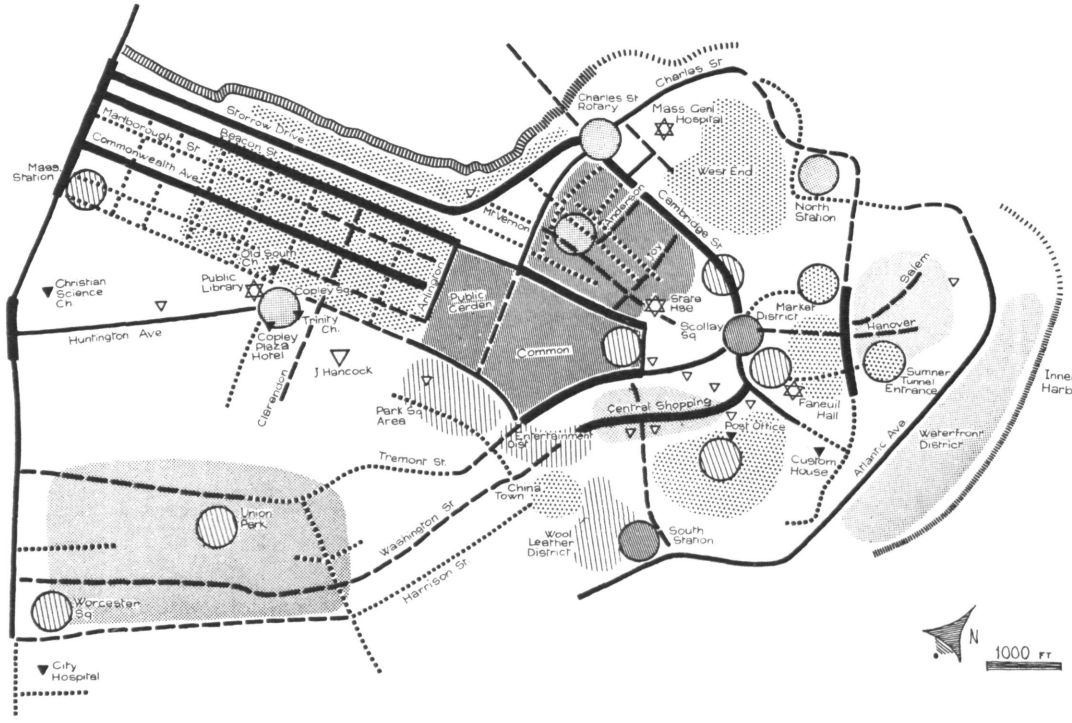


Figure 8.22 The Boston image as derived from verbal interviews. Courtesy of MIT Press.

composite maps derived from the interviews with Boston residents, while Figure 8.23 represents the composite map derived from the residents' sketch maps. Lynch concludes that overall there is a very high correlation between the two sets of maps for all three cities.

From these sets of mappings, Lynch was able to derive his now famous five general categories of urban features: path, edge, node, landmark, and district. All five types of features were delineated in each of the three cities. On the other hand, the density of these imageable features varied from city to city. Figure 8.24 shows the relative impoverishment of the composite Jersey City sketch map, compared to that of Boston.

Anne Lusk's more recent study of greenway bicycle paths is an excellent example of how mapping can been used as a basis for formulating design guidelines.[21] A longtime volunteer and activist in the greenway movement, Lusk wanted 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 nationally recognized for

