

Persuasion

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GLOSSARY

Attitude General evaluative response or disposition to respond

Influence Effect of events and others on behavior

Persuasion Power of persons to alter attitudes and behavior through information

ALL ORGANISMS HAVE BIOLOGICAL MECHANISMS for approaching, acquiring, or ingesting certain classes of stimuli and withdrawing from, avoiding, or rejecting others. For simple organisms, the stimuli that potentiate approach or withdrawal, the form of the response, and the mediating mechanisms are relatively fixed. For more complex organisms such as humans, multiple mechanisms contribute to approach and withdrawal tendencies; this potentiation can manifest consciously (cognitively, emotionally) as well as behaviorally and can be stored in memory in the form of attitudes, and both the eliciting stimulus and the form of the response are subject to generalization

and modification. Persuasion refers to the power of persons to alter attitudes and behavior through information. Attitude and behavior change resulting from a communication constitute persuasion regardless of the communicator's intent or the recipient's awareness that an attitude has been changed. Not included under the rubric of persuasion are changes in knowledge or skill (i.e., education) or changes in behavior that require another's surveillance or sanctions (i.e., compliance). Persuasion, therefore, represents a form of self-control and social control that does not rely on coercion. In addition, innate and relatively inflexible predilections to approach or withdraw—such as reflexes or fixed action patterns—and irreversible changes in parameters of approach or withdrawal—such as diminished response vigor due to aging—may be related to attitudes but are not considered instances of persuasion. Traditionally, studies of the antecedents of persuasion have focused on characteristics of the source of a recommendation and on rational or emotional forms of argumentation linking a particular recommendation to a person's beliefs and values. Any information that changes an individual's predilection to react to a class of persons, objects, or issues in a consistently positive or negative fashion could be included under the rubric of persuasion, however. Studies of the consequences of persuasion have tended to focus on changes in attitudes and cognition and the persistence of these changes, but the physiological and behavioral effects have also been investigated.

I. ATTITUDES AND PERSUASION

People's perceptions of events and people in their world are organized in part in terms of long-term

evaluative responses to stimuli. This organization is reflected in the structure of language; people's conceptual organization of motivation, emotions, and moods; facial expressions of emotion; and everyday behaviors. The evaluative (attitudinal) categorization of stimuli has even been found to emerge in some circumstances prior to an individual recognizing the eliciting stimulus.

Attitudes, in turn, influence what people perceive and feel about their world and can have direct and indirect effects on behavior across a wide range of situations. The direct effect of attitudes on behavior represents the tendency for people to approach, acquire, support, protect, and promote liked, in contrast to disliked, objects, persons, and issues. Although there may be intervening psychological operations between attitudes and behavior, such as accessing the relevant attitude and formulating a behavioral intention, these operations pertain primarily to the response side of the information-processing sequence (e.g., response execution). Promotional campaigns for products in stores, for instance, are designed simply to mobilize people to try the products. Finally, the causal relationship between attitudes and behavior is reciprocal rather than unidirectional. The feedback from actions or inactions toward some target constitutes a powerful source of information that can shape subsequent beliefs and attitudes about the target. Product trials can provide compelling reasons to individuals for purchasing, or not purchasing, particular products again. [See *Attitude and Attitude Change*.]

The indirect effect of attitudes on behavior stems from their influence on individuals' selective attention to, interpretation of, and recollection of people and events in their world and, subsequently, on their behavior and on the behavior of others toward them. In addition to the direct behavioral effects of attitudes, therefore, attitudes can also shape an individual's experience and representation of the world. If information favoring both sides of an issue is presented to groups with opposing attitudes, the discrepancy between the groups' attitudes might intuitively be expected to diminish somewhat. The opposite result has been found to be the case, however. Individuals often accept the evidence that supports their initial attitude and are critical of the evidence contradicting their initial attitude. The result is that both groups find reasons to strengthen their initial attitude, and disagreement between the two groups can actually be heightened by information favoring both positions.

In addition to having a directive function that channels activity into specific types of responses toward

certain stimuli, attitudes have also been viewed by some as having the dynamic function of energizing people to act. Thus, individuals who come to feel strongly about another person, topic, or issue may not only channel their thoughts and behavior toward the target accordingly when given the opportunity, but may also be excited to create opportunities to act in a positive or negative fashion toward the target.

In sum, attitudes are central to people's conceptual organization of their world and to the organization of their behavior. Because both attitudes and behavior are multiply determined, the correspondence between attitudes and behavior tends to be modest but significant. The correspondence between attitudes and behavior can be enhanced by: (1) general rather than specific measures of attitudes and behaviors, (2) direct experience with the attitude target, (3) prior knowledge and thought about the target, (4) a highly accessible attitude toward the target, (5) weak social norms governing behavior toward the target, (6) personal control over one's behavior toward the target, (7) strong attitudes, and (8) chronic tendencies by individuals to think about the reasons for their attitudes. By influencing attitudes and factors that moderate attitude-behavior correspondence, persuasion can potentiate a broad class of positive or negative behaviors toward a person, object, or issue.

II. TWO ROUTES TO PERSUASION

A. Background

The resolution of conflicts and the mobilization of effort to serve the goals of a collective are cornerstones of civilization. The history of humankind reveals physical force and intimidation—not persuasive skill—to be the key mode of achieving political, social, and economic control. William McGuire has noted that persuasion has played a central role in social control in only four epochs: Athens from 427 to 338 B.C. (during which time Plato and Aristotle considered the processes underlying persuasion), Rome from approximately 150 to 43 B.C. (during which time Cicero wrote about oration and persuasion), in Europe from approximately 1470 to 1572 (during the Italian Renaissance), and the present period of the mass media, which began to take form in the eighteenth century. The scientific study of what and how factors affect persuasion gained momentum during World War II, when the mass media played an important role in recruiting and indoctrinating troops, maintaining the

morale of the Allied forces and residents, and assaulting the morale of the Axis troops.

