CHAPTER 25

A Contrasting Frame of Reference: Soviet Contributions to Social Psychophysiology

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INTRODUCTION

> Reactions are a *biosociological* conception, under which it is possible to group all the phenomena of the living organism, from the simplest to the more complicated forms of human behavior in the conditions of social life. The reactions of man in connection with his social relations acquire a social significance. In this we observe the main distinction between psychology and physiology. The latter also studies the reactions of man, but studies them without any reference to his social relations, while in psychology these relations constitute the principal content of the reactions studied. (Kornilov, 1930, p. 268)

Scientific study progresses as models are developed to describe a certain set of phenomena closely. The models may be rudimentary or overly simplified at first, but refinements or replacements follow as more knowledge about the area becomes available. In principle, a model is retained as long as it fits the observations in a simple, economical, and testable fashion. The more untestable assumptions or propositions required to bridge the gap between the model and the data, the less attractive, more cumbersome, and vulnerable the model.

In the preceding chapters we have seen a variety of models bearing on social processes. Each has expanded the set of phenomena typically addressed to include hypotheses, mediations, or observations at the physiological as well as at the social level. Many of the models that have been

described may have initially appeared familiar, but most harbor significant refinements and extensions deemed necessary by the broader context of data about which the authors wrote. Less obvious to most readers of this collection of works are several distinctive features of these models that are so common to Western psychology that they form a transparent frame of reference. These features include (1) the strong emphasis on experimentation as a means of identifying the phenomena to be explained, (2) the focus on the individual (e.g., his or her qualities, dispositions, attitudes) as the unit of analysis and the object of environmental (e.g., social) influences, (3) the utilization of a potpourri of methods and theoretical doctrines in an effort to someday build a general theory supported by the accumulated experimental observations, and (4) the rejection of a priori philosophical assumptions about the nature of humankind. Although there are sound arguments for these features (cf. Boring, 1950; Brown, 1961), one contribution gained from a survey of Soviet psychology is obtaining an appreciation for the benefits and limitations of our particular frame of reference as Western psychologists. There are, of course, alternative windows through which these same phenomena may be viewed. The frame of reference of Soviet psychology, for instance, suggests alternative models for some of the social psychophysiological data reviewed in the preceding chapters and has resulted in novel paradigms and databases that must ultimately be accommodated by Western psychological models.

Before proceeding to the general Soviet perspective on psychological processes, we should note that *social* psychology in the USSR is a relatively new field of inquiry and is more similar to what we term industrial/organizational than experimental social psychology (Cole & Maltzman, 1969; Lomov, 1978–1979; Strickland, 1979). This applied brand of social psychology is now in sharp demand in the USSR because of its practical significance, but its theoretical integration with general Soviet psychology is still under way (Krauss, 1976; Petrovskiy, 1971; Strickland, 1980). The major contributions of Soviet psychology to social psychophysiology, therefore, derive not from their work in social psychology but rather from their advanced work in psychophysiology (e.g., Sokolov, 1972) and their general systems approach to thought and action within a sociohistorical context (e.g., Anokhin, 1969; Wertsch, 1981).

As in Western psychology, Soviet psychology is focused on measurable quantities and is inquisitive about all levels and aspects of human reactions (physiological, verbal, behavioral, social, political). In Soviet psychology, however, there are stronger emphases on avoiding eclectic approaches that imply assumptions about humankind that are incompatible with those of Marx, and on devising comprehensive analyses of human reactions that integrate physiological, verbal, behavioral, social, and political levels of phenomena into a single, coherent system. Although behavior is an object of Soviet psychological inquiry, the varieties of behaviorism that flourished in America in the early 1900s were rejected in Soviet

psychology as providing too limited a view of human reactions (an error termed "mechanical materialism"). Thus, while Western behaviorists in the earlier part of this century asserted that consciousness was outside the purview of a scientific psychology, Soviet psychologists embraced the study of consciousness in line with their endorsement of "dialectical materialism."

Dialectical materialism refers to the notion that all events are interconnected and in a constant state of flux. The dialectic, or what Marxism holds to be "the universal law of nature, history, and thought" (Cropsey, 1972, p. 765), refers to the sequence of affirmation ("thesis"), negation ("antithesis") and negation of the negation ("synthesis"). Human reactions in society can be viewed in terms of spiritual or psychical events, as they commonly were several hundred years ago, but this perspective (thesis) is antagonistic to scientific inquiry. Human reactions can, alternatively, be viewed in terms of matter, but this perspective (antithesis) can be antagonistic to the concept of consciousness:

> Mechanical materialism makes an initial assumption that thought, consciousness, and sensation have merely a subjective, or even a fictitious, existence. It divests matter of all those qualities which have some subjective or mental content. As a result, it lands itself in a contradiction. It creates the necessity for a realm of nonmental reality. (McLeish, 1975, p. 139)

The Soviet synthesis of this thesis and antithesis was to view consciousness as "a property which emerges historically at the point where matter has reached a certain level of complexity" (McLeish, 1975, p. 86). The effects of these different traditions can be seen in that Western psychologists might observe the "products" of consciousness and emphasize the inferential nature of the models of consciousness that are thereby derived, whereas Soviet psychologists, who are much more likely to be studying consciousness, tend to view the multitude of factors and events (e.g., physiological, social) leading to a conscious act as *components* of consciousness, and derive models based on their observations of the "process" of consciousness.

As implied by the concept of dialectical materialism, everything is affected by change and relation. The species is evolving, while individual members of the species are born, grow, and die. An organism is defined within its species by its relation among others (i.e., social context) and in time (i.e., historical context). When compared with members of the species in the past, the organism may be said to represent the spearhead of the species, whereas it may represent the opposite when compared with future generations. This relatively obtuse point, which is rarely seen in Western psychological literature (cf. Gergen, 1973), is much more common in the Soviet psychological literature because of their strong convictions that people's reactions to any single stimulus varies as a function of factors at

other levels (e.g., social, developmental), and interpretations vary with the context.

A simplified example of the type of theorizing might be helpful. In Soviet psychology, sociohistorical processes are thought to influence communicative processes such as speech. Speech (and other symbolic processes), in turn, is viewed as intimately tied to thought and to the development and activity of the nervous system. For instance, the states of excitation and inhibition within the organism are conceived as influencing the perceptions of, reflections of (i.e., thoughts about), and responses to signs and symbols in the environment. Since the human environment is a social environment, an individual's activity constitutes actions within a society that, in turn, molds the everchanging sociohistorical context influencing speech and thought.

As might be expected, the abstract experimental approach characterizing many Western psychological inquiries of individual human properties is criticized in the Soviet literature for failing to consider properly the impact of human history, society, and relations on thought and action (Shikhirev, 1980). Similarly, attempts to reduce psychological processes to the level of physiological or biological events are criticized for failing to consider the effects that emerge as the complexity of the organism increases (see Schwartz, Chapter 21, this volume).

