

## EXPERIMENTAL METHODS FOR STUDYING "ELEMENTARY MOTOR MIMICRY"

Janet Beavin Bavelas  
Alex Black  
Charles R. Lemery  
Scott MacInnis  
Jennifer Mullett

**ABSTRACT:** For over two hundred years, social psychologists have been puzzled by elementary motor mimicry—overt behavior by an observer that is appropriate to the situation of the other rather than to the observer's situation. This ubiquitous but fleeting behavior has not previously been amenable to experimental study, which might elucidate its meaning or meanings. The present article describes techniques for eliciting and videotaping such reactions in the lab. A wide variety of stimuli can be used to evoke smiling, wincing, leaning, and other motor mimicries. Recording is best done in split-screen, so that the relation between the behaviors of observer and observed can be analyzed. Several reliable scoring options are described (qualitative, quantitative, microanalysis, and self-report). Experimental controls can be introduced to rule out artifacts that might appear to be motor mimicry. These methods are introduced in the hope that the many different theories that have been offered to explain this phenomenon might finally begin to be tested.

This is a first, methodological report from a project investigating the classic phenomenon of elementary motor mimicry (see also Bavelas, Black, Chovil, Lemery, & Mullett, 1986a, 1986b; Bavelas, Black, Lemery, & Mullett, 1986 & in press). The identifying feature of

---

The authors are with the Department of Psychology at the University of Victoria.

Order of authors is alphabetical. Scott MacInnis is now with the Ministry of Post-Secondary Education, Province of British Columbia. The Social Sciences and Humanities Research Council of Canada, and the University of Victoria, have provided financial support since the earliest phases of this project. David Rosenhan and Carol Sigelman made valuable comments on the manuscript. The experimenters in the studies on which this article is based included Geoffrey Smith, Susan Cathro, and Brad Dishan. Reprint requests should be sent to J. B. Bavelas, Department of Psychology, University of Victoria, Victoria, B. C. V8W 2Y2.

this behavior is that the observer's overt motor response is appropriate *not* to his or her own situation but to the situation of the observed other. The observer acts as if he or she were in the other's place and, for that moment, winces at the other's pain, strains with the other's efforts, smiles with another's laughter or success, or even ducks to "avoid" a danger threatening someone else.

The psychological subtlety of this phenomenon is that the observer appears to supplant the other person, momentarily leaving his or her own situation and reacting instead to that of the other. Thus, on closer examination, this simple nonverbal behavior implies (albeit in condensed form) several processes fundamental to social behavior: Its occurrence suggests that the individual has co-oriented, vicariously experienced, and then visibly displayed this to the other in a single, usually quick, and apparently reflexive act.

## HISTORY OF MOTOR MIMICRY

In his historical review of recurring themes in social psychology, Allport (1968) traces interest in motor mimicry at least back to Adam Smith (1759):

Smith distinguished two basic forms of sympathy which most subsequent writers have preserved. First there is the quick, almost reflex, type of response. When we see a person struck we cringe; when we watch a tightrope walker we grow tense. In these cases we feel as the other person feels and do as he does. Some writers have regarded this mimicry as instinctive. . . .

Spencer (1870) distinguished the same two basic forms of sympathy. He called them, respectively, *presentative* (immediate, reflexive) and *representative* (conscious, reflective). . . .

Theodore Ribot [1897] . . . postulated three. The first is the primitive or automatic type. . . .

There are, according to Scheler [1923/1954], eight forms of sympathetic orientation (or acts). . . . *Einfühlung* is the primitive, reflex process mentioned by Smith, Spencer, Ribot, and others. The term "empathy" is a fair translation, provided it is understood to mean only elementary motor mimicry. . . . (pp. 24–27)

Similarly, Darwin (1872/1965, pp. 215–217) described the nonverbal expression of "sympathy," for example, crying at another's distress.

Our search has uncovered only a handful of empirical demon-

strations of this phenomenon. The first was Köhler's photograph (1927, Plate IV) of Sultan holding one arm up as he watches another chimpanzee reach for bananas. Allport showed photographs of spectators echoing the postures of a high jumper (1937, p. 531) and a lawn bowler (1961, p. 535). Anthropologists have on occasion observed instances of "couvade" or simulated, imitative illness in which, for example, the father appears to suffer the pains of childbirth (cf. Kupferer, 1965). Hull (1933, pp. 41–44) conducted the first experimental demonstration of what he called "unconscious mimicry," by ingeniously and unobtrusively recording the body sway of a subject watching another person reach far forward and backward. Hull's idea was developed into a full-scale experiment on Mead's (1934) "taking the role of the other" by O'Toole and Dubin (1968), who also made systematic observations of mothers opening their own mouths while spoon-feeding their infants. MacInnis (1979) was the first to use videotaped stimuli and to report inter-judge reliability for both overt mimesis and self-reported empathic feelings; his methods led to the work reported here.

