of conceptualization is pursued independently of a theory of change. Such a static model as the authors use seems no substitute for more macroscopic theory about broader changes in American life that might affect perceptions, evaluations, and, in the final analysis, behavior on matters pertaining to the quality of life. From a social indicator point of view, the issue boils down to whether or not a conceptualization of quality of life relatively uninformed by a theory of change provides a basis for monitoring change effectively, much less for accounting for it.

An alternative to grounding conceptualization in theory is to derive it empirically, in the present instance through learning how Americans conceptualize quality of life for themselves. Inquiry toward this end, through, for example, the use of nondirective depth interviews, would have helped to establish the degree of correspondence between the frames of reference adopted by the investigators and those held by their respondents. The investigators' conceptualization has some empirical base, clearly, in their long experience in conducting surveys of the American public, but the case for their measures would be stronger if the empirical base were stronger.

For those who find the mode of conceptualization congenial, *The Quality of American Life* is likely to be judged the seminal work on social indicators it aspires to be. For those who remain unsatisfied that the authors have come up with a conceptualization that adequately comprehends quality of life, there will be respect for the very high level of craftsmanship exhibited and gratitude for a work that is likely to prove an effective stimulus to get the social indicators movement off dead center.

CHARLES Y. GLOCK
Department of Sociology, University of California, Berkeley

Visual Behavior

Gaze and Mutual Gaze. MICHAEL ARGYLE and MARK COOK. Cambridge University Press, New York, 1976. xii, 210 pp., illus. $18.50.

Psychological and sociological views of social interaction have accorded little formal place to eye contact and gaze in the regulation of human interaction. Many experimental studies in social psychology, for example, have taken an exchange of verbal messages as constituting the totality of interaction. Likewise, sociological theories of interaction, such as symbolic interactionism, have dealt in general terms with the nature of human communication but have seldom specified, except in an incidental and somewhat anecdotal way, the nonverbal variables that govern the flow of such interaction. Occasional insightful observers, such as Simmel, have noted the social use of the eyes, but its importance has seldom been fully appreciated.

In recent years, however, an interest in nonverbal communication has arisen out of ethology and out of the recognition on the part of a few innovative social psychologists of the importance of such factors as facial expression, gaze, and gesture in everyday discourse. Among the most productive of the pioneers has been Michael Argyle, who directs an extensive program of research on nonverbal communication at Oxford. Argyle has authored several previous books in the area, including a recent general review entitled *Bodily Communication*.

Now Argyle has written, with Mark Cook, the first book-length exposition of the role of gaze patterns in human interaction. In the book Argyle and Cook systematically present the results of their own work on the subject and that of other investigators (such as Ralph Exline) around the world.

The authors begin by assessing the role of gaze in the animal kingdom, giving the biological perspective that has been traditional since Darwin's *The Expression of the Emotions in Man and Animals* appeared in 1872. The predominant use of gaze in animals appears to be as a threat signal, with gaze cut-off commonly taken as indicating appeasement. (These two uses of gaze are retained in human interactions as well.) Affiliative functions also appear to be served, especially in the higher primates, but nowhere is this more clear-cut than in the case of man, where eye contact between mother and infant appears to be instrumental to the growth of attachment.

Overlying the complex functioning of gaze as aggressive or affiliative signal are cultural norms specifying the proper use or avoidance of mutual gaze. Arab cultures, for example, seem to expect more gaze, as well as other forms of contact, between conversationalists than do northern European ones, a difference that sometimes leads to misunderstandings when members of the two cultures meet.

Most of the remainder of the book is given over to a discussion of the findings of experimental and observational studies of gaze behavior. Argyle and Cook precede their presentation by a full consideration of the formidable technical problems involved in the measurement of gaze patterns. Some experimentalists have taken the rather artificial tack of using confederates who look fixedly at the subject for 100 percent or 50 percent of the time and then recording the subject's reactions. Others have used observers behind one-way mirrors who record the amount of gaze, mutual gaze, timing of glances, pupil dilation, and eye opening. Such records are then correlated to the flow and outcome of the interaction, as indicated by pen-and-paper measures of liking and other affects as well as by the more naturalistic verbal and nonverbal transcript of the entire encounter. The latter approach permits the more complex social functioning of the eyes to emerge but presents considerable difficulties in conventional data handling, which is premised on the more usual experimental model. Most gaze research, including Argyle's own, has been a compromise between the two approaches, both utilizing experimental control and permitting interactional freedom.

Argyle and Cook go on to report on the perception and interpretation of gaze, its role in the sequence of interaction, and personality differences in the use of gaze. They report that "the most basic meaning of gaze is that another is attending, that his visual channel is open." Such attention produces arousal and, depending on the context of the gaze, can evoke positive, approach responses or negative, aggressive behavior or flight. Gaze can be evaluated only in the context of total social performance, including, of course, verbal input and situational factors. Global impressions of personality are often affected by gaze patterns, with persons who look more at others in conversation being evaluated more positively, at least in American and English cultures. Staring in public places often acts as a hostile signal and evokes flight reactions, however. Argyle and Dean have developed an intimacy equilibrium model which posits that eye contact elicits both approach and avoidance tendencies and that within any given situation participants attempt to maintain an optimum desired level of intimacy, established by gaze and other means such as facial expression and physical proximity. If deviation occurs in any of these the participants will attempt to restore equilibrium by adjusting others.