This early research was organized by the question "who said what to whom, how, and with what effect"—that is, in terms of the external stimulus factors of source (e.g., expertise, trustworthiness), message (e.g., one-sided, two-sided), recipient (e.g., sex, intelligence), and modality (e.g., print, auditory). Two assumptions underlying much of this early work were that each of these factors had general and independent effects on persuasion and that a close correspondence existed between attitude change and behavior change across situations. Both assumptions proved to be oversimplifications. After accumulating a vast quantity of data and a large number of theories, there was surprisingly little agreement concerning if, when, and how the traditional source, message, recipient, and modality variables affected persuasion. Existing literature supported the view that nearly every independent variable studied increased persuasion in some situations, had no effect in others, and decreased persuasion in still other contexts. This diversity of results was even apparent for variables that on the surface, at least, appeared to be quite simple. For example, although it might seem reasonable to propose that by associating a message with an expert source, agreement could be increased (e.g., see Aristotle's "Rhetoric"), experimental research suggested that expertise effects were considerably more complicated. Sometimes expert sources had the expected effects, sometimes no effects were obtained, and sometimes reverse effects were noted.

B. The Central and Peripheral Routes to Persuasion

Empirical and theoretical advances over the past decade have led to a more comprehensive framework for organizing, categorizing, and understanding the basic processes underlying these diverse effects. Specifically, the many different empirical findings and theories in the field have been viewed as emphasizing one of two relatively distinct *routes to persuasion*. The first is attitude change that occurs as a result of a person's careful and thoughtful consideration of the merits of the information presented in support of an advocacy (*central route*). The second is that occurring as a result of some simple cue in the persuasion context (e.g., an attractive source) that induces change without necessitating scrutiny of the merits of issue-relevant information (*peripheral route*). This model of the psychological operations underlying persuasion,

which is depicted in Fig. 1, highlights that attitudes are multiply determined and that attitudes whose verbal expression is similar may have different antecedents and consequences. For instance, the issue-relevant thinking that characterizes the central route to persuasion can result in the integration of new arguments, or one's personal translations of them, into one's underlying belief structure for the attitude object. In addition, by scrutinizing the strengths and weaknesses of a recommendation, the information and the consequent attitude are rendered more coherent, accessible, and cross-situational. Attitudes formed through the central route, therefore, are relatively persistent, resistant to counterpersuasion, and predictive of behavior.

If people were to try to adopt only those attitude positions about which they had thought carefully, they either would be unable to venture into novel situations or would be unable to respond to the myriad stimuli to which they are exposed each day. This is true even though individuals might be motivated generally to hold "correct" attitudes. The numerous stimuli to which individuals must respond daily, coupled with individuals' limited time and cognitive resources, make it adaptive to also be capable of using cognitively less demanding shortcuts (e.g., simple cues, habits, rules-of-thumbs) to guide attitudinal reactions in some situations. Although such a mechanism for attitude change (peripheral route) can guide responses to a wide variety of stimuli while minimizing the demands on individuals' limited cognitive resources, the resultant attitudes and behavior are based on information that is only superficially or peripherally related to the actual merits of the position. Hence, some responses potentiated by this generally adaptive mechanism may be unreasonable and maladaptive. These maladaptive features of attitudes derived through the peripheral route are diminished somewhat by their relatively short persistence, susceptibility to change, and weak influence on behavior.

C. The Elaboration Likelihood Continuum

The model outlined in Fig. 1 has provided a general framework for understanding how a variety of factors, such as speed of speech and source credibility, can increase, decrease, or have no effect on attitude change. If the central route is followed, the perceived cogency of the message arguments and factors that may bias argument processing (e.g., prior knowledge, initial opinion) are predicted to be important determinants of the individual's acceptance or rejection of