(It is difficult to know whether or not to include the studies of Berger and his collaborators on stimulus-specific physiological responses to the other's actions—for example, EMG activity in the appropriate arm while watching arm wrestling (Berger & Hadley, 1975; Berger, Irwin, & Frommer, 1970; Markovsky & Berger, 1983). Because they are precisely but covertly mimetic, it is probably best to class such reactions as "physiological mimicry" unless they are overtly displayed as well.)

The paucity of research on this widely noted phenomenon is undoubtedly because of difficulties in capturing and measuring such a spontaneous and fleeting event. For example, O'Toole and Dubin (1968) had to measure body sway in real time by observing their subjects' shadows. More recently, however, videotaping has made it possible to capture many apparently ephemeral nonverbal behaviors for analysis. The present article proposes that a wide variety of motor mimics can be evoked, recorded, and studied experimentally in this way. These methods, as well as some conceptual clarification, may eventually help delineate the meaning or meanings of this often observed but—as we will see—still puzzling phenomenon.

### CONCEPTUAL PROBLEMS

If motor mimicry has intrigued social theorists for over two centuries, it has also eluded their efforts to explain it. Allport summarized their frustration:

Baldwin [1895, 1897] seems to rely on the little understood tendency to elementary motor mimicry. . . .

McDougall [1908] was much troubled . . . by the manifest tendency of spectators to assume the postural strains of the dancers or athletes they are watching . . . .

This process of *empathy* remains a riddle in social psychology. It would seem to be genetically and conceptually basic to social learning and to lie at the heart of any theory of imitation. Some motor mimicry . . . seems reducible to previous conditioning, but in other cases it appears to precede and to be a precondition of learning. The nature of the mechanism is not yet understood. . . .

*Motor mimicry (empathy), basically a perceptual motor reaction, [is] at present not fully understood.* (1968, pp. 29–32, italics original)

Certainly the failure to find an adequate explanation is not for want of trying: The number of theories proposed by far exceeds the number of empirical studies. The theories applied to motor mimicry trace and re-trace the history of social psychological theory, including for example instinct (McDougall, 1908; Martin & Clark, 1982), imitation (Baldwin, 1895, 1897) or vicarious learning, and conditioning (Holt, 1931; Miller & Dollard, 1941).

Note that Allport himself equates motor mimicry with *empathy*, in the carefully circumscribed sense of that term described above (see also Bavelas, Black, Lemery, & Mullett, in press). However, as Strunk (1957) and others have pointed out, the term *empathy* has not retained the narrow precision that culminated in Scheler's (1923/1954) "eight forms of sympathetic orientation." In modern usage, *empathy* may refer to an underlying general "trait" (Dymond, 1949; see also Bender & Hastorf, 1953; Davis, 1983; Kerr & Speroff, 1951) or to a Rogerian interpersonal skill, an aspect of what is more recently called "communicative competence" (Argyle, 1972; Haase & Tepper, 1972; Miller & Steinberg, 1975; Rogers, 1975; Wiemann, 1977). However, *empathy* has also been used to describe generalized emotional responses to the other's emotions, including vicarious classical conditioning (Berger, 1962; Craig & Weinstein, 1965; Stotland, 1969), even though Berger explicitly cautioned that such diffuse autonomic reactions might equally be evidence of sadistic enjoyment of the other's pain (1962, p. 464). Hoffman (1975, p. 610) has made a useful distinction between affective and cognitive applications of this broad term, pointing out that *empathy* can mean either the cognitive process of "taking the role of the other" (e.g., Mead, 1934) or the affective process of vicariously experiencing the other person's emo-

tions. More recently, empathy has been given a prominent role in pro-social motivation or behavior, including altruism (Batson, Duncan, Ackerman, Buckley, & Birch, 1981; Feshbach, 1975; Krebs, 1975). Allport lamented this apparently irreversible expansion:

It is regrettable that with passing years the original meaning of empathy as "objective motor mimicry" became hopelessly confused and lost to view. . . . The theoretical coin has depreciated, probably beyond redemption. (1961, pp. 536–537)

In brief, equating motor mimicry with empathy has not helped in the understanding of either.

We propose that there are two principal reasons for the conceptual confusion surrounding motor mimicry. First, there has been a notable failure to maintain the necessary distinction between an observed behavior or class of behaviors (namely, motor mimicry) and any hypothesized constructs or processes that might be inferred from the behavior. That is, motor mimicry may imply an underlying process of empathy or of role taking; it may be caused by a trait, instinct, or prior conditioning. But it is vital to maintain the logical distinction between behavior and construct, because no matter how strong or appealing the inferential link, we only see motor mimicry. The network of constructs to which it is related can only be established—and clarified—by empirical tests involving these constructs.

