1 A Constructivist Perspective on Assessing Personal Cognitive Structures

James C. Mancuso and
Mildred L. G. Shaw

To build a theory of persons, a radical constructivist first accepts the premise that an organized cognitive system occupies any psychological context as definitively as does the energy-emitting event that interfaces with that system (Gergen 1985; von Glasersfeld 1984). A behavior scientist working from a constructivist/contextualist perspective builds explanations from the assumption that event-derived input will function as a psychological variable only when that input has been assimilated into a structured cognitive system. Further, that system ultimately can be represented quantitatively, so that one may relate its parameters to other aspects of psychological functioning. In other terms, meaning is assigned to a stimulus pattern only through its absorption into the acquired knowledge system the person has available, and the psychological process of assigning meaning can be studied through, among other things, assessing and quantitatively representing a person's cognitive system.

Empirically based constructivist explanation, as Shepard (1984) has illustrated, had been cogently advanced by Wertheimer's (1912) demonstration of the ways in which a person will impose the meaning "moving" onto the sensory input pattern that emanates from two stationary stimulus events. Shepard's recent (1984) work extends Wertheimer's studies well beyond their elementary significance. Shepard

has amply shown that the trajectory of a light's movement across an intervening space represents an instance of a general principle of *kinematic geometry*. In a typical investigation of the ways in which people attribute motion to rigid objects, Shepard and his associates asked a subject to watch a surface in the picture plane spread before his or her line of sight. A multi-edged polygon was then projected onto that surface. The projection was terminated, and within an appropriate time interval the same polygon was projected, for example, onto a point to the right of the initial projection. Observers report having seen the polygon move across the space intervening between the two locations of the separate projections. Like the two single light points used in Wertheimer's phi-phenomenon demonstration, the two projections of the polygon, as input-producing events, are assimilated into a complex cognitive structure that imposes the meaning of "motion" onto the input. When the right-left alternation continues, observers see the two successive projections of the polygon as a single polygon moving rapidly back and forth across the intervening space.

Other transformations of the position and the orientation of the second presentations of the polygon more dramatically illustrate the proposition that apparent motion proceeds through the most direct, single unique axis between points on the surface of the consecutively presented polygons. For example, the second projection, presented to the right of the position of the first projection, might represent the polygon in enlarged size. With this arrangement, an observer "liberates" the polygon from the picture plane. The polygon would appear to pop out toward the observer while simultaneously moving from left to right. A similar liberation from the picture plane is effected when the investigator presents, as the second projection, a straight vertical line in the exact center of the field onto which the polygon had first been projected. In this case the observer reports that the polygon had rotated 90 degrees through the *near–far* axis (some observers see it move from the right to the left, whereas others see it move from the left to the right).

One can have little cognitive difficulty if he or she were to apply the constructivist assumption to these reported observations. Event-associated input becomes part of a psychological process only when that input is assimilated to an available cognitive structure. The sense of an event derives from the ways in which its input-producing energy patterns are translated into neural impulses at sensory endings and are then assimilated to a person's existing cognitive structures. In Shepard's demonstrations of apparent movement, a person's system functions to

"fill in the space" between successive actual presentations, using an attributed representation of the rigid object. When it is necessary to do so in order to assimilate the input in a way that maintains the coherence of the system, the system will "fill in" within the third dimension. When, for example, the polygon is presented in the picture plane and is then replaced with a straight vertical line that can be experienced as an edge-on view of the rigid two-dimensional object, a person will make sense of the stimulus change by experiencing the figure moving through the third dimension.

In sum, then, these demonstrations of specific instances of constructive psychological functions provide validation of general constructivist assumptions, and they encourage investigators to search out and describe those aspects of a person's psychological system which, in conjunction with input from an event, form an integral part of any psychological action.