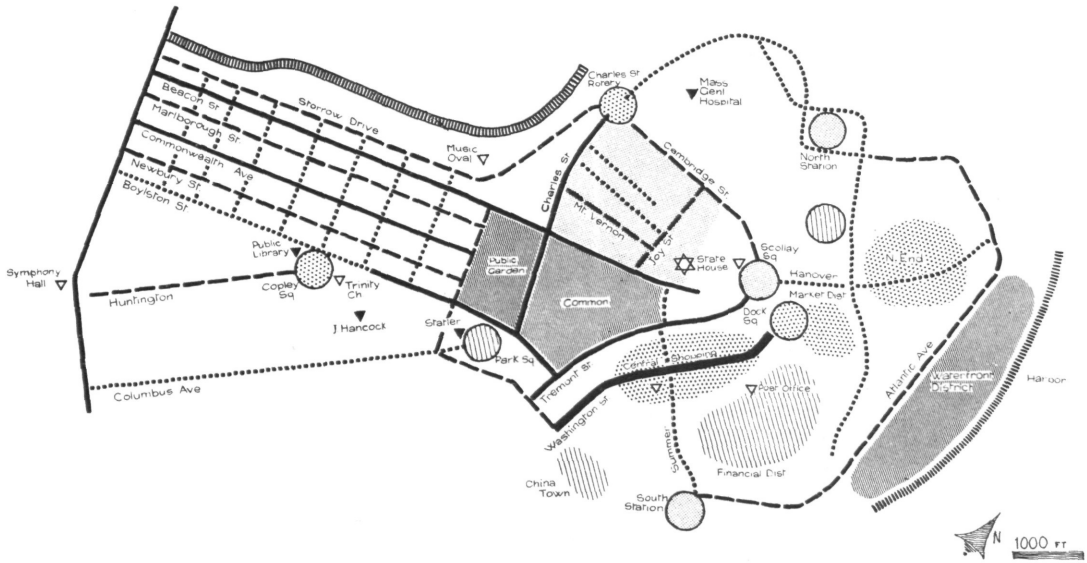


Figure 8.23 The Boston image as derived from sketch maps. Courtesy of MIT Press.

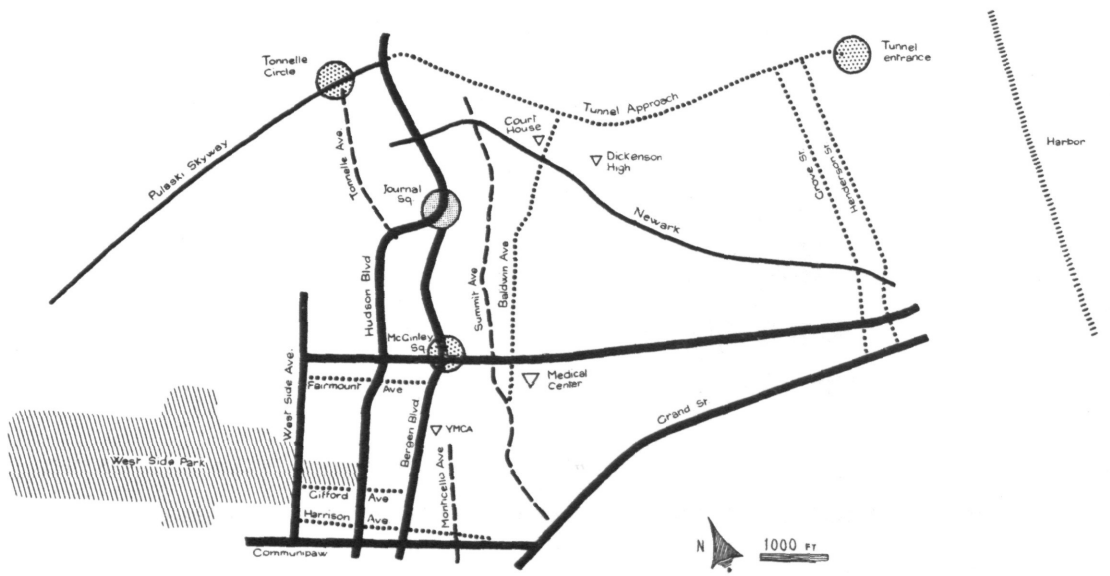


Figure 8.24 The Jersey City image as derived from sketch maps. Courtesy of MIT Press.

their aesthetic qualities: two scenic, rural trails; two urban trails; and two rails-to-trails greenways. At each site, Lusk asked greenway users to apply stickers representing different qualities of physical features to greenway maps she provided. Figure 8.25 provides the mapping instructions; and Figure 8.26 represents a composite map

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."

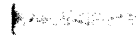
3. Put a smiley face circle by the places which you particularly enjoy and/or look forward to.