Here we encounter the second reason for the "riddle" of motor mimicry, namely, the almost complete lack of methods for reliably evoking, recording, and measuring the phenomenon. Without these, only anecdotes and speculation can be adduced to support any interpretation. Thus, while the present paper is purely methodological, it is based on the premise that theories cannot be explored without methods and that the intractability of motor mimicry to explanation has been in large part the result of its inaccessibility to empirical study.

## METHODS

In our experiments, we arrange for the participant to see an evocative incident while we videotape his or her reactions for later analysis. These incidents include, for example, laughter, embarrassment, disgust, and apparent danger or pain. Here we will describe various alternatives for stimuli, recording, scoring, and experimental controls.

The empirical findings described derive from a series of 18 pilot studies involving a total of 199 subjects (73 males and 126 females), all in the same basic procedure.

### *Recording*

The first major requirement is recording this brief, transient reaction for future analyses. Although O'Toole and Dubin (1968) successfully used live observation of both baby feeding and body sway, there is no reason for the phenomenon to disappear as soon as it has happened. Not only its occurrence but also its topography, detail, timing, and relationship to the other's reaction can be more precisely studied from a video record. As Allport said of his photographs, "Had not the camera recorded the strains and stresses in the spectators it would be hard to believe that the watchers are close physical mimics of the [other]" (1961, p. 534). We use a two-camera, split-screen technique because it locks together the subject and what he or she is observing. For example, the stimulus can be on one-quarter to one-half of the screen, with the subject in the remaining half or three-quarters. This is not a case of superfluous technical embellishment of a simple behavior but rather a necessity dictated by the logic of the phenomenon: To understand the resemblance of the reaction of one person to another, one must see simultaneously both persons, both stimulus and response. Recording only the observer would separate the reaction from its context, with at least two consequences. Comparing single-camera to split-screen studies using the same stimuli we have found, first, that the observer's behaviors are even more clearly mimetic when viewed on a split screen. As will be seen in Table 1, below, subjects often swallow, lean, and regulate their reactions in quite precise motor mimicry—too precise and transient to be reliably deduced or even seen when the stimulus is not simultaneously available to the scorer. Second, especially when the incident is "live," the temporal synchrony of the observer's response to the other can only be seen in split-screen. Thus the dyadic aspect of the reaction may be missed when the subject is filmed and studied monadically.

A cumulative time signal projected onto the tape is also very useful, both for identifying particular segments and for measuring latencies and durations.

The reader may be aware that split-screen effects can be accomplished with one camera by placing a large mirror to one side of the person to be filmed. Then the camera can capture both this person and (in the mirror) the stimulus he or she is watching (e.g., Donaghy,

1984), without the expense or space required by special effects equipment for split-screen. Similarly, an on-camera digital clock (with at least tenths of seconds) can replace an electronically generated time signal.

Regardless of equipment, there are the usual decisions about lighting, distance, and focus. These are compounded when videotaped stimuli are used, because the contrast setting that produces the best quality for the subject's viewing will result in a recording of that stimulus that is of quite poor quality; a compromise setting must be found. For live stimuli, there are equally important procedural problems. We always film the stimulus from the viewpoint of the observer, ideally along his or her line of gaze, and (with the camera opposite) film the observer as nearly full-face as possible. This means that live episodes (e.g., an apparent injury enacted by the experimenter) must be virtually choreographed so that a camera is never blocked by the action.

### Scoring

We begin with a simple, qualitative scoring system that is quite reliable and, when converted to percentages, is comparable across stimuli, subjects, and studies. For each stimulus, reactions are designated as clearly (+ +), possibly (+), or not (−) motor mimicry. The distinction between + + and + is *not* a quantitative one but rather one of ambiguity of interpretation. The + + responses are clearly appropriate to the situation of the other, that is, what a person might do in that situation or if he or she were the observed other. The + responses could be motor mimicry but have equally valid alternative interpretations. A single score is given to the entire episode, with precedence given to + + and then + (that is, the − score indicates the absence of any + + or + reaction). For example, reactions to a soccer ball being thrown hard, apparently at the face of another:

- + + = full facial wince or ducking.
- + = response limited to eyes or brows (which could be simply a startle reaction); e.g., exaggerated blinks or raised brows.
- − = smiling, looking interested, blank expression, or looking at experimenter.

Thus, all observed reactions to any stimulus are divided into three classes. Agreement on this classification among up to four inde-

pendent scorers is virtually perfect, especially when the tape can be viewed repeatedly and frame-by-frame.<sup>1</sup>

We should point out two assumptions behind this scoring system. First, we assume that motor mimicry includes not only what the other did but what the other might have done. The spirit of the historical definitions (e.g., "when we see a person struck, we cringe") seems to include "phenomenological mimicry," in that the observer appears to have entered into the situation of the other and to be reacting to that, rather than only mimicking the other. For example, when the soccer ball was thrown, the apparent victim did not in fact duck, yet the observer's ducking should clearly be included.