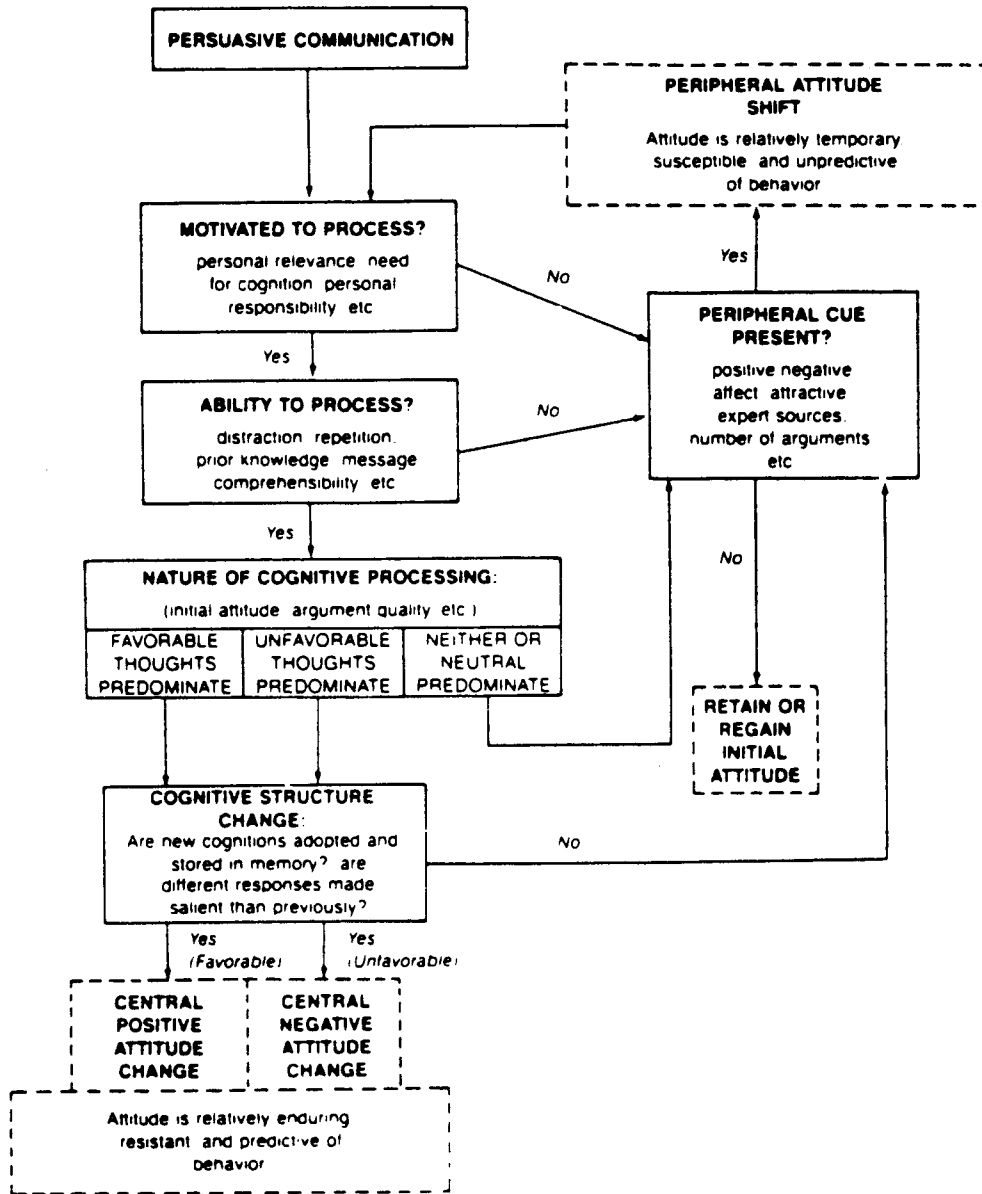


FIGURE 1 The elaboration likelihood model of persuasion. This figure depicts the two anchoring end points on the elaboration likelihood continuum: the central and peripheral routes to persuasion. [From R. E. Petty and J. T. Cacioppo, 1986, "Communication and Persuasion: Central and Peripheral Routes to Attitude Change," Springer-Verlag, New York.]

the recommendation, and factors in the persuasion setting that might serve as peripheral cues are relatively unimportant determinants of attitudes. If, on the other hand, the peripheral route is followed, then the strength of the message arguments and factors that bias argument processing become less important and peripheral cues become more important determi-

nants of attitudes. That is, there is a trade-off between the central and the peripheral routes to persuasion.

Importantly, the conditions that lead to influence through the central versus the peripheral route have also been specified. For instance, many attitudes and decisions are either perceived to be personally inconsequential or involve matters about which people are

uninformed. In these situations, people may still want to be correct in their attitudes and actions, but they are not willing or able to think a great deal about the arguments for or against a particular position. Peripheral cues provide a means of maximizing the likelihood that one's position is correct while minimizing the cognitive requirements for achieving this position.

Implicit in the central route, on the other hand, is that people must relate the incoming message arguments to their prior knowledge in such a way as to evaluate the cogency and scope of the arguments—that is, they expend cognitive effort to examine the information they perceive to be relevant to the central merits of the advocacy. When conditions foster people's motivation and ability to engage in this issue-relevant thinking, the *elaboration likelihood* is said to be high. This means that people are likely to attend to the appeal, attempt to access relevant information from both external and internal sources, and scrutinize or make inferences about the message arguments in light of any other pertinent information available. Consequently, they draw conclusions about the merits of the arguments for the recommendation based on their analyses and derive an overall evaluation of, or attitude toward, the recommendation. Thus, the central and the peripheral routes to persuasion can be viewed as anchors on a continuum ranging from minimal to extensive message elaboration or issue-relevant thinking, and issue-relevant thinking may be relatively objective or biased. Factors governing an individual's motivation and ability to scrutinize the truthfulness of various attitude positions determine whether the central or the peripheral route operates.

D. Determinants of the Likelihood That Issue-Relevant Thinking Mediates Persuasion

Motivational variables are those that propel and guide people's information processing and give it purposive character. There are a number of variables that have been found to affect a person's motivation to elaborate on the content of a message. These include: (1) task variables such as the personal relevance of the recommendation, (2) individual difference variables such as need for cognition, and (3) contextual variables such as the number of sources advocating a position. These kinds of variables act on a directive, goal-oriented component that might be termed *intention* and a nondirective, energizing component that might be termed *effort or exertion*.

Intention is not sufficient for motivation, for instance, since one can want to think about a message or issue but not exert the necessary effort to move from intention to thought and action. If both intention and effort are present, then motivation to think about the advocacy may exist, but message elaboration may still be low because the individual does not have the ability to scrutinize the message arguments. There are a number of variables that can affect an individual's ability to engage in message elaboration, including *task variables* such as message comprehensibility, *individual difference variables* such as intelligence, and *contextual variables* such as distraction and message repetition. Contextual variables that affect a person's ability to elaborate cognitively on issue-relevant argumentation can also be characterized as factors affecting a person's opportunity to process the message arguments.