> Dialectic psychology concedes willingly enough that man's biology and physiology provide the springboard for his psychical development and that they most certainly participate in its progress. However, this participation does not proceed in any mechanical or invariable manner. (London, 1950, pp. 84–85)

Thus, there is a tendency for contemporary Soviet researchers to employ psychophysiological methods, include developmental and sociocultural factors, and collect observations in naturalistic settings. Social and physiological processes are theoretically viewed as constituting not so much different areas of inquiry as different levels of inquiry about the same general process or system.

We should emphasize that the results reported in the Soviet literature, at least those that are easily accessible to Western psychologists (e.g., in English translation), have in many cases been unreplicable in Western laboratories. Several factors may be responsible for this state of affairs. Soviet psychologists view the operation of many psychological processes as contingent on the particular sociocultural environment from which the subjects were drawn (Shikhirev, 1980), a view that is similar to a position occasionally voiced by Western social psychologists (cf. Gergen, 1973). Hence, it might be argued that difficulty by Western psychologists in replicating results reported in the Soviet literature are due more to the sociocultural and historical differences between the East and West than to

any other factor. Although possible, several other factors are noteworthy. Typically, we have found fairly sparse reports in the literature regarding the exact methods, instrumentation, material, and data reduction procedures used in Soviet experiments. Moreover, we have found a general tendency by Soviet psychologists to interpret data based on few, if any, inferential statistical analyses. Hence, generalizations drawn from the observations of a few individuals may represent unreliable differences between these individuals. Finally, the predilection for Soviet psychologists to collect data in less than perfectly controlled (e.g., educational) settings may contribute as well to the difficulty Western researchers have encountered in replicating Soviet findings, since Western researchers tend to attempt the replications in more carefully controlled laboratory studies. There is also some pressure to construct interpretations that are in accord with the Marxist conception of man, although this pressure does not appear to exert a substantial bias in the research literature (cf. McLeish, 1975). In any case, findings reported in the Soviet literature might best be viewed as being of questionable generalizability until successful replications are available in Western psychological laboratories.

BRIEF HISTORY OF SOVIET PSYCHOLOGY

Soviet psychology developed in the context of scores of years of sociopolitical crises, and the essential nature of Soviet psychology (and its contributions to social psychophysiology) may not be fully appreciated without some rudimentary knowledge about its history. In addition, a basic understanding of the environment out of which Soviet psychology grew might aid readers who wish to keep somewhat abreast of the Soviet psychological literature. We therefore sketch the history of Soviet psychology in this section. The interested reader may wish to consult McLeish (1975), Lomov (1978–1979), Corson and Corson (1976), or Rahmani (1973) for more detailed discussions of the history of Soviet psychology, or *Soviet Psychology*, English summaries in *Voprosy Psikhologii*, various government documents, and occasional edited works and books of Soviet psychological research that appear in English translation (e.g., Cole, John-Steiner, Scribner, & Souberman, 1981; Cole & Maltzman, 1969; Sokolov, 1972).

Science in general and psychology in particular were slow to develop in Tsarist Russia due to several sociocultural factors (McLeish, 1975; Rahmani, 1973):

1. Tsarist Russia was characterized by an isolationism from other societies.
2. A Christian Orthodox religion presupposing the dualistic nature of humankind was accepted by or imposed on all citizens and served to maintain the autocracy (even though Peter the Great, a Russian Tsar, established the Soviet Academy of Sciences).
3. Serfdom and illiteracy characterized the vast majority of citizens.

4. Families were patriarchal and extended.
5. The governmental bureaucracy greeted opposition or the expression of dissent with censorship, intimidation, and elimination.

Russian intellectuals in this environment were exposed to severe surveillance and restriction, but a minority emerged who resisted the ruling pressures and who tended to develop their ideas to their logical extreme. Since the number of such intellectuals was too small at any one time to bring about a direct change in the sociopolitical climate of Russia, the intellectuals realized a need to recruit the understanding and support of the masses to bring about a sociopolitical change (McLeish, 1975). Apparently, one means of doing this pursued by the intellectuals was to undermine the need for the dominant sociocultural (e.g., religious) beliefs by developing materialistic explanations for practical human social behavior (i.e., behavioral phenomena observable to the masses of illiterate peasants). The Orthodox Church in Russia, which supported the autocracy by persecuting intellectual dissenters, provided psychical explanations for such pervasive events as consciousness. Thus, a natural objective for the early intellectuals was to develop a materialistic account of consciousness as it manifests in normal, daily activities. It was in part for this reason that one of the most distinctive characteristics of Soviet psychology is the total rejection of dualistic theories of any kind (e.g., mind-body, spiritual-material, ideal-actual) as the basis for explaining human thought and behavior and their focus on the natural, physiological substrates of thought and actions observed in a social context. Although we cannot hope to provide a comprehensive summary of the history of Russian psychology here, it is possible to sketch the development of Soviet psychology by summarizing the contributions of a few prominent Soviet intellectuals.

Lomonosov (1711–1765) is credited by McLeish (1975) with laying the groundwork for contemporary Soviet psychology. Lomonosov, who was one of the founders of Moscow University, appealed to empiricism as the arbiter of philosophical arguments, explanations of social phenomena based on natural and lawful forces rather than arbitrary decisions of Tsars or divine interventions, and the search for the interconnectedness of forces, objects, and events. Radishchev (1749–1802) and Belinsky (1811–1848) advanced the position of dialectical materialism by advocating notions of evolution wherein humans were viewed as "kin—born of the same womb—to everything that lives on the earth; not only beast and bird but also plant, fungus, metal, stone, earth" (Radishchev, 1907, p. 149, cited in McLeish, 1975). Belinsky went on to assert the basic unity of the human organism, setting the stage for contemporary Soviet psychological inquiries. He argued that psychology must be practical while based on physiology:

> Pure thought, mind without flesh, is a logical dream, a lifeless abstraction. But this does not imply that mental activity can be explained solely in terms of physiological laws—on the contrary. Mental activity has its own specific features which can only be studied in the activities of the mind itself. Nevertheless, [Belinsky] maintained, "Psychology which is not based on physiology is as unsubstantial as a physiology that knows not of the existence of anatomy." (McLeish, 1975, p. 42)

Chernyshevsky (1828–1889) spent the last 27 years of his life as an exile in Siberia for expressing his ideas, which included: "materialistic monism, demand of the objective method, the principle of determinism, [and] the affirmation that psychics reflecting the reality appears in the activity of man" (Budilova, 1978, p. 30). Chernyshevsky is considered a Russian pioneer of the concept of humans as social organisms. He postulated that people's actions were motivated by self-interest (or needs) rather than abstract principles, but argued that it is the social organization rather than the individual that is responsible for the form and morality of an individual's deeds.