Second, we are aware that we have limited the above principle by a nomothetic or normative criterion, in that we distinguish between what a person might usually do in the situation (+ +) and what a person would not ordinarily do in that situation (−).<sup>2</sup> It could be argued that some individuals might smile when hurt or even have no detectable expression to minor pain. However plausible this principle may be, it leads to serious measurement problems. Either (1) any reaction or none at all must be called motor mimicry—a tautologous definition; or (2) only idiographic research could be done, in which each individual would serve as his or her own control (e.g., eliciting first the direct reaction in order to define the vicarious reaction for each person).

Other, more specialized approaches to scoring motor mimicry (microanalysis, quantitative measures, and self-report) will be described later. The present system will permit us to describe the results of pilot studies bearing on some of the methods to be described next.

### Stimuli

**Medium.** There are at least four ways in which evocative stimuli can be presented. (1) Originally, we used our own "home-made" video episodes in which incidents were enacted by amateur actors. (2) We have also taken excerpts from documentary films and presented them on videotape (e.g., the stimulus in Table 1, below) and in Bavelas, Black, Chovil, Lemery, and Mullett (1986a). (3) Experimenters have enacted incidents that were real as far as the subjects were concerned (e.g., Bavelas, Black, Lemery, & Mullett, 1986). (4) Experimenters have occasionally described incidents or told stories to

<sup>1</sup>Full scoring details and examples are available from J. B. Bavelas.

<sup>2</sup>Paul Ekman and James Russell made this point clear to us.

subjects (e.g., Bavelas, Black, Chovil, Lemery, & Mullett, 1986b). All of these stimuli have been brief, ranging from less than 5 seconds to 1 minute 55 seconds, with a median of 50 seconds.

When matched as well as possible for theme, there is an increasing probability of definite motor mimicry as one moves from acted video to video documentary to live incidents. For example, comparing live and video stimuli involving pain or danger, 48% vs. 22% of observers made a ++ reaction; 11% vs. 30% made a + reaction; and 41% vs. 48% made a – reaction.

Narration, in the form of either description or story-telling, permits virtually any incident imaginable to be presented in the lab. For example, a description of the experimenter's cutting herself badly, told without facial wincing, evoked exaggerated wincing and vocalizations (sharp intake of breath, "ouch") by the listeners. If the storyteller uses gestures or other movements, these may be mimed by the listener (cf. Bavelas, Black, Chovil, Lemery, & Mullett, 1986b).

**Theme.** In order to show that motor mimicry is a general phenomenon not limited to any particular stimulus or class of stimuli, 20 different evoking stimuli have been used so far. The person observed (live or on film) was displaying laughter, affection, embarrassment, discomfort, or disgust; making a verbal effort (stuttering or searching for a word) or a physical effort (reaching or doing a construction task under time pressure); was in apparent danger (e.g., in a stunt car or having a ball thrown at the face) or in apparent pain due to a simulated cut, burn, shock, hammer blow, or crushed finger.<sup>3</sup> All of these stimuli have evoked some motor mimicry. In order to say which qualitatively different stimuli are more or less evocative, it would be necessary to equate them in medium, intensity, duration, and rate of comprehension—a task well beyond the goal of our pilot work, which was to show that motor mimicry is not limited to specific stimuli such as body sway or pain.

### *Experimental controls*

In order to eliminate alternative explanations, various experimental controls can be used.

Simple controls for the laughter stimuli were necessary to eliminate the joke as a possible stimulus, that is, in order to ensure that any response was to the other's laughter and not to the cause of that

laughter. In one episode, we simply eliminated the initial joke and showed only a woman laughing long and freely and occasionally trying (unsuccessfully) to stop. Fourteen of 16 observers smiled, grinned, or laughed. In another episode (an excerpt from a documentary about Paul Anka), the eliciting joke was deliberately obscured. Because the stimulus and subject were filmed in split-screen with a time signal on the tape, the onset of the viewer's reaction could be matched to the joke vs. Anka's sudden laugh. Eight of 12 participants in one pilot study smiled or laughed, and the responses of six of these eight were clearly timed to the laughter, not the joke.

When stimuli involving sudden pain or danger are presented, the observer's reaction may be a startle response rather than avoidance or a wince. What is needed is a control condition in which there is an equally sudden, loud stimulus but no threat to another person. We used a soccer ball in a net, suspended by a wire like a pendulum from the center of the ceiling at a height that made it appear that the ball would hit the face of the seated "victim" at the end of its swing (whereas in fact its arc was carefully arranged to miss by approximately one inch). In the experimental condition, the experimenter swung the ball, quite hard, in the direction of the victim, who was another experimenter. The victim flinched involuntarily, and the ball hit the wall above her head. In the control condition, no victim was seated in the chair, and the ball hit the wall only, with the same loud noise. In one pilot study, twelve subjects saw both the experimental and control conditions in alternating order across subjects. The ++ reactions (described above) only occurred in the experimental condition.