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

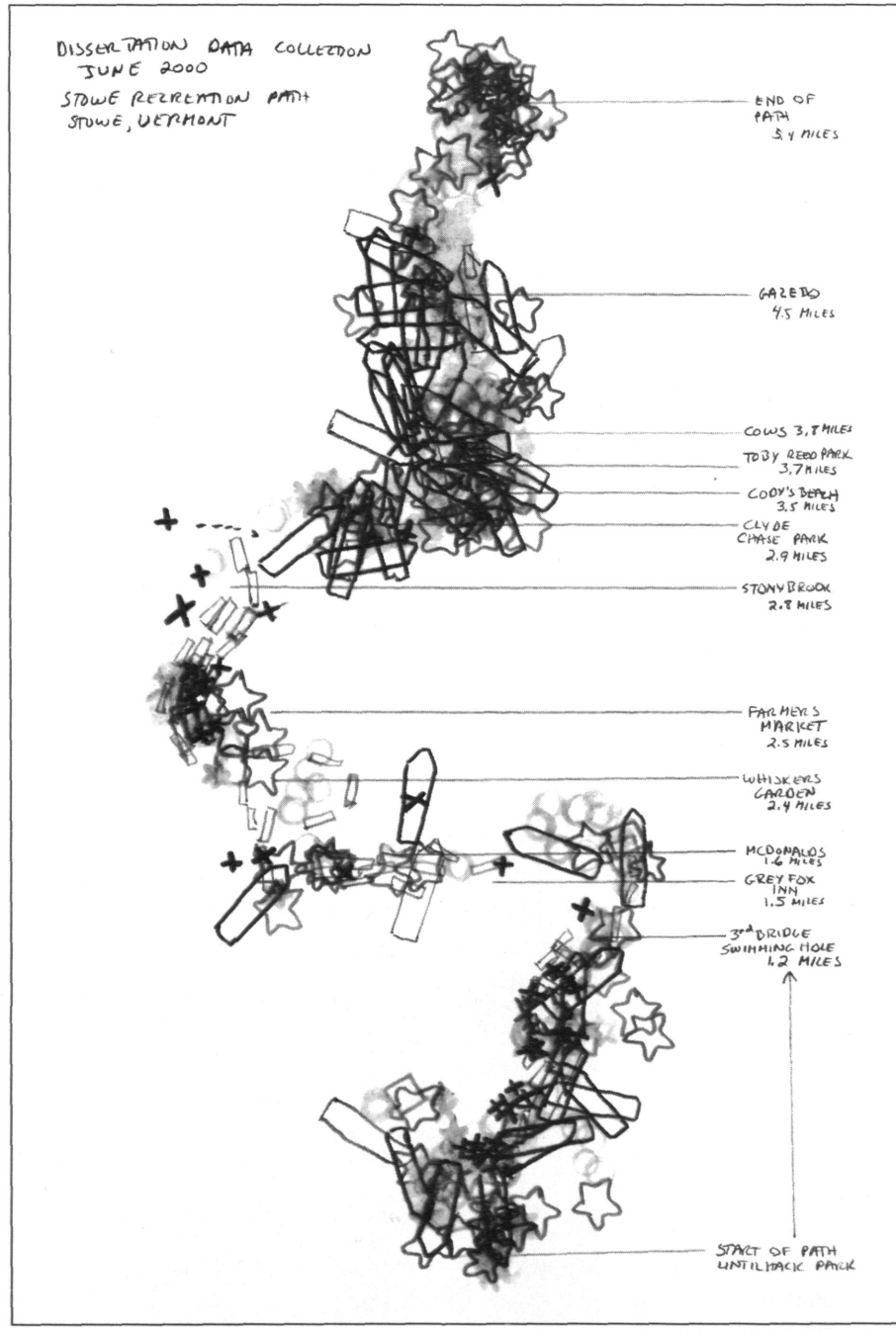


Figure 8.26 Composite map of Stowe, Vermont greenway. Courtesy of Anne Lusk.

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 8.27 represents a typical destination along the Stowe, Vermont greenway; it is a place where multiple features of interest converge, including cows 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.

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.[22] 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 a *free* sort, the respondent can establish whatever categories make sense to him/her. For example, s/he might choose to sort a set of buildings into functional types, including houses, commercial buildings, churches, etc. Or the respondent might choose to sort a set of houses by categories of traditional vs. modern styles. In a *multiple* free sort, the respondent is typically asked to sort the items as many times as possible.

Figure 8.27 Typical greenway destination. Courtesy of Anne Lusk, photo by Jeff Turnaw.

Figure 8.28 A respondent beginning the sorting task. Photo by Linda Groat.

Other versions of the sorting task procedure (including examples such as the Q-sort and F-sort) can be found in some of the more specialized research methods books focusing on correlational research.

In a class for beginning architectural students, Groat has used the sorting task to clarify the design dialogue between the architect-student and a friend who serves as the client. The student is asked first to do several sortings of the 20 Xerox photos of houses both to familiarize her/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 8.29 and 8.30) for each student and "client" to indicate a rank for each house in order of preference. Finally, the student is urged to discuss the similarities and differences in the sorting categories and the ranked preferences with his/her 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. If both architect and client sort the houses according to 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.