Sechenov (1829–1905), who was influenced significantly by Chernyshevsky, helped establish both the Russian fields of physiology and psychology. Sechenov (1973) employed the notion of materialistic monism as the basis for a program of physiological research, which he set forth in his book, *Reflexes of the Brain*. Interestingly, Sechenov began as an idealist (i.e., he believed that mental activities derived from spiritual sources), but while working in the laboratories of Helmholtz in Germany and Claude Bernard in France, he adopted materialism as his basic premise. In his doctoral dissertation ("Data for the Future Physiology of Alcoholic Intoxification," 1860), Sechenov advanced the notions that there was a unity between the organism and the conditions of their existence, the forces governing organic and inorganic nature were the same, and the mysteries of consciousness could be unraveled using the objective methods of physiology (premises still apparent in Soviety psychological research). Following Sechenov's discovery of the process of "central inhibition" in the nervous system,[1] he proposed that mentation manifested externally in muscular movement (i.e., action), and that instances of mentation separated from action resulted from the central suppression of a reflexive muscular response (Sechenov, 1973). Unlike Watson, Sechenov viewed the external muscular movements as a component rather than the essence of thought. Sechenov

1. Central inhibition in the nervous system can be illustrated by placing salt on the lesioned end of a decapitated frog's spinal cord; spinal reflexes, such as the movement of a frog's leg following pinching, are completely inhibited by this application of salt. This demonstrates that the overt response normally elicited by an external stimulus can be attenuated or inhibited by neural factors within the central nervous system.

also posited that activity of behavior has different levels. The lowest level pertains to the physiological processes underlying the behavior, whereas the highest level "involves a special subsystem of personality designated as 'self' and appearing in the process of interpersonal communication" (Yaroshevskiy, 1979, p. 107). Thus, Sechenov more than anyone was responsible for outlining the premises and methods of contemporary Soviet psychology.

Pavlov (1849–1936), a Russian physiologist who studied the digestive system and, later, the conditioned response, succeeded Sechenov as the major force in Soviet psychology. Pavlov's research on the classical conditioning of salivary responses in dogs is well known to Western psychologists. Less well known to some, however, is Pavlov's influential theoretical transition in interpreting his data (Corson & Corson, 1976; McLeish, 1975). Pavlov began by explaining his data in terms of the subjective state of the dog, basing his explanations on the analogy to human experience. His attempts to develop a predictive rather than a descriptive model of the dog's behavior using the anthropomorphic concepts he thereby derived ultimately proved frustrating. The physiological concepts of excitation and inhibition of nerve centers proved to be far less frustrating ingredients for Pavlov's model of the conditioning of an organism's behavior using "distant" external events. Pavlov dropped all subjective and dualistic explanations in his model of the dog's behavior in favor of developing a model based on physiological (particularly cortical) functioning. This move, and Pavlov's expositions on its merits, had a dramatic influence on the development of Soviet psychology (e.g., see Kurtsin, 1976).

In the next section we sample aspects of contemporary Soviet psychological research that bear more directly on the social psychophysiological issues broached in preceding chapters. Recall that reports of Soviet psychological research available in English translation typically contain sparse information about the exact methods employed, involve naturalistic rather than strictly controlled laboratory observations, and are based on nonstatistical analyses of data. Thus, while the following reports may prove useful in generating hypotheses, alternative viewpoints on existing data, or new phenomena that may ultimately need to be explained by existing Western psychological theories, replications and extensions of this work are needed before the actual value of the research can be determined.

CONTEMPORARY SOVIET WORK

Arousal and Wakefulness

As we noted in Chapter 1 of this volume, physiological arousal has been used to refer to the nonspecific, energizing aspect of behavior. This concept has played and continues to play an important role in organizing social

psychophysiological data (e.g., see Batson & Coke, Chapter 14; Fazio & Cooper, Chapter 5; Geen, Chapter 13; Moore & Baron, Chapter 15; Spitzer & Rodin, Chapter 20; Zillmann, Chapter 8). As has been noted by these and other contributors to this volume, however, the concept of arousal has been difficult to operationalize and, hence, meaningful theoretical work has been impeded.

Several solutions to this problem have been suggested, such as using an aggregate physiological index (see McHugo & Lanzetta, Chapter 23) or self-report responses to an adjective checklist (Mackay, 1980; cf. Cacioppo, Marshall-Goodell, & Gormezano, Chapter 24). A unique procedure that might prove informative in understanding at least one aspect of the concept of "arousal" is outlined by Luria (1973) in an article entitled "The Quantitative Assessment of Levels of Wakefulness."

You may recall from preceding chapters that the problems with present social psychophysiological procedures for assessing a person's "arousal" include:

1. The various physiological responses to an "arousing" stimulus are sometimes poorly correlated.
2. The physiological responses to different but purportedly equally arousing stimuli are inconsistently correlated.
3. Reportable and physiological measures of arousal are not consistently correlated and, indeed, appear to change across time in a different fashion.

These specific problems are circumvented by the procedures outlined by Luria (1973) and demonstrated in Luria and Vinogradova (1959). Luria (1973) (1) conceptualizes the nonspecific, energizing aspects of the central nervous system as varying with the person's "wakefulness" and enabling the person's system of selective associations; (2) apparently does not find any single measure of physiological activity, such as EEG activity, to be monotonically related to the person's state of wakefulness; and (3) argues instead that the existence and intensity of the orienting response (i.e., a pattern of physiological responses—see Chapter 1) to semantic associations reflect the organism's underlying state of "wakefulness." Since consciousness, or the stream of reportable states, is such a pervasive issue in Soviet psychology, it should not be too surprising that the concept of "wakefulness" rather than "arousal" has been a focus of the study of the nonspecific actions of central nervous system (CNS) activity in Russia, and that wakefulness is defined in terms of people's ability to respond discriminately to human signals, such as words.