Experiments have demonstrated that if task, individual, and contextual variables in the influence setting combine to promote motivation and ability to process, then the arguments presented in support of a change in attitudes or behavior are thought about carefully. If the person generates predominantly favorable thoughts toward the message, then the likelihood of acceptance is enhanced; if the person generates predominantly unfavorable thoughts (e.g., counterarguments), then the likelihood of resistance or boomerang (attitude change opposite to the direction advocated) is enhanced. The nature of this elaboration (i.e., whether favorable or unfavorable issue-relevant thinking) is determined by whether the motivational and ability factors combine to yield relatively objective or relatively biased information processing and by the nature of the message arguments. If elaboration likelihood is low, however, the nature of the issue-relevant thinking is less important, and peripheral cues become more important determinants of attitude change (see Fig. 1).

A number of experiments have explored ways to stimulate or impair thinking about the message arguments in a persuasive appeal. Distraction, for instance, can interfere with a person's scrutiny of the arguments in a message and thereby alter persuasive impact. In an illustrative experiment on distraction and persuasion, students listened to a persuasive message over headphones while monitoring in which of the four quadrants of a screen a visual image was projected (a distractor task). In the low-distraction condition, images were presented once every 15 seconds, whereas in the high-distraction condition, images were presented once every 5 seconds. Importantly, neither rate of

presentation was so fast as to interfere with the students' comprehension of the simultaneously presented persuasive message, but the students' argument elaboration was much more disrupted in the high- than in the low-distraction condition. The results revealed that the students' postcommunication attitudes were a function of message processing when distraction was low but not when distraction was high.

Numerous task, contextual, and individual difference variables have been identified that enhance or impair argument elaboration by affecting a person's motivation or ability. Moderate levels of repetition of a complicated message can provide individuals with additional opportunities to think about the arguments and, thereby, enhance argument processing. Messages worded to underscore the self-relevance of the arguments enhance individuals' motivation to think about the arguments. Being singly responsible rather than one of many assigned to evaluate the recommendation can induce more issue-relevant thinking, as individuals are unable to diffuse their responsibility for determining the veracity of the recommendation.

III. ARGUMENT ELABORATION VERSUS PERIPHERAL CUES AS DETERMINANTS OF PERSUASION

The hypothesis that there is a trade-off between argument scrutiny and peripheral cues as determinants of a person's susceptibility or resistance to persuasion has also been supported by more than a decade of research. In an illustrative study, two kinds of persuasion contexts were established: one in which the likelihood of relatively objective argument elaboration was high and one in which the elaboration likelihood was low. This was accomplished by varying the personal relevance of the recommendation: students were exposed to an editorial favoring the institution of senior comprehensive exams at their university, but some students were led to believe that these comprehensive exams would be instituted next year (high elaboration likelihood) whereas others were led to believe that the exams would be instituted in 10 years (low elaboration likelihood).

To investigate the extent to which students' argument scrutiny determined attitudes, half of the students heard eight cogent message arguments favoring comprehensive exams, and the remaining students heard eight specious message arguments favoring the exams. Finally, to examine the extent to which periph-

eral cues were important determinants of attitudes, half of the students were told that the recommendation they would hear was based on a report prepared by a local high school class (low expertise), whereas half were told that the tape was based on a report prepared by the Carnegie Commission on Higher Education (high expertise). Following the presentation of the message, students rated their attitudes concerning comprehensive exams and completed ancillary measures. Results indicated that argument quality was the most important determinant of the students' attitudes toward comprehensive exams when they believed that the recommendation was consequential for them personally, but that the status or expertise of the source was the most important determinant of the students' attitudes when they believed that the recommendation would not affect them personally. These results held even though comprehension of the message arguments, and judgments of the expertise of the source, were equal across the experimental groups.

IV. OBJECTIVE VERSUS BIASED ARGUMENT PROCESSING

Message processing in persuasion research was traditionally thought to imply objective processing. This, too, proved to be an oversimplification. When an individual is motivated to scrutinize arguments for a position, there are no assurances that the information processing will be objective or rational. *Objective argument processing* means that a person is trying to seek the truth wherever that may lead. When a variable enhances argument scrutiny in a relatively objective manner, the strengths of cogent arguments and the flaws in specious arguments become more apparent. Conversely, when a variable reduces argument scrutiny in a relatively objective fashion, the strengths of cogent arguments and the flaws of specious arguments become less apparent. Objective processing, therefore, has much in common with the concept of "bottom-up" processing in cognitive psychology because elaboration is postulated to be relatively impartial and guided by data (in this case, message arguments).

In contrast, *biased argument processing* means that there is an asymmetry in the activation thresholds for eliciting favorable or unfavorable thoughts about the advocacy. Consequently, the encoding, interpretation, and recall of the message arguments are distorted to make it more likely that one side will be supported over another. Biased processing has more in common

with "top-down" than "bottom-up" information processing, because the interpretation and elaboration of the arguments are governed by existing cognitive structures, such as a relevant knowledge or attitude schema, which guide processing in a manner favoring the maintenance or strengthening of the original schema. Research on factors such as the role of initial attitudes described in Section I has demonstrated that people are sometimes motivated and able to augment even specious arguments to arrive at a more cogent line of reasoning for their desired position.

V. PERSUASION VARIABLES HAVE MULTIPLE AND INTERACTIVE EFFECTS

Another reason why the processes underlying persuasion have appeared enigmatic is that some variables may increase argument processing at one level of the factor, but may actually bias or decrease argument processing at a different level of that factor. For instance, repeating a long or complicated persuasive message can provide individuals with additional opportunities to think about the message arguments and, therefore, enhance relatively objective argument scrutiny. Excessive exposures to a persuasive message can become tedious, however, and can actually motivate a person to reject the recommendation. Hence, the same stimulus factor—message repetition—had quite different effects on issue-relevant thinking as the amount of this factor increased.