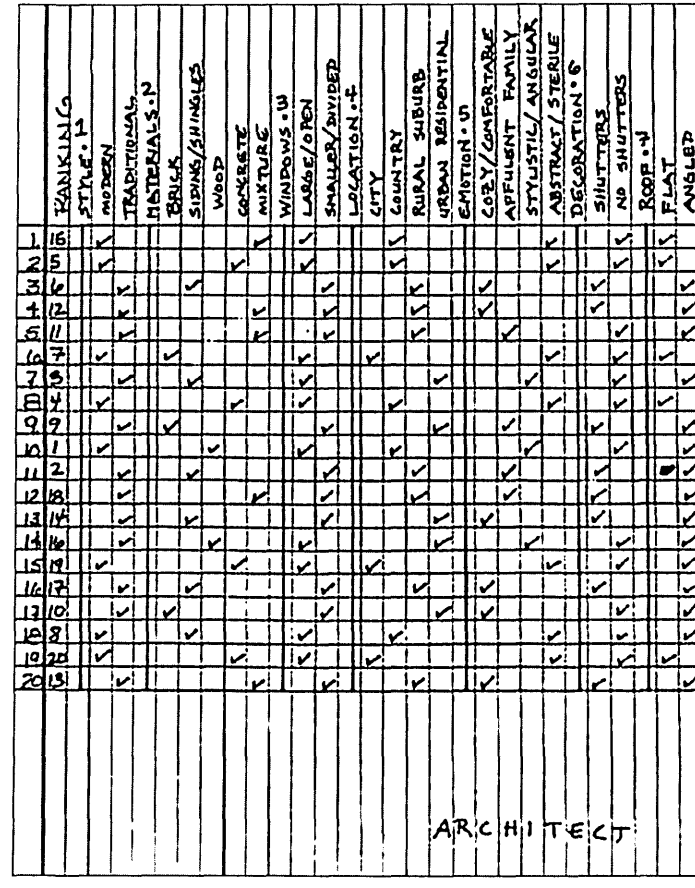


Figure 8.29 The student "architect's" sortings. Courtesy of Sara Stucky.

In a research context, both the preference rankings (an example of ordinal measurement as described in section 8.2.2) and the nominal sorting category designations can be subjected to statistical measures such that correlations between rankings and sortings can be investigated. However, the modest use of the sorting task in a practice setting—between client and architect, or among a small number of client/users—often serves more as a creative foundation for dialogue than as the basis for specific measures of correlation.

The essays that students have written about this experience suggest 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 interview. Indeed, by sorting out alternative design elements and articulating the categories that come to mind, many

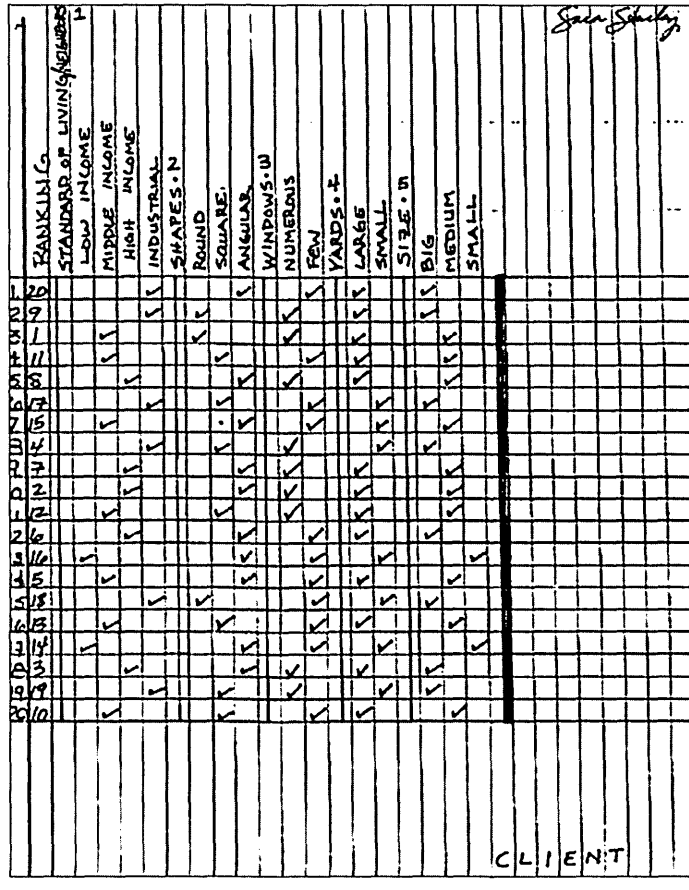


Figure 8.30 The "client's" sortings. Courtesy of Sara Stucky.

nonarchitects begin to experience architecture in ways that they might not otherwise be aware of or know how to express.