In the early part of this century, a number of Soviet psychologists were investigating the structural organization of the brain and localization of functional systems in the cerebral cortex. Following the report by Moruzzi and Magoun (1949) of nonspecific actions emanating from the reticular formation, Soviet psychologists "began to examine the *nonspecific*

functions of the brain—the processes of waking, levels of consciousness, and general levels of activation" (Luria, 1973, p. 74). In their investigations, Soviet psychologists took as their starting point Pavlov's "law of strength," which holds that significant stimuli evoke strong physiological responses, whereas insignificant stimuli evoke weak physiological responses. This organization of the CNS, according to Luria (1973), ensured the clear, selective functioning of the cerebral cortex, which is to say that the stream of reportable states would be coherent and highly discriminating of external stimuli. Interestingly, Pavlov's "law of strength" holds for a person who is awake and alert, but exceptions to it are observed as the person passes from wakefulness to deep sleep (Luria, 1973). As the person begins this transition, EEG activity slows and becomes more synchronous, and what previously had been classified as "significant" and "insignificant" stimuli begin to elicit the same type of response. (Although the nature of this "response" was not specified explicitly by Luria, it appears from the report that some measure of cortical activity or orienting response was employed.) This epoch of the transition is called the "equalizing phase." As the person continues through this transition from wakefulness to sleep, a "paradoxical phase" is encountered where "insignificant" stimuli actually elicit stronger responses than do "significant" stimuli. Finally, in what Luria (1973) describes as the "ultraparadoxical phase," significant stimuli fail to elicit any response, whereas responses continue to be seen following the presentation of insignificant stimuli. In Luria's words:

> In the normal (optimal) state of the cortex, important (significant) stimuli easily become dominant, and weak (insignificant) stimuli are forced into the background; and the course of conscious processes assumes an organized character. However, as the cortex passes into the "phasic" state and cortical tone is reduced, this selective functioning of mental processes is inevitably disturbed. Important (significant) stimuli are reduced to the same level of importance as weak (insignificant) stimuli, and they lose their dominant character; they cease to act as determinant factors, and the train of thought no longer gives the appearance of organization; well-ordered associations directed toward a particular goal give way to incidental, uncontrolled associations; haphazard images begin to rise to the surface of consciousness, and the organized flow of consciousness is disrupted. (pp. 75-76)

As noted, and consistent with the Soviet focus on verbal thought, the psychophysiological index of wakefulness is keyed to changes in the pattern of physiological responses that follow the spoken word. The reasoning is that as wakefulness recedes, the nonspecific actions of the brain stem that energize the various specific functional systems involving higher cortical processes are reduced, and the selective nature of the word meanings becomes increasingly disrupted:

> Incidental and insignificant associations that are elicited by a word, but that are normally ignored, begin to assume the same importance as significant, dominant, semantic associations; and as a result, the train of thought loses all semblance of organization. . . . Might not this fact serve as a starting point for evaluating the level of reduction of cortical tone, for providing an objective description of the operating potentialities of the cortex, and, in the final analysis, for quantitatively assessing wakefulness. (Luria, 1973, pp. 76-77)

Luria's assessment procedure was as straightforward as his rationale (Luria, 1973; Luria & Vinogradova, 1959). As we noted in Chapter 1, the presentation of a novel or significant stimulus (e.g., word) can elicit an orienting response. (Recall from our discussion in Chapter 1 that Pavlov, 1927, was the first to document the orienting response.) The orienting response habituates when the stimulus is presented repeatedly, but reappears when the stimulus is changed. The orienting response intensifies when the physical presentation of the stimulus is intensified (up to a point, after which a defense rather than an orienting response is elicited); it diminishes as the intensity of the stimulus decreases; and paradoxically, it is strengthened again as the stimulus approaches the sensory threshold level. If the stimulus is initially irrelevant to the subject (i.e., it possesses no particular significance to the person), extinction of the orienting response (i.e., habituation) proceeds quickly. Luria and Vinogradova (1959) note that the orienting response to a stimulus can be made more stable and durable with the help of a verbal instruction (e.g., having the subject press a button on hearing a particular stimulus) or a UCS (e.g., a painful stimulus accompanying the stimulus).

In the Soviet studies, only "neutral" words (i.e., words that possessed no special emotional or symbolic significance to the subjects) were employed. During the study, a subject hears a list of words and is instructed to press a button with the right hand every time a particular test word is announced. Thus, one word out of the list of words (i.e., the test word) is selected to serve as the "significant" stimulus, and this word attains significance through its function as the signal for an overt response. The words in the list are pronounced, each separated by a brief (15- to 30-second) delay. The subject initially displays an orienting response (as assessed by vasoconstriction in the left hand and vasodilation in the temporal artery) to each presentation, but at some point during this reading of words (typically after 15 to 20 words have been announced), the subject habituates to the reading of the words and ceases to evince an orienting response to each word as it is announced. In normal, waking subjects, the announcement of the test word at this point elicits the button press and an orienting response. The announcement of words that are semantically related to the test word does not elicit the voluntary button press that the test word

elicits, but it is accompanied by an orienting response. The more semantically similar the word is to the test word, the more pronounced is the orienting response. No orienting response is observed following the announcement of unrelated words or words that are related *phonetically* to the test word (Luria & Vinogradova, 1959).

In another study using the same procedure, two groups of mentally retarded children who differed in the severity of their disability served as subjects (see Luria, 1973). The children with the milder form of retardation displayed the orienting response to the test word, words that were semantically related to the test word, and words that were phonetically related to the test word (even though only the test word elicited the overt button-press response). The remaining words did not elicit an orienting response. Children with a severe disability, and those children with the milder form of disability but who were younger, displayed the orienting response to the test word and to words similar in sound to the test word, whereas words semantically related to the test word and words totally unrelated to the test word did not elicit the orienting response.

If the older children with the milder form of retardation were tested when they were not fatigued (e.g., early in the schoolday), orienting responses were observed primarily in response to words similar in meaning (rather than in sound) to the test word. When the same experiment was conducted later in the schoolday (e.g., after 5 hours of classes), this finding had reversed: Words similar in meaning to the test word generally failed to elicit the orienting response, whereas words similar in sound did elicit an orienting response. This was interpreted as evidence that reduced wakefulness due to fatigue led to the expected quantitative differences in autonomic response patterning (Luria, 1973).

One implication of Luria's reasoning and data worth noting at this point is that as wakefulness decreases, the likelihood of semantic processing decreases at a faster rate, and to a lower point, than do shallow (e.g., phonetic, orthographic) levels of stimulus processing.

Luria (1973; Luria & Vinogradova, 1959) describes a second procedure similar to the first except that, following habituation to the word list, the test word is accompanied by a painful stimulus (i.e., a UCS such as an electric shock) rather than an instruction to press a button. After 18 to 25 repetitions of this pairing, the presentation of the test word was found to elicit a defense rather than an orienting response (as indicated by vasoconstriction in the hand and temporal artery of the head—see Cacioppo & Petty, Chapter 1). At this point, Luria (1973) suggests, wakefulness could be measured by examining the subject's autonomic response patterning (e.g., orienting vs. defense response) elicited by neutral words that are semantically related, phonetically related, and unrelated to the test word. The results of such a study using normal subjects, reported in Luria and Vinogradova (1959), indicated that words similar in meaning evoked a defense response. Words that were not precisely related in meaning but nevertheless were related semantically, and words related phonetically to the test word, evoked an orienting rather than defense response, whereas unrelated words did not evoke a consistent autonomic pattern.