Factors previously thought to have simple effects on information processing and persuasion have also been found to have quite different effects depending on the presence or absence of other factors. For instance, presenting a persuasive message on a noninvolving issue in rhetorical rather than declarative form can increase an individual's propensity to think about the message arguments. When the recommendation is already personally involving, however, the insertion of rhetorical questions in the message arguments can actually interfere with the individual's ongoing idiosyncratic argument scrutiny.

In sum, the introduction of new factors (e.g., arguments presented in rhetorical rather than declarative form) can have striking but explicable effects on people's cognitive processes and attitudes. Current models of persuasion are now able to account for rather complicated patterns of data even though the intervening processes are fairly straightforward.

VI. BIOLOGICAL ASPECTS OF ATTITUDES AND PERSUASION

Despite early conceptualizations of attitudes as postural orientations and neural predispositions to respond, programmatic research on the biological mechanisms underlying attitudes and persuasion is fairly recent. This gap in theory and research on persuasion is due in part to the methodological approaches championed by the pioneers in the field, the interest by early theorists in applying persuasion research to address social problems (e.g., wartime propaganda), and the relative ease for governments and institutions to manipulate environmental rather than biological factors to achieve social control. Occasionally, study of the biological aspects of attitudes and persuasion has been dismissed because attitudes are said to be acquired through experience, as if environmental influences were antithetical to biological mechanisms. More recently, attention is being paid to the physiological manifestations by which the elementary psychological operations underlying persuasion can be indexed and to the physiological mechanisms through which attitudes and persuasion are accomplished.

A. Genetic Factors

The achievement of strong behavioral proclivities in animals through selective breeding (e.g., herding behavior in border collies, aggressiveness in the pit bull) raises the possibility that some attitudes, and the manner in which individuals respond to information pertinent to attitude change, may be partially determined genetically. The existing data, though sparse, support both possibilities. Most studies bearing on the genetic contributions to attitudes and persuasion are based on the similarities observed between monozygotic twins reared apart from an early age. These studies have documented genetic contributions to individual differences in general intelligence, positive and negative affective dispositions, interests, general social attitudes (e.g., liberalism/conservatism), and job satisfaction. Although some of the individual differences shaped by genetic factors may influence attitudes directly, most of these dispositional factors (e.g., intelligence, affective disposition, interests, values) would likely influence attitudes and persuasion by increasing objective or biased message processing or by affecting what constitutes a compelling argument or peripheral cue to a particular individual.

The contribution of genetic factors tends to be modest, so that environmental factors are also major determinants of attitudinal reactions. Perhaps a more important finding to emerge from research on behavioral genetics is that genetic and environmental factors are not as separable as once thought. Environmental factors can inhibit or trigger the expression of genetic influences, and genetic factors can lead individuals to seek and remain in certain environments. Monozygotic twins reared apart, for instance, have been found not only to express similar levels of satisfaction with their jobs, but to hold jobs that are similar in terms of complexity, motor skills, and physical demands. Possible mechanisms of heritability for this finding range from affective disposition to cognitive and physical capacity.

B. *In Utero* Factors

Based on the billions of dollars spent annually each year on advertising, it has been estimated that the average person in the United States has the potential to be exposed to over 1400 persuasive appeals per day. Even if only a small fraction of these appeals are effective, this deluge of appeals suggests that an individual's attitudes are under nearly constant challenge. As noted earlier, attitudes based on little prior knowledge are particularly susceptible to change. One of the more surprising findings is that repeated, unreinforced exposures to a novel or unfamiliar stimulus result in a positive attitude toward the stimulus. That is, repeated exposure to a novel stimulus that results in neither reward nor punishment breeds preference for this stimulus over a similar stimulus to which an individual has not been exposed. This *mere exposure* effect has been demonstrated using stimuli as diverse as nonsense words, ideographs, polygons, and faces, and the mere exposure effect is enhanced by factors such as a heterogeneous exposure sequence, a moderate number of presentations of the target stimulus (e.g., less than 100), brief exposure durations (e.g., less than 5 sec), and a delay between the stimulus presentations and attitude measurement.

Attitude change due to information emanating from the environment has also been documented *in utero* and appears to be a variation on the mere exposure effect. In an illustrative study, pregnant women recited a speech passage aloud each day during their last 6 weeks of pregnancy. Their newborns were tested within a few days following birth to determine whether the sounds of the recited passage were more reinforcing (i.e., preferred) than the sounds of a novel

passage. A matched group of newborns who had not been exposed previously to either passage were also tested to determine whether one passage was simply more likeable. Results revealed that the passage to which the fetuses had been exposed during the third trimester was preferred over the comparison passage, whereas the matched group of newborns exhibited no preference for one over the other passage. *In utero* recordings indicate that the auditory frequencies to which fetuses are exposed range between approximately 125 and 1000 Hz. The fundamental frequency of the speech of women, but not men, tends to fall within this frequency range. As would be expected, therefore, this "mere exposure" effect is not found for fathers' voices, but instead a preference for paternal voices over less familiar male voices develops postnatally once paternal voices have become perceptually salient among other male voices.

C. Autonomic Factors

The activity of the autonomic division of the peripheral nervous system has been of interest in studies of attitudes and persuasion because it was thought to reflect, if not represent, the emotional substrate of attitudes and attitude change. Reports of the autonomic differentiation of attitudes and emotions appear occasionally, but the autonomic responses found to differentiate hedonic states have tended to differ across studies, as factors such as the implications of the attitude for an individual's action vary. A more robust finding to emerge from psychophysiological research is that autonomic activity varies as a function of the intensity of the emotion (regardless of valence), cognitive effort, and behavioral effort aroused by an attitude object or persuasive appeal. In an illustrative study, students indicated their agreement or disagreement with 20 controversial statements. Several weeks later students were tested individually while a measure of autonomic activation—palmar skin resistance—was recorded. The 20 statements were again read to each student, but in addition students were told that a fictitious majority of their peers held a similar or dissimilar attitude. Students were then asked to restate their original attitude toward each statement, at which time skin resistance was measured. The major finding was that autonomic activity was higher the greater the discrepancy between the attitudes of the student and the fictitious majority, except when students were absolutely confident of their original attitude.