A control group may also be needed to establish a baseline. For example, in the first experimental study of motor mimicry, O'Toole and Dubin (1968) recorded the "body sway" of an observer watching a reaching actor. These authors were interested in whether subjects would lean forward when the actor leaned forward from each side of a table. They reasoned that more forward than left or right movement would suggest that the subject was "taking the role of the other from the other's point of view" (Mead, 1934). However, they noted that there is the possible confound of static ataxia, i.e., the tendency to sway forward and backward when trying to stand still (Edwards, 1942, 1943). Because static ataxia could produce artifactual forward movements, we devised a control or baseline condition. The actor (on videotape) alternately stood and reached, in 10 second intervals, from each of three sides of a table, so that the subject observed an actor reaching forward for a total of 30 seconds and standing still for a

<sup>3</sup>Detailed descriptions and/or copies are available from J. B. Bavelas.

total of 30 seconds. The question can then be put more precisely: Do subjects sway forward more when the other is reaching than when the other is standing still?

#### *Alternative dependent measures*

As the questions asked about motor mimicry become more subtle, it is often desirable to supplement or replace the simple + +/+/- scoring system with more specialized dependent measures. Three classes of further measures will be described here.

**Microanalysis of synchrony.** The + +/+/- analysis treats the entire stimulus as one event and all motor mimicry occurring during it as equivalent. Unless the stimulus is extremely brief and uniform, this may oversimplify the nature of the response, which often seems to "track" events quite precisely within the stimulus (cf. Bavelas, Black, Chovil, Lemery, & Mullett, 1986a). To explore the possibility of such detailed responses to the other requires a different level of analysis, one that treats the entire episode as a series of smaller, sequential units (microanalysis) and which also focusses on the relationship of the subject's response to the stimulus at any given moment (synchrony analysis). Thus, rather than aggregating and reducing all data from one individual, we would examine it as a behavioral stream of S1-R1, S2-R2, S3-R3. . . .

In video episodes, the stimulus sequence is fixed, so a standardized format across individuals can be used. The successive stimulus events are used as a framework on which to "hang" a subject's reactions. An example of such analysis for three different individuals is given in Table 1. The stimulus is an excerpt from a documentary on hypothermia research, in which volunteers are being prepared with various medical recording devices. The successive scenes, shots, and events are described in the first column.

The stimulus time given is the *onset* of an event, from the observer's point of view, for example, the time at which it is first apparent that the experimenter has an electrode in his hand. Note that some acts continue for a while, so that an event or posture is to be read as continuing until termination is indicated.

The time given for the subject's reaction is also its onset. These reactions may consist of one behavior, which may continue for a while, or of several behaviors that form a continuous unit (e.g., licks lips and swallows). The observer's reactions are aligned with the stimulus events by a simple temporal principle: They are assumed to follow the immediately preceding event. For example, a reaction at

8.82 s is aligned with the stimulus event at 6.48 s (and not the next, at 10.73 s). Thus, the arrow between stimulus and response indicates a presumed sequential connection, a synchrony of the subject's behavior to the situation or behavior of the other.

Analysis by such detailed tabulation reveals that the subjects tilted their heads, swallowed, withdrew, and made "disgust" faces in close synchrony to the film. In fact, the table shows that most behaviors were motor mimicry, closely related to the film—few behaviors were *not* mimetic and even fewer were random "noise." This was probably because the material being viewed is strong and because the medium of television is itself engrossing and minimizes extraneous behaviors.

The strongest case for microanalysis of synchrony is the observer's movement, left or right, forward and backward. What would appear in isolation (e.g., just reading down the column for any individual) to be random shiftings and changes of position can be seen to be a consistent pattern in which the observers move in concert with the volunteer's actions, leaning forward, bobbing, and swaying as he does.

Although such scoring is demanding, it can be done quite reliably. The qualitative descriptions of behaviors such as those in Table 1 present no problem once conventions for terminology have been established; the real question is whether or not a "micro-behavior" occurred at all. This can be assessed by scoring each second of stimulus for the occurrence/nonoccurrence of intentional behavior (e.g., excluding ataxias). For example, for four subjects watching this 120-second stimulus, two independent scorers agreed on 90.8% of the 480 observations.

For "live" incidents, in which the stimulus sequence may vary slightly from experiment to experiment, a simple verbal description is the best initial approximation. For example, in one study, the experimenter (E) appeared to shock himself on some equipment, just as the subject (S) looked at him:

Shock at 3:35.02. S is smiling and tracking the downward movement of E with her eyes. When eye contact is re-established at 3:35.95, S forms an "O" with mouth (losing smile). As eye contact is maintained, S knits brows (at 3:36.25) and has now formed an "ew" expression with whole face. This is held until E begins to smile, at the end of the sequence.