Luria and Vinogradova (1959) assessed what in essence were the experimental demands of their studies. They reported that the subjects *"were unable either exactly to formulate the aims of the experiment, or to designate exactly that group of words evoking definite vascular reactions"* (p. 103; italics theirs). It is also worth emphasizing that "neutral" words were employed in all these studies. This may be an especially important facet of their procedure if wakefulness is to be assessed. For instance, Oswald (1966) reports that sleeping people display a phasic EDA response and a large-amplitude burst of asynchronous EEG activity (the "K complex") when their own or beloved's name is announced, but not when a name of an unfamiliar person is announced. Similarly, a mother may sleep through an alarm clock but awaken to a less intense cry or unusual sound coming from her child. Hence, the reasoning developed by Luria for quantifying wakefulness may hinge on the use of words that initially possessed no particular significance or emotional value and that still have not attained a particularly high level of importance to the subjects.

These procedures for assessing the nonspecific actions of the brain, what Luria (1973) terms "wakefulness," provide an interesting contrast to the procedures outlined elsewhere in this book for assessing nonspecific bodily reactions, or what social psychologists have occasionally referred to as a person's physiological arousal. Interestingly, Luria's procedures could easily be adapted to the experimental designs commonly employed in social psychophysiological research. For instance, subjects could be randomly assigned to alone or group conditions to determine whether or not mere presence (see Moore & Baron, Chapter 15) results in between-group differences in the nature and intensity of the autonomic response pattern elicited by semantically, in contrast to phonetically, related and unrelated words; the nature and intensity of the autonomic response patterns displayed by introverts and extraverts exposed to these procedures, and differences in fatigue using a modified version of these procedures, might be examined and explained (see Geen, Chapter 13); one or both of the assessment procedures outlined above might be employed following the presentation of a counterattitudinal essay under high- and low-choice conditions to determine the effect of cognitive dissonance (see Fazio & Cooper, Chapter 5); and so on.

Finally, an opinion voiced by a number of contributors to the present volume is that the concept of "arousal" in social psychology needs to be refined or partitioned into its various functional components. Even though there are some similarities between the Soviet concept of wakefulness and the concept of arousal in social psychology in the West, we believe

it best to retain Luria's term "wakefulness" to refer to the phenomenon assessed using the procedures outlined above rather than adding yet another operationalization to the list presently included under the term "arousal."

Attitudes

Western psychologists have long sought psychophysiological indices of attitudes (see Cacioppo & Petty, 1981a; Cacioppo & Sandman, 1981; Petty & Cacioppo, Chapter 3; Tursky & Jamner, Chapter 4) and, more recently, the mechanisms by which bodily processes and attitude change are related (Cacioppo & Petty, 1982; Fazio & Cooper, Chapter 5; Hirschman & Clark, Chapter 7; Petty & Cacioppo, Chapter 3; Rogers, Chapter 6). In the Soviet psychological literature, we found a number of interesting references to or brief reports of related work. The most detailed reports pertained to what has been termed the "classical conditioning" or "indirect attitude response" approach (Cacioppo & Sandman, 1981; Petty & Cacioppo, Chapter 3), and we discuss this work first. We also found a few intriguing passages in contemporary work that pertained to what we have termed the "emotional response" or "direct attitude response" approach to attitude assessment using physiological measures. Although we had not found definitive evidence in the Western psychological literature that autonomic activity reflected the polarity and intensity of affective responses (see Chapter 3), we did find several passages in the contemporary Soviet psychological literature suggesting that phasic EDA and heart rate responses could be used to index these parameters. The paradigm used in the Soviet research is slightly different than any employed previously by Western social psychologists and may merit investigation. Hence, even though most of the original reports of this Soviet research were not accessible to us, we have summarized what we could obtain in the section "Emotional and Cognitive Response Approaches." Afterwards, a section summarizes reports in the Soviet literature that imply that, with properly prepared and delivered materials, people's attitudes are especially susceptible to change during the transition from normal levels of wakefulness to sleep.

Classical Conditioning Approach

This approach involves monitoring an induced (i.e., classically conditioned) physiological response rather than a naturally occurring physiological response to an attitude object or issue. Accordingly, the conditioning of the response is a necessary antecedent to attitude assessment. The details of the classical conditioning approach are outlined in Petty and Cacioppo (Chapter 3) and Tursky and Jamner (Chapter 4). The basis of this approach grew out of the work of the Soviet laboratories of Kragnogorsky and

Ivanov-Smolensky in the late 1920s and early 1930s, when, according to Razran (1961), it was observed that a conditioned response elicited by the sound of a metronome was also evoked by the announcement of the word "metronome," and vice versa. Razran (1961) also summarizes an early Russian study wherein semantic conditioning was adapted for gauging an individual's attitudes toward sociopolitical slogans. According to Razran, a 13-year-old boy was conditioned to salivate to the word *khorosho* (well, good) and to differentiate this word and response from the word *plokho* (poorly, badly, bad). To validate the conditioning procedure, the boy's secretion of saliva was monitored for the 30 seconds beginning with the spoken sentence *Khorosho uchenik otvechayet* ("Well the student answers") and similarly for the spoken sentence *Plokho vorobey poyot* ("Poorly the sparrow sings"). The boy was found to secrete 14 and 3 drops of saliva, respectively, providing support for the efficacy of the semantic conditioning. Over the course of the next several days, the boy's salivary responses to sociopolitical slogans and sentences were assessed. The data reported by Razran (1961) are summarized in Table 25-1. The secretion of saliva during the 30-second epoch beginning with the announcement of the statements with which the boy was likely to approve averaged 18.8 drops of saliva; beginning with the announcement of the word *plokho* averaged 1.5 drops; and beginning with the announcement of statements with which the boy was likely to disapprove averaged 1.5 drops of saliva (see Table 25-1).

The classical conditioning approach to the study of attitudes is cumbersome in regard to the equipment involved and the initial conditioning that must be done (see Cacioppo & Sandman, 1981; Petty & Cacioppo, Chapter 3). Nevertheless, as Tursky and Jamner (Chapter 4) have delineated, this methodological cost may well be worth it in some instances to obtain a more accurate and complete mapping of a person's attitude domains and to study the discrepancies that are sometimes observed across levels of analysis (e.g., psychophysiological, psychophysical, verbal, behavioral).