General autonomic arousal, as might be achieved by exercise or by watching a sexually explicit film,

has also been found to enhance an individual's normal affective reaction to an unrelated but evocative stimulus presented several minutes after the initial evocative stimulus. The specific mechanism responsible for this effect is not entirely clear, although the effect appears to be limited to instances in which (1) the second stimulus itself elicits a clear and dominant affective response and (2) the second stimulus is presented while individuals' autonomic activity is still elevated from the initial evocative stimulus but the individuals no longer feel aroused. More recent studies that have examined the effect of exercise-induced arousal on argument scrutiny and persuasion have found that peripheral cues (e.g., celebrity status) have a greater influence on attitudes at high than at moderate levels of arousal, whereas the quality of the message arguments has a greater influence at moderate than at high levels of arousal.

D. Somatic Factors

Attitudes were defined initially in terms of a postural orientation and the resulting disposition for an ensuing action. Subsequent theory and experimentation has focused on the latter dynamic component evoked by a stimulus. Somatic factors have been of interest in these inquiries for two reasons: (1) measures of skeletomuscular activity have provided information regarding cognitive and emotional responses to attitude stimuli, and (2) skeletomuscular activity has been found to influence attitudes and persuasion.

As noted earlier, the initial studies of bodily responses and attitudes focused on autonomic activity. Over the past quarter century, however, somatic responses to emotionally evocative stimuli have been found to be highly differentiated. Research on facial efference (measured using electromyography) and observable facial actions has revealed that: (1) individuals perform at better-than-chance levels when categorizing facial expressions of happiness, sadness, fear, anger, disgust, surprise, and contempt; (2) the inductions of what individuals report as being positive and negative emotional states are associated with distinctive patterns of facial actions (emotional expressions); (3) distinctive expressions of emotion are displayed by neonates and the blind as well as sighted adults; (4) cultural influences can, but do not necessarily, alter these expressions significantly; (5) the variability in emotional expressions that can be observed across individuals and cultures is attributable to factors such as the individual or cultural significance of a given evocative stimulus and to cultural prescriptions re-

garding the display of emotions; and (6) although many subtle emotional processes or events are not accompanied by visually perceptible expressive facial actions, the valence and intensity of these emotions are accompanied by distinctive patterns of facial efference that are measurable using surface electromyography. Heightened facial electromyographic activity can also be recorded over the perioral (speech muscle) regions during silent language processing, and this has provided a method of examining gross differences in message processing in persuasion.

Manipulations of somatic activity such as body posture, arm flexion/extension, and facial expression also appear capable of modulating affective reactions, biasing message processing, and influencing persuasion. Early research, for instance, suggested that people have difficulty feeling a particular emotion (e.g., joy) when they are posed in a contrasting stance (e.g., anger). In another study, students were led to believe that they were participating in a study on the comfort and sound quality of stereo headphones when listeners were engaged in movement (e.g., dancing, jogging). Some students were told that they should move their heads up and down (vertical movements condition) about once per second to test the headphones, whereas others were told to move their heads from side to side. A final group of students heard no specific statements about head movements. Head movements were chosen because of their strong association with agreeing and disagreeing responses in a wide variety of cultures. Students heard musical selections and either an editorial in favor of raising tuition at their university or one in favor of reducing tuition. Following the broadcast, the students answered questions, including what they thought tuition should be. Results revealed that students who heard the editorial favoring an increase in tuition supported a higher level of tuition than did students who heard the editorial favoring a reduction in tuition. More interestingly, this effect was modulated by head movements. Vertical head movements (as if nodding in agreement) led to the most attitude change to both editorials, and horizontal head movements (as if shaking in disagreement) led to the least attitude change to the editorials.

In conceptually related research, stimuli evaluatively categorized while performing isometric upper arm flexion (a somatic act associated with approach) are subsequently preferred to stimuli evaluatively categorized while performing isometric upper arm extension (a somatic act associated with withdrawal). The attitudinal effects of motor processes (arm flexion or extension) have also been found to be more evident

when the stimuli had few associations (e.g., pronounceable nonwords) than when the stimuli had many associations in memory (e.g., familiar words). Somatic manipulations have been less effective in inducing affective responses, but a growing number of studies suggest that somatic events can modulate affect and persuasion.

VII. CENTRAL NERVOUS SYSTEM SUBSTRATES OF DISPOSITIONS TO RESPOND

From a biological perspective, attitudes and persuasion are ultimately products of the operation of the nervous system. In this regard, the features of the conceptual central and peripheral routes to persuasion evidence striking parallels with functional levels of organization in the nervous system. Although both the central and peripheral routes to persuasion can involve the highest levels of the central nervous system (CNS) (e.g., the cerebral cortex), it is probable that the elaboration likelihood continuum has its ultimate origin in fundamental ontogenetic and phylogenetic trends in CNS development. Historical and recent findings from the neurosciences support this view.