As described in another report (Bavelas, Lemery, Black, & Mullett, 1986), the observer's reactions to such stimuli seem to be not a sim-

TABLE 1  
Examples of Microanalysis of Synchrony

Subject #6	Subject #7	Subject #10
<b>SCENE 1: CHEST AND NECK ELECTRODES</b>		
Shot 1: Full-length shot of V and E: V's head is averted R as E places electrodes on chest from V's L 6.48 E begins placing 1st electrode; 10.73 E begins placing 2nd electrode; 12.76 V begins moving head forward and down 14.33 End of 2nd electrode placement		
8.82 licks lips and swallows	15.23 scratches beard and leans head forward and slightly L	13.35 bobs body and jerks head R
Shot 2: Close-up of V's shoulder Shot 3: Close-up of V's head and neck: E's hands entering from L to place neck electrode 27.98 E pushes V's head hard to R and holds it 28.43 E begins wiping V's neck vigorously 31.88 E stops wiping, removes hand; V's head recoils to L 34.45 V blinks as E's hands approach with electrode 35.58 E presses electrode on neck 4 times . . . 39.00 . . . culminating in a 5th, hard press to R		
28.48 moves head slightly R . . . 30.28 . . . then back 32.96 leans head R, sniffs, and swallows		
36.10 swallows and moves lips		39.53 turns head R, jerks head and shoulders R, blinks/winces, returns head gradually L
Shot 4: Close-up of V's neck, averted R: E's hands entering from L to place neck electrode 42.70 E's hands enter screen holding electrode 43.79 E places electrode on neck and presses 3 times		
43.22 leans head L		
Shot 5: Head and neck only: placement of neck electrode from L 48.95 V turns head R and down 51.75 Electrode placed on neck and pressed 4 times 54.79 End of pressing; V recoils slightly to L 56.95 V begins to reposition head, up and to L		
51.88 tightens (bites?) lips		56.00 leans head R jerkily, then gradually back to L
57.60 jerks head R		
<b>SCENE II: EAR THERMISTER</b>		
Shot 1: Close-up of V's L ear, with head averted to R: E will carefully insert a narrow ear thermister from the L 58.36 V's head wavers back and forth 1:02.06 E's hand appears from L and moves V's hair to expose ear 1:05.43 Insertion begins 1:10.58 Insertion completed 1:10.95 E's hand moves off screen 1:15.36 Camera zooms out to full body shot of V with head leaning L		
1:03.13 purses lips slightly	59.32 looks down to R, then back to screen, with head tilted down and L	1-08.28 jerks head back and L
1:10.20 leans head to L, wavers slightly	1:11.54 jerks head slightly 1:15.58 repositions head to R	
<b>SCENE III: ESOPHAGEAL THERMISTER</b>		
Shot 1: Full-length shot of V sitting facing E: E will insert tube into V's nose and push it down to level of heart 1:25.93 Insertion begins 1:28.09 V winces, blinks, and wrinkles nose 1:32.64 V's head pushed back by insertion; he winces. As insertion continues, V drinks water, winces hard, and wrinkles nose several times. 1:42.12 V gags after drinking water; gags become stronger and convulsive 1:46.90 Insertion completed, gagging stops 1:48.72 V begins to return to upright, moving head and body forward and head slightly R 1:52.86 V exhales (relaxes) after tube secured, swallows, and continues easier breathing 1:59.55 stimulus ends		
1:26.16 pulls back corners of mouth 1:28.68 pulls back right side of mouth 1:31.60 wrinkles nose, pulls back both sides of mouth	1:45.80 pulls up corner of mouth 1:48.40 tightens cheek muscles? 1:49.35 moves head down and R (1:57.33 bobs head slightly) (1:59.23 sniffs, shifts L in chair, and moves head L)	1:27.98 furrows brow and winces, wrinkles nose, and pulls up corner of mouth 1:43.22 furrows brows, wrinkles nose, jerks head down and up, draws mouth in and up 1:53.08 winces slightly

## Notes:

V = volunteer.

E = experimenter.

L and R are given from the actor's (V's or E's) own perspective.

Time is given in minutes:seconds hundredths of seconds.

() = reaction probably not mimetic.

ple relax but strongly linked to the communicative relationship with the experimenter. Subjects tracked not only the initial injury but also the subsequent eye contact (or lack thereof), changing in micro-synchrony as the sequence changed within the few seconds or less that the episodes lasted. This tracking is in fact so precise that we have found it necessary to do "micro-experiments" with live stimuli, that is, to rehearse the experimenter's behavior until it is standard to within tenths of seconds. Otherwise, the synchronous variation in the observer's behavior greatly complicates the analysis.