CONSTRUCTIVIST PRINCIPLES IN PERSONALITY THEORY, MEASUREMENT, AND APPLICATIONS

Concurrent with the cognitive scientist's affirmation of the utility of constructivist principles, other psychologists have explored the utility of constructivist approaches to explanations of person functioning (Averill 1982; Carver and Scheier 1981; Mancuso and Adams-Webber 1982a; Mandler 1984). With this redirecting of focus by general theorists, applied psychologists, as well, have increasingly investigated the advantages of using constructivist principles to guide their work (Adams-Webber and Mancuso 1983; Guidano and Liotti 1983; Goldfried and Robins 1983; Landfield and Leitner 1980; Neimeyer 1985; Neimeyer and Neimeyer, 1987).

A personality theorist using a total constructivist position would assume that a person would be defined in terms of the complete, integrated system of internal representations that he or she can retrieve to impose on and to anticipate the steady flow of input that he or she encounters in the continuous movement of psychological adaptation. From this position one would believe that every input must be processed in terms of the idiosyncratic, organized system the person has acquired in the pre- and postnatal period during which she or he has developed psychologically. The person, then, comprises that cognitive system — a system which is stored in long-term memory and which is carried from situation to situation.

With the rise of interest in and use of innovations by which to conceptualize cognitive processes, investigators have developed a variety of techniques for assessing the content and organization of a person's cognitive structures. Often investigators (Cantor and Mischel 1979; Murphy and Wright 1984) have borrowed directly from the technology that cognitive scientists (Posner 1978; Rosch and Lloyd 1978) have used in laboratory studies. In many cases the investigator's use of theory implicates a structure for the subject's cognitive systems through the assumptions that guide the study. The investigator then accepts the outcome of the study as a suitable demonstration that the implied, but not directly assessed, system had functioned to produce particular results.

The work of Bargh (1982) illustrates the use of standard laboratory technology to deduce the structural properties of the construction systems that people apply to processing self- and person-relevant input. Bargh set out to add to the demonstrative base for regarding a personality as the cognitive processing systems that a person takes into interactions with his or her world (Wyer and Srull 1984). Bargh (1982) explored the ways in which an existing cognitive organization becomes implicated in the directing of attentional processes. To demonstrate the validity of his assumptions, Bargh, among other procedures, classified the persons who participated in his study as either *schematics* or *aschematics*. He placed his subjects in one or the other category on the basis of their responses to self-report rating scales. Essentially, those participants who rated themselves on the high end of scales assumed to be "independence-relevant" were judged to be persons who would readily access independence-defining schemata as they processed the flow of inputs. Bargh then used the standard dichotic listening task (a separate message to each ear) to assess the extent to which *schematics* would apply automatic attentional processes to cognize adjectives judged to be synonymous with the term *independence*.

In his attempt to work from a base of constructivist assumptions, Bargh, as noted (1982), chose his schematics on the basis of participants' self-ratings with reference to scales purportedly describing self characteristics of independence. Bargh assumed that those persons who rated their selves (this pronomial construction is used deliberately to show that participants rated self as an object that can be ordered into categories) to be highly independent would have acquired a highly accessible independence construct; whereas persons who had rated themselves low on independence would not have done so. Although this assumption would have an immediate face validity, it cannot be accepted

without further consideration, and its ultimate acceptance must depend on the availability of evidence based on technologies that allow quantitative representation of an individual's person-construing system. After those technologies have been developed, an investigator may better test the hypotheses that persons who rate their selves highly on a particular dimension also use that dimension as a superordinating self-construing dimension.

Note that Landfield and Schmittdiel (1983) report an exploration of the concept of *meaningfulness* within a person's construing system. Building on earlier investigations of the concept (Bonarius 1970a, 1970b), Landfield and Schmittdiel have shown the utility of a meaningfulness measure based on the assumption that the meaningfulness of a construct, in a particular person's system, is reflected by the person's use of *both* extreme ends of rating scales (which, in their studies, are embedded in a Role Repertory Grid Analysis; see Kelly 1955). Extending this proposition, then, one would need to conclude that Bargh's aschematic participants, who had been selected on the basis of their having rated their selves at the dependent end of the dependent–independent construct, would use that construct as "meaningfully" as would the schematics. One would hesitate, then, to endorse Bargh's expectation of a processing difference attributable to his schematics' ability to easily access an independence construct, whereas the aschematics would less readily access that construct.