The highest levels of the CNS show the greatest expansion and elaboration through both the development of the individual (ontogeny) and that of the species (phylogeny), and serve to differentiate the adult human from the infant, and from other animals. In contrast, lower levels of the CNS (e.g., the spinal cord) evidence a more common, primordial organization throughout ontogeny and across phylogeny. Basic approach/withdrawal dispositions, however, are intrinsic to all levels of CNS organization, as documented by both experimental studies in animals and clinical findings in humans with spinal cord injuries. Cord transections isolate spinal networks from higher neural influences, leaving the lower regions of the body (e.g., the legs and trunk) under the exclusive control of spinal mechanisms. In spite of this loss of higher neural controls, the spinal cord is intrinsically capable of supporting reflexive limb-withdrawal to a noxious stimulus. This response is mediated, in part, by a relatively simple three-neuron circuit. The simplicity of this basic reflex circuit, however, does not imply an immutability of spinal networks. Just as attitudinal dispositions are subject to change, so are spinal dispositions. For instance, spinal networks can learn to withdraw from innocuous stimuli that, al-

though not painful themselves, come to predict the occurrence of pain stimuli through Pavlovian conditioning.

The isolated spinal cord can also evidence primitive approach responses, as indicated by basic genital reflexes to tactile stimulation (erection, pelvic thrusting, and ejaculation). Thus, basic approach/withdrawal behaviors can be seen not only in the simplest of organisms, but also at the lowest level of organization in the mammalian central nervous system. Moreover, these basic approach/withdrawal dispositions do not differ from attitudinal dispositions in modifiability—spinal reflexes are clearly subject to learned modification with experience. At the same time, no one would mistake the primitive responses of the isolated spinal cord for the richness of the reactions of an intact organism to aversive or sexual contexts. The fundamental distinctions between these classes of reaction are two: (1) stimulus dependence and response variability and (2) the level of contextual control.

The first striking difference between the spinal organism (i.e., an organism with a lesion separating the spinal cord from the brain) and an organism with an intact connection between the brain and spinal cord is the repertoire of responses to, for example, an aversive stimulus. Although a spinal organism may show limb-withdrawal, the intact organism also exhibits more global escape and avoidance responses, aggression, vocalization, or instrumental responses that serve to eliminate or diminish the aversive stimulus. A related difference is apparent in the persistence of behavioral responses. Although the spinal withdrawal is highly stimulus bound, the intact organism may evidence behavioral activation, agitation, and escape attempts that persist well after the pain stimulus is withdrawn. That is, the aversive reaction of the intact organism is less dependent on the immediate sensory environment. Indeed, the stress that frequently characterizes human existence in contemporary societies is seldom directly related to pain stimuli.

This latter feature anticipates the second major distinction in the approach/withdrawal responses of spinal and intact organisms. That difference is in the complexity of contextual controls over behavior. The approach/withdrawal responses of the spinal organism appear to be sensitive only to relatively simple dimensions of a stimulus, such as its modality, intensity, or body location. In contrast, the aversive or sexual reactions of an intact organism frequently depend on highly complex relational features of the social/environmental context. In the intact organism, sexual arousal may not require direct tactile stimula-

tion, but may be manifest in the presence of a specific individual, or by the thought of a specific individual, in an appropriate social context.

Studies of decerebrate organisms further illustrate the increase behavioral flexibility and the expansion of relational contextual controls over behavior that result from higher-order neural organizations. The decerebrate organism, deprived of the cerebral hemispheres, can display highly complex orofacial consummatory responses (orientation, chewing, swallowing) to palatable items placed within the mouth, and vigorous rejection responses to nonpalatable items. These approach/withdrawal behaviors parallel the basic capacities of the spinal preparation, but evidence a degree of complexity and integration beyond that characteristic of spinal systems. Moreover, these complex reflexive responses are not only influenced by the immediate sensory features of the stimulus (palatability), but are also sensitive to internal motivational conditions (e.g., food deprivation, metabolic need). Thus, even though mechanisms for reflex ingestive responses to palatable foods may be relatively hard-wired, their ultimate expression is further controlled by an additional class of internal stimuli.

Although decerebrates are sensitive to metabolic needs and are capable of competent ingestive (i.e., approach/withdrawal) responses in the presence of a suitable goal object, they still fail to adequately regulate food intake or maintain body weight in typical environments. What appears to be lacking in these organisms is the ability to anticipate metabolic need, to evidence goal searching behavior in the absence of an immediate stimulus for ingestion, or to respond to the normal contextual controls over food intake (e.g., social convention, passage of day, consideration of caloric need). These controls require a contextual representation that transcends simple dimensions of environmental stimuli (e.g., presence of food, level of food deprivation) and entails relational aspects among stimuli (e.g., passage of time together with the presence of food, or hunger together with the memory of the location of food). It is this latter class of contextual controls, entailing relational features among stimuli, or transcendent representations of the environment, that liberates an organism from the immediate dictates of the sensory environment and confers what has been interpreted as deliberative or goal-directed action.

The progression of increased behavioral flexibility and the expansion of relational contextual controls over behavior constitute hallmarks of higher-level neural organizations. These higher-level systems appear to be organized partly in a hierarchical fashion,

and both extend the sensory processing of lower systems and expand on the motor repertoire and flexibility of lower mechanisms. Moreover, this hierarchical organization permits multiple levels of analysis and control over behavioral processes. In response to a pain stimulus, for example, lower-level processing may predominate initially, resulting in a rather stereotyped but highly adaptive, short-latency limb-withdrawal. The significant advantage of lower-level processing is that, although somewhat inflexible, it is highly efficient and places minimal burdens on higher-level processing substrates. Indeed, for the initial protective response, elaborate processing of the stimulus is not necessary, and in fact may be maladaptive. Lower-level processing, however, does not preclude further analysis at higher perceptual levels. In the case of a pain stimulus, this further analysis may be manifest in subsequent emotional reactions (e.g., fear, anxiety), which may motivate subsequent behavior (e.g., avoidance, aggression).