**Quantitative measures.** Some specific stimuli and recordings can be set up so that motor mimicry is captured quantitatively. For example, the "body sway" procedure described above can be scored quantitatively as the "range of movement," the difference (in cm) between the maximum forward and backward movement for each 10 s interval. Reliability between one scorer and two other, independent scorers was .97 and .99.

We have also used "naive decoders" to rate the meaning of facial motor mimicry (Bavelas, Black, Lemery, & Mullett, 1986). Intra-class reliability coefficients for the degree of caring, awareness, and appropriateness were .87, .88, and .89.

**Self-report.** To supplement the nonverbal reactions, observers can be asked afterwards about what they experienced while watching the stimulus. We usually do this in two stages, starting first with an open-ended question ("Would you describe your internal reactions while watching X?") and then following up with more specific probes (e.g., for the Stuttering episode: "Were you feeling like you were trying to complete the words? Were you saying them in your head?"). The responses, either written or recorded on videotape, can be scored to yield results comparable to the  $++/+/-$  system.<sup>4</sup> The pair-wise agreement among three judges was calculated (in simple percentages) separately for the self-reports based on the open-ended first question (80–82%) and for the complete response including answers to the more "leading" follow-up questions (87–92%). Thus it appears that acceptable levels of agreement can be obtained even for answers to the broadest possible question and that this agreement is improved by the addition of answers to more specific questions.

An example of the possible use of self-report data is the following: We showed 40 subjects (20 male, 20 female) a video incident in

which the actor hit his or her finger with a hammer while building a box. (Sex of actor was counterbalanced.) The male vs. female comparisons for overt motor mimicry were 0% vs. 15%  $++$ , 10% vs. 25%  $+$ , and 90% vs. 60%  $-$ . For these responses, there is a significant sex-of-subject effect for  $++$  and  $+$  vs.  $-$  (Chi-square on the raw frequencies = 4.8,  $df = 1$ ,  $p < .05$ .) However, for the self-reported answers to the question, "What were your internal feelings when he/she hit him/herself with the hammer?" the male vs. female comparisons were 35% vs. 32%  $++$ , 10% vs. 5%  $+$ , 55% vs. 63%  $-$  (Chi-square = .27,  $df = p > .10$ ). This suggests that there may be a gender difference in display of motor mimicry but not in self-reported vicarious experience, a discrepancy of potential theoretical interest.

## CONCLUSION

The classic phenomenon of elementary motor mimicry, which has remained principally anecdotal for at least two hundred years, need not remain outside experimental study. Clearly, a class of such phenomena exists, and these reactions can be evoked, recorded, and measured in the lab. The techniques described here can be used to examine this deceptively simple phenomenon more closely. By varying and studying its antecedents and correlates, we may begin to understand its theoretical meaning and its function as nonverbal behavior. While our group is pursuing the hypothesis that it is a nonverbal communication (Bavelas, Black, Lemery, & Mullett, 1986 and in press), this is not the only possibility. Motor mimicry may be, as has been proposed, evidence of an instinct, of prior conditioning, of cognitive identification with the other, of vicarious emotion, of individual differences in empathic understanding—or of none of these. Now that a systematic methodology is available, we are in a position to begin to explore the nature of the phenomenon.

## REFERENCES

- Allport, G. W. *Personality. A psychological interpretation*. New York: Holt, 1937.
- Allport, G. W. *Pattern and growth in personality*. New York: Holt, Rinehart, and Winston, 1961.
- Allport, G. W. The historical background of modern social psychology. In G. Lindzey & E. Aronson (Eds.), *Handbook of social psychology* (2nd ed.,) 1968, (Vol. 1, pp. 1–80). Reading, Mass: Addison-Wesley Publishing Co.

<sup>4</sup>Full scoring details and examples are available from J. B. Bavelas.