In short, those investigators who would undertake studies based on constructivist assumptions will ultimately profit from having available a variety of sound methods for representing the cognitive systems that a participant brings into a study. Such methods will be useful not only for establishing the parameters of the cognitive system that participants can access while being exposed to the experimental procedures, but those methods can also serve to quantify the system's changes following the applications of experimental and clinical manipulations.

APPROACHES TO ASSESSMENT OF COGNITIVE STRUCTURE

Investigators who have worked to expand on personal construct psychology, which was originally formalized by George Kelly (1955), have given special attention to specific methods of quantifying and assessing the contents and structural properties of an individual's cognitive systems. In the original presentation of his theory, Kelly

described a methodology by which to obtain quantitative summaries of patterns of organization within an individual's person-perceiving system. Kelly's first applications of *role repertory analysis* required that a respondent produce a grid or matrix whose rows would be labeled with bipolar, person-defining constructs and whose columns would be labeled as persons significant in the life of the participant. The completed role repertory grid, which contained ratings of each person relative to each construct, could then be subjected to a wide variety of multidimensional quantitative analyses. From Kelly's first explorations there grew a large body of investigations based on repertory analysis (Adams-Webber 1979; Stringer and Bannister 1979). To conduct these studies investigators (Fransella and Bannister 1977; Landfield and Schmittdiel 1983; Shaw 1980, 1981; Slater 1977) have adapted the original assessment techniques to the wide range of computing technologies that have appeared since the introduction of role repertory analysis.

Beyond this plethora of studies of people's constructions of people, investigators have adopted the technology of analyzing role repertory grids to the analysis of a wide variety of cognized elements. Construct grid technology has been used to study conceptualizations of seaside resorts (Riley and Palmer 1976), of architectural and environmental designs (Honikman 1976), of automobiles (Boxer 1981), and of postgraduate students' activities as they progress through research training (Phillips 1981). Shaw and McKnight (1981a) have devised and published methods of using grid technology for personal decision making. Role repertory technology holds particular promise as a method for the analysis of expert systems (Boose 1985a, 1985b; Shaw and Gaines 1984).

As personal construct theorists have pushed forward their techniques, investigators working outside of this specific framework also have provided methods to be used in the analysis of cognitive structures. Rosenberg and his associates (Rosenberg 1977; Gara and Rosenberg 1979), who have concentrated on person cognition, have developed extended analytic methods. Following their interest in communication processes, Woelfel and his associates (Woelfel and Fink 1980) have devised procedures by which to track the cognitive changes that follow from the deliver of a constant flow of information. Jaccard (Jaccard and Wood 1986; Jaccard and Wan 1986) has devised methods for extracting the idiosyncratic cognitive systems that underlie decision-making processes.

THE UTILITY OF MULTIDIMENSIONAL ANALYSES AND MICROCOMPUTERS

Much of this work has been enhanced by analytic procedures that have become feasible with the advent of high-speed computing. A variety of multidimensional analyses have been adapted to the assessment of construction systems (Massaro and Schmuller 1975; Rosenberg 1977; Shaw 1980; Tversky and Gati 1982; Woelfel and Fink 1980), and these applications have served particularly well to advance conceptualizations of cognitive processes. Such techniques allow quantitative representations of the structural properties of cognitive systems, and with such representations an investigator may frame hypotheses that are then amenable to additional quantified assessment.

In the last five years the rapid development of microcomputers, coupled with statisticians' greater attention to multidimensional analytic procedures, has created an ambience that presages a huge burst of activity in multidimensional approaches to analysis of cognitive structures. Portable, inexpensive computers now have the capacity to complete computations that recently were accessible to only the small number of investigators who could employ data tabulators and who could purchase expensive computer time. Additionally, the microcomputer allows for the easy collection and filing of data. In the recent past only well-financed investigators could collect data interactively by the use of computers. At this moment an investigator or an applied psychologist can collect and arrange large blocks of data by having respondents engage in tasks they find simple and stimulating. In short, one may now collect and analyze large data sets through relatively time-economical and inexpensive procedures.