This pattern of multiple-level analysis and control confers significant advantages. By their nature, higher-level organizations must integrate information from varied modalities and sources and exert control over diverse aspects of behavior. This convergence of sensory information, the need for integration with prior memories, and the divergence of output control can create a processing bottleneck that taxes the information-processing capacity of neural networks. Consequently, these higher-level systems may require active attentional focus and may have limited capacity for multiple concurrent activities. Those stimuli or conditions that do not effectively compete for attentional resources may be subject to only lower-level processing, or to fairly elementary processing by higher-level neural networks. An important question, and an actively researched area, relates to the determinants of which stimuli are selected for further processing. This is also a fundamental question in the area of attitudes and persuasion, since it addresses the distinction between peripheral and central routes to persuasion and their underlying mechanisms.

Parallels can be noted in the distinctions between central and peripheral routes to persuasion and the continuum between hierarchical and lower-level information processing. The peripheral processing route, lower-level neural processing, and elementary information processing within a higher level of neuraxis are characterized by: (1) minimal cognitive elaboration, (2) limited flexibility, (3) stimulus dependency or relative lack of persistence, and (4) reliance on rather simple, nonrelational features of the stimulus

context. In contrast, the central route to persuasion as well as higher-level neural processing are characterized by: (1) elaborate, integrative analysis of multiple stimuli, (2) maximal flexibility, (3) persistence and resilience, and (4) reliance on complex relational features of the stimulus context (i.e., abstractions). In both neural processing and persuasion, analysis may frequently take place across multiple levels, within a level to varying degrees, or may shift between one level or another, depending on the context and competing demands.

With rapidly developing electrocortical and neuroimaging techniques, views are available of aspects of brain function in conscious individuals during a variety of cognitive and affective activities. These techniques, together with more basic studies of cellular processes, information transformations among neurons, and behavioral analyses of attitudes and persuasion, should provide the tools for a truly interdisciplinary study of social psychological phenomena such as attitudes and persuasion. For instance, evaluative categorization processes have been found to be measurable using event-related brain potential, and these measures have been found to be relatively insensitive to attitudinal response (e.g., selection/execution) processes. In a typical study, subjects are exposed to sequences of six traits and perform a dichotomous evaluative categorization task. Evaluative inconsistency may be varied by embedding, for instance, very positive, moderately positive, moderately negative, and very negative traits in sequences containing predominantly very positive traits. Results have shown that highly and moderately evaluatively inconsistent traits, compared to mildly inconsistent or consistent traits, evoke a larger-amplitude late positive potential (LPP) that is maximal over centroparietal scalp regions. Furthermore, extremely evaluatively inconsistent traits evoke a larger-amplitude LPP than moderately evaluatively inconsistent traits even though both sets of traits are judged to be negative. Research has also shown that the amplitude of the LPP is larger when subjects evaluatively categorize inconsistent rather than consistent attitude stimuli even when they intentionally misreport their attitudes. Finally, analyses of the spatial distribution of the LPP in these studies have revealed that, consistent with the relative involvement of the right hemispheres in hedonic processes, evaluative categorizations evoke a more asymmetrical (right lateralized) LPP than nonevaluative categorizations of the same stimuli.

In sum, all species must be capable of discriminating positive from negative stimuli and events in their environment. For simple organisms with limited environmental niches, relatively fixed (reflex) mechanisms can effectively process environmental stimuli to support life. All species have this evolutionary legacy, but the development of more complex stimulus representation, appraisal, and reasoning processes can greatly expand the adaptability and flexibility of a species. In humans, attitudes and evaluations can be socially and culturally transmitted and can help people understand events and guide their actions in their world. Because attitudes are so central to people's conceptual organization of their world, attitudes are subject to modification based on vicarious experience and information (persuasion). Social scientists have provided a rich corpus of effects, principles, and theories of persuasion, whereas neuroscientists have provided basic knowledge of neural organization and motivation processes. Social scientists and neuroscientists initially worked in isolation, but common interests have fostered interdisciplinary research and intertheoretic translations that are providing new insights into the processes of attitude formation and persuasion.

BIBLIOGRAPHY

- Arvey, R. D., Bouchard, T. J., Jr., Segal, N. L., and Abraham, L. M. (1989). Job satisfaction: Environmental and genetic components. *J. Appl. Psychol.* 74, 187-192.
- Berntson, G. G., Boysen, S. T., and Cacioppo, J. T. (1993). Neurobehavioral organization and the cardinal principle of evaluative bivalence. *Ann. N. Y. Acad. Sci.* 702, 75-102.
- Cacioppo, J. T., Crites, S. L., Jr., Gardner, W. L., and Berntson, G. G. (1994). Bioelectrical echoes from evaluative categorizations. I. A late positive brain potential that varies as a function of trait negativity and extremity. *J. Personality Social Psychol.* 67, 115-125.
- DeCasper, A. J., and Spence, M. J. (1986). Prenatal maternal speech influences newborns' perception of speech sounds. *Infant Behav. Dev.* 9, 133-150.
- Eagly, A., and Chaiken, S. (1993). "The Psychology of Attitudes." Harcourt Brace Jovanovich, Fort Worth, Texas.
- McGuire, W. (1985). Attitudes and attitude change. In "Handbook of Social Psychology" (G. Lindzey and E. Aronson, eds.). Random House, New York.
- Petty, R. E., and Cacioppo, J. T. (1986). "Communication and Persuasion: Central and Peripheral Routes to Attitude Change." Springer-Verlag, New York.
- Tesser, A. (1993). The importance of heritability in psychological research: The case of attitudes. *Psychol. Rev.* 100, 129-142.