Reflecting on the use of the sorting task, Frances Downing found that her respondents—even the very busy professionals—quickly became captivated by the sorting process. (See Box 8.3.) 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 [sorting] cards with names of a history of places written on them.[23]

BOX 8.3

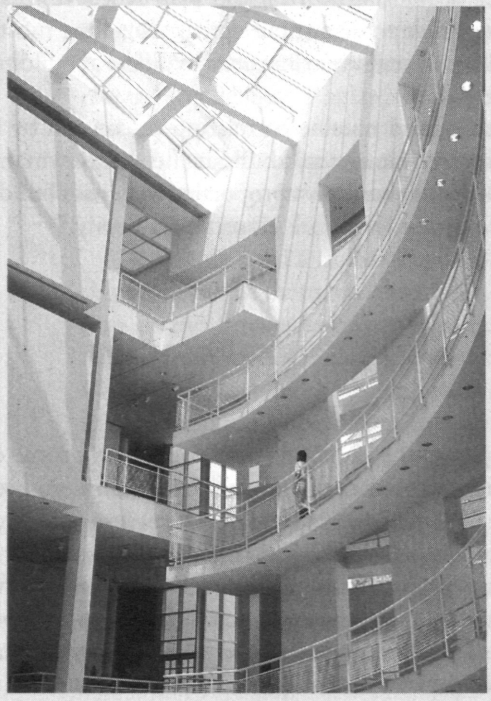
Tactics for Correlational Research: The Sorting Task

Frances Downing has used the sorting task to great effect in uncovering architectural designers' use of image banks in their design process.* 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 of evocative questions (e.g., As a child, what places did you live in that remain particularly memorable?) to elicit meaningful place images. 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.

Downing conducted her study at two different architecture schools, and included practicing professionals from the schools' respective regions. She found some intriguing differences of emphasis between the two groups of students and the professionals. Using a combination of inferential statistics for nominal data (see sections 8. 3.1 and 8.4) and multivariate statistics (see section 8.5), Downing was able to dis-

Figure 8.31 A memorable image that might be experienced in youth. Photo by Linda Groat.

*Frances Downing, "Image Banks: Dialogs Between the Past and the Future," *Environment and Behavior* 24, no. 4 (July 1992): 441–470.



cover 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. Entering students, by contrast, were less able to integrate the two types of images. Downing concludes architecture programs may be failing to help students make sense of their own experience of place while facing the challenge of creating place in their professional roles.

Figure 8.32 A memorable image that might be experienced during professional education. Photo by Linda Groat.

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 put an existing data base to extremely effective use. Newman is quite explicit about how the precision and wealth of data kept by the New York Housing Authority contributed to the success of his study. Newman explains that the wealth of demographic variables measured by the housing authority included age, income, years of residence, previous backgrounds, and history of family pathology. Similarly, the housing authority's police force maintained extensive records that included not only the nature of the crime or complaint, but also the precise location of the incident in the housing project.

These data on demographic characteristics and the presence/location of criminal behavior were then correlated with data on the physical properties of the various housing projects. 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, and plan type. 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."[24]

One particularly influential and notable correlation discovered by Newman is that of the relationship between crime rate and building height. Newman concludes: "Crime rate has been found to increase almost proportionately with building height" for the projects administered by the New York Housing Authority.[25]

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 statistics; but we do anticipate that both students and practitioners who choose to read about research findings during a literature review may well find it useful to understand the intent of such complex analyses. To this end, we will describe in the chapter segments that follow three types of multivariate statistical procedures: 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 at the conclusion of the chapter.

8.5.1 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 that is contributed by each of the independent (or predictor) variables.

An example of how multiple regression might work in environmental research is provided by Olusegun Obasanjo, who studied the effect of the urban environment on adolescents.[26] Obasanjo used a survey questionnaire that measured adolescents' sub-

jective experience of various social behaviors; cognitive functioning; and environmental quality (i.e. housing quality, neighborhood quality, and access to restorative resources). Restorative resources, as defined by Obasanjo and based on well-known research by Stephen Kaplan, are defined as places and experiences that are likely to enable people to experience the quality of being away, thereby overcoming mental fatigue.[27] Thus, Obasanjo included such questions as whether the respondents had quiet places to go in their neighborhood, whether they ever had the opportunity for nature experiences such as camping, etc.