Additionally, the use of the microcomputer facilitates the transmission of data, technologies, and information. Once collected, data may be transmitted in electronic form, either through direct linkage between computers or through the exchange of light-weight records of data (floppy discs, tapes). Investigators may similarly transmit programs designed to collect or process data.

ORGANIZATION OF THIS VOLUME

This volume has been planned to provide a wide range of potential readers with a readily accessible compendium of illustrative descriptions of techniques that have been developed to assess individual construct

systems. A variety of these techniques have been developed by theorists and practitioners who have described their work in widely spread outlets. In many instances the techniques have been described incidentally as investigators have reported the results of investigations.

These descriptions should highlight the significance of this research in ways that have not been realized by the less systematic presentations that have thus far been assembled. In the first place, by the study of these juxtaposed descriptions an interested reader can become aware of the intertwined technological and theoretical problems the designers of these techniques have considered. It will be seen that the development of these methodologies depends on and facilitates the reciprocal refinement of theories about cognitive process and measurement.

Additionally, by consulting this single source a reader can become acquainted with the workings of a variety of techniques, any one of which might be adaptable to the kinds of problems that he or she might pose and might wish to explore. As a reader surveys the available techniques, he or she will become aware that the people who have developed these techniques have tried to develop their methods toward greater flexibility of application. Although many of these techniques had been developed originally for the assessment of a person's construction systems relative to one event domain (persons, for example), the inventors of the techniques have attempted to make allowances for adapting the techniques to any domain in which an investigator might be interested.

The presentations in this volume will also illustrate the constant interplay of applied and theoretical problems that have informed the work of those people who have developed the described technologies. As will be seen, some of the chapters focus primarily on measurement and theoretical considerations. Other chapters are written from an applied perspective. Nonetheless, the activity described herein attests to the investigator's belief that technologies can usefully guide thought about day-to-day psychological functioning.

Nine chapters in this volume describe programs the authors have developed for use on microcomputers. (The programs described in a tenth chapter have been used on a large computer, and are not yet translated for microcomputer use.) Each of the authors has worked toward the goal of devising a suite of programs that would allow a quantitative representation of the cognitive system a person would use as he or she processes the input from one or another set of events.

As a reader can see, the authors' work represents a range of concerns, as those concerns are reflected in the chosen elicitation

techniques and in the analysis strategies. Shaw and Gaines report on an extended suite of programs (PLANET) that one can use to elicit and then to analyze, in a variety of ways, the cognitive system a person would use to think about any domain of events. They have designed elicitation and analysis programs of wide generality. Their chapter contains a description of the intricate detail that they have worked into their programs to ensure that clinicians and investigators will be able to take into account and adequately meet the many contingencies that can arise as one attempts to access and to assess cognitive systems relative to any domain of input a person might receive from his or her environment.

Landfield, one of the first investigators to develop computer programs to assess grids based on Kelly's Role Repertory Test, describes (with Cannell) the analysis programs Landfield and his associates have devised. These programs extract scores related to concepts that are important to the tenets of Personal Construct Psychology. With their programs Landfield's group has focused sharply on measure of hierarchy in the organization of those construction systems that people apply as they construe other persons. Landfield and Cannell describe the theoretical base of their measure of hierarchical organization, report on the computerized techniques by which the measures are extracted, and point to the research and clinical questions that one may answer with the extracted measures.

Mitterer and Adams-Webber take yet another task. They have programmed a method through which an investigator or clinician can construct a wide variety of instruments by which to elicit and analyze the system a person would use to construe events. They aimed at high flexibility in constructing and analyzing the data produced by any kind of instrument that would be of interest to the administrator of an assessment process. The content of their chapter illustrates the diversity of approaches that have become available to behavior analysts who wish to explore the complexity of personal systems of cognitive structures.