- Argyle, M. *The psychology of interpersonal behavior* (2nd ed.). New York: Pelican, 1972.
- Baldwin, J. M. *Mental development in the child and in the race*. New York: Macmillan, 1895.
- Baldwin, J. M. *Social and ethical interpretations in mental development*. New York: Macmillan, 1897.
- Batson, C. D., Duncan, G. D., Ackerman, P., Buckley, T., & Birch, K. Is empathic emotion a source of altruistic motivation? *Journal of Personality and Social Psychology*, 1981, 40, 290–302.
- Bavelas, J. B., Black, A., Chovil, N., Lemery, C. R., & Mullett, J. Evidence for microsynchrony of nonverbal behaviour to a video stimulus. Unpublished manuscript, University of Victoria, 1986a.
- Bavelas, J. B., Black, A., Chovil, N., Lemery, C. R., & Mullett, J. Form and function in motor mimicry. Unpublished manuscript, University of Victoria, 1986b.
- Bavelas, J. B., Black, A., Lemery, C. R., & Mullett, J. "I show how you feel." Motor mimicry as a communicative act. *Journal of Personality and Social Psychology*, 1986, 50, 322–329.
- Bavelas, J. B., Black, A., Lemery, C. R., & Mullett, J. Motor Mimicry as primitive empathy. In N. Eisenberg & J. Strayer (Eds.), *Empathy: A developmental perspective*. New York: Academic Press, in press.
- Bender, I. E., & Hastorf, A. H. On measuring generalized empathic ability (social sensitivity). *Journal of Abnormal and Social Psychology*, 1953, 48, 503–506.
- Berger, S. M. Conditioning through vicarious instigation. *Psychological Review*, 1962, 69, 450–466.
- Berger, S. M., & Hadley, S. W. Some effects of a model's performance on an observer's electromyographic activity. *American Journal of Psychology*, 1975, 88, 263–276.
- Berger, S. M., Irwin, D. S., & Frommer, G. P. Electromyographic activity during observational learning. *American Journal of Psychology*, 1970, 83, 86–94.
- Craig, K. D., & Weinstein, M. S. Conditioning vicarious affective arousal. *Psychological Reports*, 1965, 17, 955–963.
- Darwin, C. *The expression of the emotions in man and animals*. Chicago: The University of Chicago Press (originally published 1872), 1965.
- Davis, M. H. Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology*, 1983, 44, 113–126.
- Donaghy, W. C. *Data collection and analysis approaches in nonverbal behavior research*. In A. Wolfgang (Ed.), *Nonverbal Behavior*, Lewiston, New York: C.J. Hogrefe, 1984.
- Dymond, R. F. A scale for the measurement of empathic ability. *Journal of Consulting Psychology*, 13, 1949, 127–133.
- Edwards, A. S. The measurement of static ataxia. *American Journal of Psychology*, 1942, 55, 171–188.
- Edwards, A. S. Factors tending to decrease the steadiness of the body at rest. *American Journal of Psychology*, 1943, 56, 599–602.
- Feshbach, N. D. Empathy in children: Some theoretical considerations. *The Counseling Psychologist*, 5, 1975, 25–30.
- Haase, R., & Tepper, D. T. Nonverbal components of empathic communication. *Journal of Counseling Psychology*, 1972, 5, 417–424.
- Hoffman, M. L. Developmental synthesis of affect and cognition and its implications for altruistic motivation. *Developmental Psychology*, 1975, 11, 607–622.
- Holt, E. B. *Animal drive and the learning process*. New York: Holt, 1931.
- Hull, C. L. *Hypnosis and suggestibility*. New York: Appleton-Century, 1933.
- Kerr, W. A., & Speroff, B. J. *The measurement of empathy*. Chicago: Psychometric Affiliates, 1951.
- Köhler, W. *The mentality of apes* (2nd ed.) [translated from the 2nd revised edition by Ella Winter]. New York: Harcourt, 1927.
- Krebs, D. Empathy and altruism. *Journal of Personality and Social Psychology*, 1975, 32, 1134–1146.
- Kupferer, H. J. K. Couvade: Ritual or real illness. *American Anthropologist*, 1965, 67, 99–102.
- Markovsky, B., & Berger, S. M. Crowd noise and mimicry. *Personality and Social Psychology Bulletin*, 9, 1983, 90–96.
- Martin, G. B., & Clark, R. O. Distress crying in neonates: Species and peer specificity. *Developmental Psychology*, 1982, 18, 3–9.
- McDougall, W. *Introduction to social psychology*. London: Methuen, 1908.
- Mead, G. H. *Mind, self, and society*. (C. M. Morris, Ed.). Chicago: University of Chicago Press, 1934.
- Miller, G. R., & Steinberg, M. *Between people*. Chicago: Science Research Associates, 1975.
- Miller, N. E., & Dollard, J. *Social learning and imitation*. New Haven: Yale University Press, 1941.
- O'Toole, R., & Dubin, R. Baby feeding and body sway: An experiment in George Herbert Mead's "taking the role of the other." *Journal of Personality and Social Psychology*, 1968, 10, 59–65.
- Ribot, T. *The psychology of the emotions*. London: W. Scott, 1897.
- Rogers, C. Empathic: An unappreciated way of being. *The Counseling Psychologist*, 1975, 5, 2–9.
- Scheler, M. *The nature of sympathy* (2nd ed., transl P. Heath). New Haven: Yale University Press, 1923/1954.
- Smith, A. *The theory of moral sentiments*. London: A. Miller, 1759.
- Spencer, H. *The principles of psychology* (2nd ed., Vol. 1). London: Williams and Norgate, 1870.
- Stotland, E. Exploratory investigations of empathy. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 4). New York: Academic Press, 1969.
- Strunk, O., Jr. Empathy: A review of theory and research. *Psychological Newsletter*, 1957, 9, 47–57.
- Wiemann, J. M. Explication and test of a model of communicative competence. *Human Communication Research*, 1977, 3, 195–213.