Obasanjo used a series of multiple regression analyses to sort out the relationships among the many variables being measured, particularly the predictive association of the three sets of physical environment measures with either positive or negative social behaviors, such as delinquency or mental illness. For instance, Obasanjo found that housing quality and access to restorative resources accounted for the variation in perceived support from family at a statistically significant level. (See Figure 8.33.) Additionally, perceived neighborhood quality, along with housing quality and restorative resources, accounted for the variation in perceived support from friends. (See Figure 8.34.)

Space does not permit a complete description of the relationships among the many demographic, social, and physical variables that Obasanjo measured. Of particular interest to environmental designers, Obasanjo was able to establish statistically significant relationships between the *lack* of housing quality, neighborhood quality, and restorative resources and tendencies toward psychological illness and mild delinquency.

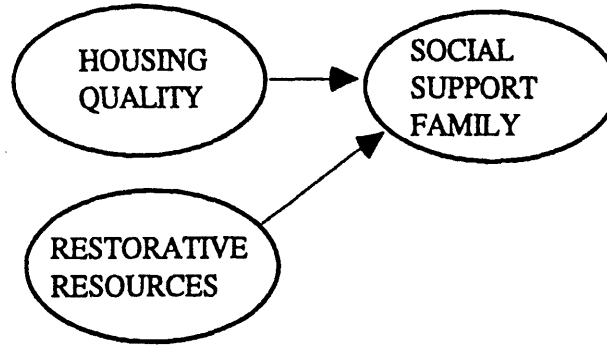


Figure 8.33 Effect of environmental experience on social support from family. Courtesy of Olusegun Obasanjo.

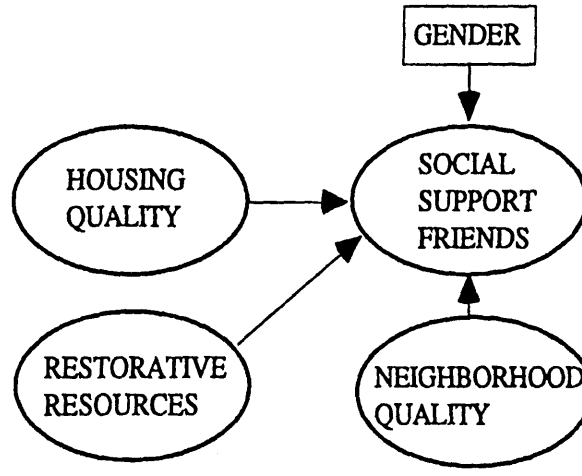


Figure 8.34 Effect of environmental experience on social support from friends. Olusegun Obasanjo.

8.5.2 Factor Analysis

Like multiple regression, factor analysis depends on interval or ratio data. But instead of using key variables to predict the outcomes of other variables, factor analysis aims to articulate an overall structure or pattern among 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 environmental design variables is provided by Kim's research on new urbanist and conventional suburban developments.[28] 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' sense of community in the two neighborhood developments.

What Kim discovered is that even though the new urbanist residents rated their sense of community more highly than the residents of the conventional suburb, the underlying factors influencing their assessments of specific design features were remarkably similar. For example, in the evaluation of community identity, the same three factors were identified for both neighborhood developments: community plan;

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 8.35 Factor analysis of community identity. Courtesy of Joongsub Kim.

community appearance, and amenities. In Figure 8.35, 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.

8.5.3 Multidimensional Scaling

Multidimensional scaling analysis offers more flexibility than either factor analysis or multiple regression. Depending on the particular computer program used, it can make use of nominal data as well as interval or ratio data. In addition, because the outcome of the analysis is represented graphically, it may 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 (such as the Guttman-Lingoes series or LIFa from University of Liverpool) allow for a greater degree of interpretive flexibility than is possible 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 the relationship among all variables spatially. Two points (variables) plotted in close proximity mean that these variables represent a similar pattern of responses or observations; distant points (variables) on the graph 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.[29] Groat was interested in investigating the extent to which architects and laypeople (in this case a group of accountants) responded differently to modern vs. postmodern styles. 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 8.36 represents the multidimensional scalogram analysis plot of a typical architect's set of sortings. Groat's interpretation of the plot reveals that basic *stylistic* categorizations underlie the architect's sortings, regardless of whether the architect