In Boose's chapter one sees the results of a more precise focus of cognitive assessment methodologies on the problems that interest a specific investigator. Boose set out to find an efficient method of extracting the knowledge system of experts. Building on the work of Shaw and Gaines (Shaw 1979; Gaines and Shaw 1981), Boose has developed a computer-assisted methodology for representing the knowledge base of an expert construer: the Expert Transfer System. Among other things, Boose's methods simulate the rules that would be

embedded in the cognitive systems of experts, and constantly refine representations of the systems.

The work of Jaccard, Wan, and Wood parallels that of Boose, in that it reflects the development of techniques by which one can usefully quantify personal cognitive systems that are of interest to a special line of investigation. Jaccard and his co-workers have developed their methods to enhance work related to Jaccard's long-time interest in decision-making processes. The computerized operations, described in Chapter 7, facilitate the collection and analysis of information about the cognitive organizations that guide a person's decision-making processes relative to any product, event, or issue.

Knowledge of the cognitive systems underlying decision making would be of special interest to scholars and practitioners of communications technology. Woelfel, who studies communications processes, has built a highly refined system for analyzing the development and change of personal cognitive systems. In his chapter he describes programs with which he can analyze the ways in which people construe any topic, for example, that might be a matter of current public discussion. Woelfel's analysis programs are of particular interest to persons in communications, because they include procedures by which one can project the state of a person's system in the event that one or another part of the system changes.

Lehrer and Mancuso, who share a strong interest in developmental processes, write about programs that take an even narrower focus. Lehrer has been particularly interested in the structures that young people bring to their school learning. That specialization led him to consider the connections between learning to read, personal narrative grammar, and the ways in which a person constructs his or her self within the narrative grammar structure that he or she uses implicitly to process all input. Mancuso's programs have been put together to explore a specific area of personal role construction. His ParRep analysis programs systematize the cognitive organizations a person uses as he or she construes enactments of parent roles.

Ashbrook, Spaulding, and Cromwell have followed yet another direction. Their studies have focused on the cognitive processes of persons who have been diagnosed in clinical settings. They have followed a theoretical position from which they have explored the deficits in the processing functions these persons bring to their interactions with inputs. In their chapter they describe the instruments by which they, using microcomputers, have assessed the various cognitive functions

psychopathologists have implicated in the processes underlying the development of deviant behaviors.

In the last chapter, Pruzek reminds readers that the selection and justification of methods of analysis demand constant attention to measurement theory. Pruzek has devoted years of his career to the study of the intricacies of factor analytic methods, and remains a strong advocate of model-based methods for psychometric and statistical inference. He presents a strong brief for common factor analysis as a means of drawing inferences. He illustrates the ways in which common factor analysis can be of special value to investigators who rely on the analysis of two-dimensional matrices, to develop representations of the structures one presumes to underlie cognitive processes.

A FINAL WORD

Ultimately, the contributors to this book intend to convince investigators of the immense possibilities of exploration that have been created by the development of useful theory and technologies. The field has progressed beyond the "blood and sweat era." Persons who have not mastered the first principles of computer programming may implement available programs, although one could safely guarantee that anyone who begins to use one of the systems described in this volume will not remain at that rudimentary level. In the long run, the further development of theory and technology will depend on the versatility of investigators who can envision the multiple possibilities of adapting programs for analysis and re-analysis of data.

The state of affairs presented by this volume can satisfy only the scholar of cognitive processes who has observed the recent immense acceleration of activity devoted to building a theory base from which to investigate cognitive processes, to inventing methods for accessing and representing cognitive structure, and to extending the territory under exploration. Consider that 15 years ago the ambience surrounding the behavioral sciences and the then current state of technological developments would have seriously constrained the assembling of a book like this. Currently, one can easily introduce undergraduate students to the contents of this book. What is more, some of those undergraduates will readily add elaborations to the conceptualizations and techniques discussed in these chapters.

As editors of this volume, we regard this collection of papers as an invitation. Some readers, we hope, will be invited to elaborate on this

work by reasoned criticism. We want other readers to accept the book as an invitation to become acquainted with the diversity and ready availability of computer-assisted approaches to assessing cognitive systems. More than anything, of course, we invite readers to collaborate with the writers who have built these systems. Each of the authors anticipates the opportunity to share his or her excitement and enthusiasm.