Emotional and Cognitive Response Approaches

One of the more surprising statements we encountered while surveying contemporary Soviet research was the assertion that the direction and intensity of a person's emotional response to an object or issue are reflected in autonomic changes. Western research using autonomic responses to gauge attitudes has confounded the emotionality and the novelty/signal value of the attitude objects. Hence, it was unclear whether the observed autonomic changes (typically, skin conductance responses) reflected an orienting response or the emotionality of the stimulus (Cacioppo & Sandman, 1981). Putlyaeva (1980), in an article entitled "The Function of Emotions in the Thought Process," indicated that the same problem

TABLE 25-1. Salivation to Statements following Conditioning

TEST STATEMENT*	DROPS OF SALIVA
Negative statements	
The pupil was fresh to the teacher	0
Brother is insulting sister	1
The pupil failed to take the examination	2
The Fascists destroyed many cities	2
The pupil broke the glass	2
My friend is seriously ill	2
Intermediate statement	
The pupil passed the examination with a mediocre grade	10
Positive statements	
The pupil studies excellently	14
Leningrad is a wonderful city	15
The Soviet Constitution is the most democratic	17
The Soviet people love their Motherland	17
The fisherman caught many fish	18
The children are playing well	19
The Soviet Army was victorious	23
The pioneer helps his comrades	23
The enemy army was defeated and annihilated	24

Note. Adapted from Razran (1961).
*In addition to these statements, the word *khorosho* was announced seven times and elicited an average of 14.7 drops of saliva, whereas the word *plokho* was announced two times and elicited an average of 1.5 drops during the 30-second recording interval.

had been recognized in Soviet psychology and, more interestingly, that a resolution using a distinctively Soviet paradigm had been reached:

> Some investigators considered the GSR to be an index solely of an orienting response, whereas others regarded it as an indicator of emotional states. These two points of view were in each case demonstrated with empirical data by their adherents. It was especially designed studies by V. S. Merlin (1960), and A. E. Ol'shannikova (1969) that not only confirmed the presence of GSRs in both cases but also made it possible to distinguish between these cases on the basis of the pattern of development and extinction of a GSR. Thus, these two viewpoints complemented, rather than contradicted, one another. (p. 24)

The Soviet resolution to the problem was apparently based on the fact that the orienting components of an autonomic response to an attitude stimulus should habituate with repeated presentations, whereas the components of the autonomic response pattern attributable to the emotional nature of the stimulus should not (at least, not as quickly). Putlyaeva (1980) goes on to summarize the nature of the autonomic pattern reflecting a person's positive or negative reaction to a stimulus (presumably following habituation):

> 1. Phasic increases in EDA are noted regardless of the individual or the polarity of the individual's emotional response to the stimulus.
> 2. Consistent directional changes in heart rate are observed *within individuals* in response to a positive or negative stimulus.
> 3. Averaging heart rate responses across individuals leads to an "apparent" dissociation between EDA and heart rate responses to the stimulus, with the former showing increases and the latter exhibiting no consistent overall change. This "apparent dissociation" of heart rate and affective response is avoided by obtaining background data from each subject to take into account that for some subjects "positive emotions caused a slowing of the pulse rate, whereas in others, the pulse rate speeded up" (Putlyaeva, 1980, p. 26).

Hypnopaedia and Persuasion

Hypnopaedia stems from the Greek words *hypno* meaning sleep and *paidea* meaning education or tuition and refers to instruction during sleep and low levels of wakefulness. Incidental or spontaneous learning during what behaviorally appears to be sleep states was first documented by Sviadoshch while he observed neuropsychiatric patients under his care (Rubin, 1971; Sviadoshch, 1968). Although most of the studies stimulated by Sviadoshch's observations and accessible to Western psychologists have dealt with the learning of foreign languages (particularly English), a few studies have examined attitude change. We begin by summarizing the "principles" of successful hypnopaedia as gleaned from studies of learning (cf. Rubin, 1968, 1971), and then survey the few studies pertaining most to attitude change (cf. Budzynski, 1976; Sviadoshch, 1968).

The acquisition of information through hypnopaedic training appears primarily during hypnagogic reverie and light sleep rather than during EEG slow-wave sleep (Levy, 1969; Simon & Emmons, 1955). When information is presented during EEG slow-wave sleep, learning is poor and then only when the presentation of the information also evokes desynchronized EEG activity ("K complexes"), REM (paradoxical) sleep, or lighter sleep (Cooper & Hoskovec, 1967). Rubin (1971), after reviewing the literature on hypnopaedia, concludes that "sleep-learning" is actually a misnomer, that "familiarizing and learning verbal material at the beginning of bedtime behaviour lapsing into drowsiness and light sleep is analogous with hypnopaedia" (p. 42), that complex material cannot be learned by hypnopaedic procedures alone, but that hypnopaedic procedures can substantially augment the learning of simple and complex materials.

The effectiveness of hypnopaedia as a supplementary teaching method for complex material is believed to be the result of the enhancing effect of

low levels of wakefulness on a person's unquestioning acceptance of (e.g., reduced counterargumentation to) the material being presented: "Speech assimilated during sleep, in contrast to that assimilated during waking state is not subjected during assimilation to the critical processing, and is experienced on awakening as a thought of which the source remained outside consciousness" (Sviadoshch, 1968). This observation, when applied to the area of persuasion, has potentially far-reaching implications. Consider Bliznitchenko's (1968) report of a study in which there was a radio instruction of the English language by means of the hypnopaedic method. The radio broadcasts were aired daily (except Saturday and Sunday) from December 21, 1965, to February 16, 1966, and "embraced some 2000 residents of Dubna, a town not far from Moscow known as a centre of nuclear physicists" (Bliznitchenko, 1968, p. 202). Bliznitchenko's study, which apparently did not examine the utility of the hypnopaedic method for persuasion, was reportedly successful: hypnopaedic instruction facilitated the acquisition of English by many of the residents of Dubna. There were no control comparisons, however, and the significance of the hypnopaedic training per se is difficult to assess. Nevertheless, the fact that the method can apparently be used on large masses of people suggests the potential social impact of the procedure should hypnopaedic instruction and persuasion prove to be effective.

Rubin (1971) argues that the format of hypnopaedic tutorials is particularly important. He suggests that a hypnopaedic tutorial possess the following characteristics:

1. It should begin with a positive suggestion to listen and remember the story.
2. The duration of sounds is increased by 10 to 15%.
3. The range of frequency is restricted to 120 to 200 Hz.
4. The timbre of the speaker's voice is designed to be pleasant to the listener(s).
5. There is an equal emphasis on all components of a sentence.
6. There are no abrupt changes in tempo or intonation.
7. There is a frequent repetition of the information presented with no changes in sequence.
8. With each repetition the speed of speech quickens and volume decreases to a whisper.

But the recipient apparently need bear no responsibility for preparing these materials, nor does he or she necessarily have to voluntarily approve of the entire training program (e.g., by being privy to the persuasive intent of a communicator) for hypnopaedia to be a theoretically effective procedure for undermining the person's critical evaluation of a persuasive appeal (see Budzynski, 1976).

We might note in this regard that research on hypnopaedic instruction and persuasion may have much in common with the area of distraction and

persuasion. As distraction increases from low to moderate levels, the likelihood that a recipient will evaluate the merits for a recommendation decreases while retention of the message arguments remains high. The effect of this is to increase the attitude change found in response to weak arguments, but to decrease the attitude change engendered when there are meritorious arguments for a recommendation (Petty, Wells, & Brock, 1976). As distraction continues to increase, however, the attention to and encoding of the message arguments drops, and attitude change is reduced regardless of the merits of the arguments (Romer, 1979; see Petty & Brock, 1981; Petty & Cacioppo, 1981). Hence, it may be the case that hypnopaedic presentations of persuasive messages can increase or decrease persuasion depending upon the quality of the arguments supporting the recommendation and the recipient's ability to learn and elaborate on the message arguments that are presented.