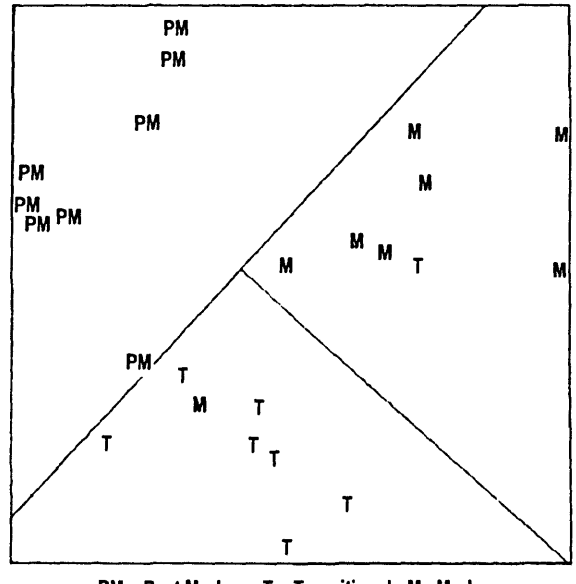


Figure 8.36 Underlying structure of architects' sortings.

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.

On the other hand, Figure 8.37 represents a typical accountant's set of sortings. In this case, it is not possible to find any distinct 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 sortings 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 *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 than to modern buildings—was flawed. Indeed, even among the architects, only half revealed a consistent underlying stylistic differentiation between modern and postmodern styles.

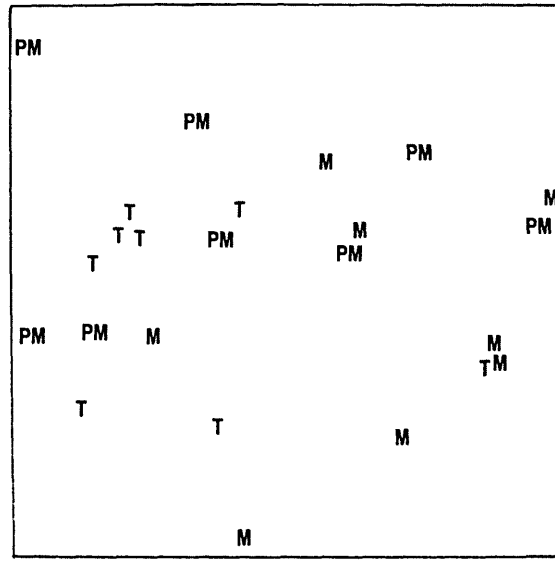


Figure 8.37 Underlying structure of accountants' sortings.

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 relationship among variables. This characteristic means that it is particularly appropriate in circumstances when variables either *cannot* be manipulated for practical reasons or *should not* be manipulated for ethical reasons. (See Figure 8.38.)

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 a wide range of variables. However, its consequent disadvantage is that a robust and deep understanding may not be achieved.

Finally, researchers who choose to employ a correlational strategy will have to bear in mind the distinction between causality and prediction. By revealing consistent patterns of relationships among variables, correlational research can predict whether certain physical features may be associated with certain social outcomes. But that is not the same thing as establishing the physical variables as the cause of those outcomes. Researchers who seek to establish direct causality between variables will need to turn to experimental and quasi-experimental strategies. They are the subject of the next chapter.

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 8.38 Strengths and weaknesses of correlational research.

8.7 RECOMMENDED READING

Readers interested in a more detailed overview of correlational and causal-comparative research, and their related tactics, can refer to Donna Mertens's textbook *Research Methods in Education and Psychology* (Thousand Oaks, Calif.: Sage Publications, 1998). In addition to her chapter on correlational research design, readers may also want to refer to her chapters on sampling (chapter 10), data collection (chapter 11), and data analysis (chapter 12).

For those particularly interested in survey research, two very useful sources are Robert Marans, "Survey Research," in Robert Bechtel, Robert Marans, and William Michelson, eds., *Behavioral Research and the Environment* (New York: Van Nostrand-Reinhold, 1987) pp. 41–81; and Donna Mertens, "Survey Research," in *Research Methods in Education and Psychology* (Thousand Oaks, Calif.: Sage Publications, 1998), pp. 105–143.