Within conversations, the patterning of gaze is intimately linked to the tempo of speech and gesture, producing an interactional pattern of incredible complexity. Glances are used by speakers to signal breaks in interaction, encourage feedback, and permit entry by another speaker. Listeners signal their attention through gazing, accompanied by appropriate facial expressions to indicate more specific meaning. In a dyad, each person is simultaneously pursuing his own social goals as well as responding to those of the other, according to Argyle and Kendon's conceptual model of social behavior as a motor skill. Throughout, gaze plays a crucial regulating role. Unexpected gaze patterns, such as inattention or staring, can disrupt the flow of discourse as surely as an ill-chosen word, and often do so with much greater rapidity and effect.

Although there is a certain regularity within any culture in the encoding and decoding of affect and intention via the eyes, individual differences do exist. Aberrant use of the eyes has been noted in various mental disorders, notably autism, schizophrenia, and depression. In these cases, a general aversion to social encounter seems to be reflected in gaze aversion patterns. A need to cut down on sensory overload may also be operative, particularly in the case of autistic and schizophrenic individuals. In the more normal range, extraversion and affiliative needs have been found to correlate with greater use of gaze. Females overall seem to exhibit higher levels of gaze, a finding that gives rise to speculations on innate sex differences (six-month-old girls look more than boys of the same age) and on cultural conditioning (affiliative needs and interest in persons presumably are stressed more in the socialization of females).

Overall, then, Argyle and Cook conclude that gaze operates in the synchronization of conversation, the reception and sending of information, and the regulation of the emotional tone of an encounter. Intimacy and dominance are signaled by gaze, acting in concert with innumerable other verbal and nonverbal signals. Argyle and Cook have not tied up the loose ends of the field, of which there are many, but they have done a service by collecting and presenting in a readable manner evidence revealing the importance and complexity of the role of the eyes in interpersonal encounters.

SHIRLEY WEITZ
Department of Psychology, Graduate Faculty, New School for Social Research, New York, New York

Interfaces

Grain Boundary Structure and Properties. G. A. CHADWICK and D. A. SMITH, Eds. Academic Press, New York, 1976. xviii, 388 pp., illus. $34.75. Materials Science and Technology.

Grain boundaries have challenged the imaginations of metallographers, ceramists, mineralogists, and others who have observed the interfaces of grains or crystallites under the microscope. These interfaces, particularly the ones observed for an etched metallic specimen with an optical microscope, are so definite that it was felt that something must be present at the boundary, and the earliest conception of a grain boundary was as a thin, amorphous cement that held the grains together. Although there were no direct observations of any grain boundary structures, that conception was used to explain a variety of properties. In high-temperature metallurgy, for example, the concept of an equicohesive temperature was used to describe the creep behavior of certain metals as the temperature was raised: At low temperatures the grain boundaries were stronger than the grains and creep occurred by slip within the grains. At high temperatures the grain boundaries were weaker and creep occurred by slip at the boundaries. At the equicohesive temperature the grains and the grain boundaries were equally strong and both mechanisms operated. Grain boundary precipitates were observed and blamed for such phenomena as the sensitization of austenitic stainless steels to corrosion and the brittle fracture of certain steels. Although the search for an amorphous cement was fruitless, there was the abiding feeling that a grain boundary was *something*.

The feeling that a grain boundary had the qualities of a membrane was reinforced by the pioneer work of Cyril Smith and others on the energies of solid interfaces at equilibrium. The conceptual shift from specific interfacial tension was made immediately, and the simple calculations for relative interfacial energies were made on the assumption that the shape of a grain was determined by the balance of tension forces acting on a grain boundary intersection. This approach is still valuable, but it did leave an impression that grain boundaries were envelopes encompassing each grain. Only in the case of diffusion did it appear that they were something else. It was shown early that atomic migration was faster along grain boundaries than through the lattice, at least at low temperatures, and this implied that there was considerably more room at the interfaces. Furthermore, studies of sintering indicated that boundaries might act as vacancy conduits and as vacancy sinks. The diffusion mechanisms implied that boundaries were disordered regions that were active in transporting absorbing vacancies.

Our experimental techniques and theoretical methods are now much more powerful, and we should be able to determine what a grain boundary is. The book under review provides a very good picture of the principal recent work in the field. There is a paper by Loberg and Norden on the use of field ion microscopy and high-resolution electron microscopy and on the theoretical interpretation of the data obtained by these techniques in terms of the coincidence site lattice theory, the structural unit model, and the plane matching theory. This paper has more the look of instructions to a computer than of a treatise in English, and indeed the very next paper is a computer simulation of grain boundaries. Both these papers leave the reader with the thought that a grain boundary is not simply a collection of dangling lattice sites, but rather a defect structure that may have some degree of regularity. Indeed, the coincidence site lattice model defines a parameter, Σ, which is the reciprocal density of the common lattice points in two neighboring grains, to describe the character of a grain boundary. The topographical concepts dominate the book, with discussions of models based on free volume (Aaron and Bolling) and models devised for special high-angle grain boundaries (Pumphrey). The atomic arrangements at grain boundaries are being actively investigated, and the most important product of this effort may well be a method of characterizing a grain boundary in terms of structural elements.

Some of the most interesting work, however, is on the chemical properties of grain boundaries (Hondros; Stein, Johnson, and White). Auger electron spectroscopy has provided a powerful tool for examining the segregation of impurities at grain boundaries, particularly oxygen in iron, antimony in tempered steels, and phosphorus in stainless steel. There is also a very interesting account of the role of calcium in the production of the high-density aluminum oxide; the densification effect had previously been ascribed to magnesium oxide. The discussions of the chemical effects at grain boundaries and the role of Auger spectroscopy are worthwhile, and the casual