Several Western studies do indeed suggest that a person's cognitive defenses against weak arguments for a recommendation are lowered during the transition from wakefulness to sleep and, therefore, may be susceptible to attack using hypnopaedic tutorials. Barber (1957) compared the suggestibility of people who were awake, drowsy (or in light sleep), and hypnotized. He found that subjects who were drowsy or sleeping lightly, and subjects who were hypnotized, were more suggestible than subjects who were awake. A report by one subject in Barber's (1957) study indicated that "I was just sleepy enough to believe what you were saying is true. I couldn't oppose what you wanted with anything else" (p. 59). In another study, attitude change (assessed using pre- and postattitude scales) was examined after subjects were exposed to a counterattitudinal message (favoring interracial marriage) during a state of wakefulness, drowsiness/light sleep, or deep sleep (Felipe, 1965). Attitude change in the state of wakefulness and deep sleep was negligible, whereas attitude change in the drowsy/light sleep state was significant. Finally, Budzynski (1976) reported several case stories in which he and his colleagues exposed clients to what could be considered persuasive (psychotherapeutic) messages while maintaining their clients' state of drowsiness/light sleep using biofeedback. In one case, Budzynski (1976) described a student with severe test anxiety who responded with large changes in EDA when "certain words from a list [were] read to him" (p. 377). A message was prepared in which it was suggested that the words and the situations they represented would no longer cause the person to feel anxious. The student recorded the message and twice listened to it during a drowsy/light sleep state. Afterward, the student was again exposed to the list of words, but this time no substantial deflections of EDA following the key words were observed. The student also reported a lessening of test anxiety. This research is suggestive, but far from conclusive. For instance, even if hypnopaedic presentations facilitate persuasion, there remains important questions regarding the per-

sistence of the attitude change. The Soviet work in this area nevertheless has brought attention to these issues and, perhaps more importantly, has uncovered a number of the parameters that appear important for successful hypnopaedic tutorials (see Rubin, 1971).

Emotions

Western psychologists and psychophysiologists have done considerably more research on emotions than Soviet psychologists. Rahmani (1973) indicates that the sole chapter on emotions and feelings in the two-volume *Psychological Science in the USSR* lists only 56 papers and books in the area in contrast to bibliographies of many hundreds of works that can be found in chapters dealing with thinking and learning. Moreover, the study of emotions is one of the areas where the gap between Soviet and Western psychological study is widest.

In one interesting set of studies (Grimak & Ponomarenko, 1967), heart rate and respiration were recorded to determine the bodily reactions to emotional stress. In the first experiment, beginning parachutists were hypnotized, and a parachute jump was verbally recreated as they lay motionless on the floor. In a second experiment, experienced pilots were placed under actual flying conditions, and their automatic controls failed to operate when the pilots were ready to land their aircraft. (This latter stressor may not have been as excessive as it may initially seem, since pilots typically go on manual control prior to landing.) The analyses of the autonomic responses to these emotionally stressful situations revealed three distinct patterns of responding. One, which characterized the inexperienced more than experienced subjects, reflected a low level of responding before and during the critical moment and a flurry of "functional deviations" after the critical moment. (This pattern appeared to be similar to the pattern people sometimes display before, during, and immediately after an unexpectedly close call in an automobile.) The pattern is schematically displayed in the top panel of Figure 25-1. A second pattern, which was reported to be almost as frequent among the experienced as the inexperienced subjects, was characterized by an increased pulse and respiration rate at the critical moment (see the middle panel of Figure 25-1). This pattern of autonomic activity is similar to that found by Fenz and Epstein (1967) to characterize relatively novice parachutists on the day of a jump. A third autonomic pattern, which was exhibited more frequently by experienced than inexperienced subjects, was characterized by a rise in pulse and respiratory rate that reached peaks before the critical moment (i.e., during a period of anticipation) followed by a decline (see the bottom panel of Figure 25-1). This pattern is similar to that found by Fenz and Epstein (1967) to characterize experienced parachutists the day of a jump. Grimak and Ponomarenko (1967) reported that the type of reaction did not reflect

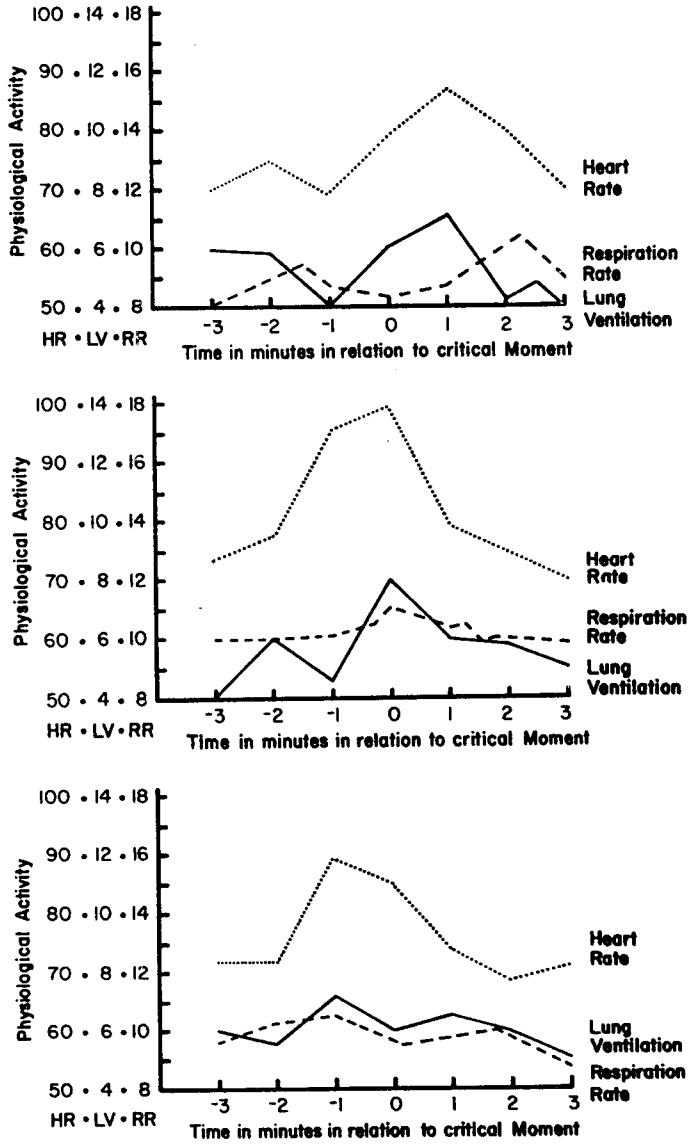


FIGURE 25-1. Three temporal patterns of autonomic activity to emotional stress. A pattern characterizing relatively inexperienced subjects is displayed in the top panel, a pattern characterizing both inexperienced and experienced subjects is displayed in the middle panel, and a pattern generally characterizing experienced subjects is displayed in the bottom panel.

the quality of the subject's performance, but the sensitivity of their measure is unclear. It may be that when people know that a fearful event is impending they respond physiologically with greater activity in the autonomic nervous system (i.e., conditioned emotional response). With practice, people may develop means of coping with their physiological reactions to avoid its subjectively unpleasant effects or its debilitating behavioral effects (cf. Fenz & Epstein, 1967; Kagan, Haith, & Caldwell, 1971).