Students and professionals who are particularly interested in tactics for correlational research in practice and other applied settings may find two books of particular value. Several chapters in John Zeisel, *Inquiry by Design* (Monterey, Calif.: Brooks/Cole Publishing Co., 1981) describe tactics that are especially relevant to correlational research, including: "Observing Environmental Behavior" (chapter 8), "Standardized Questionnaires" (chapter 10), "Asking Questions" (chapter 11), and "Archives" (chapter 12). In addition, John Harrigan and Paul Neel, *The Executive Architect* (New York: John Wiley and Sons, 1996) includes a chapter on "Knowledge Development" (chapter 7) that describes the use of various research tactics in practice settings.

Other more specialized chapters or articles on some of the data collection tactics referenced in this chapter include David Canter, Jennifer Brown, and Linda Groat, "The Multiple Sorting Procedure," in Michael Brenner and David Canter, eds., *The Research Interview* (London: Academic Press, 1985) pp. 79–114.

For students and researchers who want to learn more about specific statistical applications, there are dozens of such books available. In addition to the chapters in Mertens that have already been cited, a classic and useful book is H. Blalock, *Social Statistics* (Tokyo: McGraw-Hill International Student Edition, 1979). A more advanced, comprehensive text is Thomas Black *Doing Quantitative Research* (Thousand Oaks, Calif.: Sage Publications, 1999).

Finally, readers who wish to study the details of the influential exemplars of correlational research may wish to refer to Oscar Newman, *Defensible Space* (New York: MacMillan Company, 1972); and William Whyte, *The Social Life of Small Urban Spaces* (Washington, D.C.: The Conservation Foundation, 1980).

NOTES

1. William Whyte, *The Social Life of Small Urban Spaces* (New York, NY: Project for Public Spaces, Inc., 1980).

2. Joongsub Kim, Sense of Community in Neo-Traditional and Conventional Suburban Developments (Ph.D. diss., University of Michigan 2001).

3. Todd Bressi, "Planning the American Dream," in *The New Urbanism: Toward an Architecture of Community*, ed. Peter Katz (New York: McGraw-Hill, 1994).

4. Kim, Sense of Community.

5. 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.

6. Linda N. Groat, "Meaning in Post-Modern Architecture: An Examination Using the Multiple Sorting Task," *Journal of Environmental Psychology* 2 no. 1, (1982): 3–22.

7. H. Blalock, *Social Statistics* (New York: McGraw-Hill Book Co. 1960), pp. 12–18.

8. Ibid., 15.

9. Donna Mertens, *Research Methods in Education and Psychology* (Thousand Oaks, Calif.: Sage Publications, 1998), p. 332.

10. 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. Mertens, *Research Methods.*

11. Oscar Newman, *Defensible Space: Crime Prevention Through Urban Design* (New York: Macmillan, 1972).

12. Ibid., xiv.

13. Ibid., 3.

14. Mertens, *Research Methods*, 94.

15. Newman, *Defensible Space*, xv.

16. Ibid., 48.

17. Kim, Sense of Community, xxx.

18. Iftikhar A. Raja, J. Fergus Nicol, Kathryn J. McCartney, and Michael A. Humphreys, "Thermal Comfort: Use of Controls in Naturally Ventilated Buildings," *Energy and Buildings*, 33 (2000): 235–244.

19. Mark Frederickson, "Gender and Racial Bias in Design Juries," *Journal of Architectural Education* 47, no. 1 (September 1993): 38–48.

20. Kevin Lynch, *The Image of the City* (Cambridge, Mass.: MIT Press, 1960).

21. Anne Lusk, Greenways' Places of the Heart: Aesthetic Guidelines for Bicycle Paths (Ph.D. diss., University of Michigan, 2002).

22. David Canter, J. Brown, and Linda Groat, "The Multiple Sorting Procedure," in *The Research Interview*, eds. Michael Brenner and David Canter (London: Academic Press, 1985) pp. 79–114.

23. Frances Downing, "Conversation in Imagery," *Design Studies* 13, no. 3 (July 1992): 297.

24. Newman, *Defensible Space*, xiv.

25. Ibid., 27.

26. Olusegun Obasanjo, The Impact of the Physical Environment on Adolescents in the Inner City (Ph.D. diss., University of Michigan, 1998).

27. Stephen Kaplan, "Beyond Rationality: Clarity-Based Decision Making," in *Environment, Cognition, and Action: An Integrated Approach*, eds. Tommy Garling and Gary Evans (New York: Oxford University Press, 1991); S. Kaplan, "The Restorative Benefits of Nature: Toward an Integrated Framework," *Journal of Environmental Psychology* 15 (1992): 169–182.

28. Kim, Sense of Community.

29. Linda N. Groat, "Meaning in Post-Modern Architecture."