Grimak and Ponomarenko's (1967) study is not too dissimilar to studies conducted by Western psychologists studying the James-Lange theory of emotions (cf. Grings & Dawson, 1978). However, a tenet common to most Soviet theories of emotion is that the cerebral cortex acts as a coordinator, interpreting perceptual signals, monitoring proprioceptive and interoceptive signals, and commanding effectors to respond appropriately. Yet according to the concept of activity, which most Soviet models of emotion embrace, the emotion does not arise within a particular center of the body or brain, but rather the physiological substrates of emotions "are less their bases than they are the springboards for their subsequent development" (London, 1950, p. 88).

A description of a theory of emotion popular in Soviet psychology may be helpful. What would appear to be one of the more sophisticated Soviet theories of emotion has emanated from the work of Beritashvili (1969). Beritashvili has studied the emotional behaviors of animals following the removal of the neocortex (the most recently evolved, outer layer of the cerebral cortex) or the entire cerebral cortex. Beritashvili found that removal of the neocortex does not deprive the animals entirely of emotional reactions. For instance, when deprived of food, cats become restless, mew, and cry furiously; they act as if terrified when subjected to painful stimulation; and they enter a rage during irritation to the skin. Moreover, electrical stimulation to areas in the lower cortex (the archipaleocortex) can obtain these same types of reactions. Finally, a pairing of a neutral sound or light with such stimulation is often sufficient for conditioned emotional responding to develop. None of these emotional behaviors are observed, however, in the decorticate animal (i.e., following the removal of the entire cerebral cortex). Beritashvili (1969) has also noted that stimuli act on the archipaleocortex via the reticular formation and, independently, via nuclei of the diencephalon (i.e., part of the forebrain that includes the thalamus and hypothalamus—see Chapter 1). From these and similar observations, Beritashvili (1969) constructed the following model of emotions:

> It may be assumed that, during the first effective influence of a vitally important object on the organism, a perception by means of the neocortex as well as an emotional excitation by means of the archipaleocortex is produced. As a result of the coincidence of these neuropsychic processes, differential neural bonds are first formed between excited sensory complexes of the neocortex and the archipaleocortex by means of association pyramidal neurons. Therefore reproduction of an image of a given object should lead not only to orienting reactions via the neocortex but also to emotional excitation of the archipaleocortex with its subjective experience and overt somatovegative expression. (p. 660)

Hence, in the tradition of Pavlov, emotions are viewed as the product of organismic-environmental interactions, regulated by the cortex, and expressed in somatic and autonomic changes. Note that, contrary to Schachter and Singer's (1962) cognitive-physiological model of emotions and the peripheralist views of James (1884) and Lange (1885/1922), the somatovisceral and the subjectively qualitative components of an emotion are viewed as independent consequences of the cortical regulation of the organism's activity in the environment. Beritashvili's model can be used to describe Grimak and Ponomarenko's (1967) data by postulating that experience alters the cortical regulation of organismic-environmental interactions—a postulate endorsed by Beritashvili (1969). It is somewhat more difficult, however, to derive specific predictions regarding how experience will alter emotional responding in complex circumstances such as those studied by Grimak and Ponomarenko (1967) and those broached by Leventhal and Mosbach (Chapter 12), Fridlund and Izard (Chapter 9), Hager and Ekman (Chapter 10), and Sackeim and Gur (Chapter 11) in this volume.

Inner Speech

Given the emphasis today in social psychology on cognitive (particularly verbal) mediators (cf. Berkowitz, 1978; West & Wicklund, 1980), it may be informative to review the Soviet research on inner speech. The Soviet theory of and research on inner speech suggest methods for assessing independently the presence of concentrated verbal thought in social psychological paradigms as well as new experimental paradigms for examining the role of inner speech in social processes.

Before proceeding to the Soviet research, however, let us examine the specific meanings given some of the key terms:

> The term "inner speech" usually signifies soundless, mental speech, arising at the instant we think about something, plan or solve problems in our mind, recall books read or conversations heard, read and write silently. In all such instances, we think and remember with the aid of words which we articulate to ourselves. . . . The elements of inner speech are found in all our conscious perceptions, actions, and emotional experiences, where they manifest themselves as verbal sets, instructions to oneself, or as verbal interpretation of sensations and perceptions. This renders inner speech a rather important and universal mechanism in human consciousness and psychic activity. (Sokolov, 1972, p. 1)

Although inner speech was at one time held to be identical to external speech minus sound, work particularly by Vygotsky (cf. Cole *et al.*, 1981) and Sokolov (1972) have promoted the view that inner and external speech are related through partially independent processes. External speech is graphically characterized by Sokolov (1972) as follows:

> A rather complex phonetic, lexical, and grammatical system, human speech is characterized by a sound envelope, its form, with which is associated a meaning, which comprises its objective content. Both become fixed in the course of the historical development of language, acquiring a relatively constant character, and are mastered by each individual in the process of his intercourse with other members of a given language community. In mastering the societally determined system of generalized and abstract signals of reality that is language, man masters all the logical forms and thought operations connected with it in its role as a (verbally) mediated reflection of real connections and relationships among objects. (p. 2)

These definitions imply an intimate link between inner speech and thought, and indeed a close relationship between the two is postulated. Inner speech and thought, however, are not equated, since the same thought can be expressed (even to oneself) in different words, different grammatical forms, or in different signal systems (e.g., mathematical, pictorial, cryptographic).

Theoretical Positions

The theoretical work on the interrelationships among external speech, inner speech, and thought can be traced to Sechenov (1973) and Vygotsky (Cole *et al.*, 1981), where the notion was advanced that thinking begins as the encoding of objective associations. For instance, a child learns about his or her environment by various movements that lead to concrete associations between these movements and visual, auditory, tactile, and other sensory impressions. Mastering external speech allows the child to express these associations symbolically, which sets the basis for the transformation of thought from concrete images and associations to complex abstractions and generalizations. The mastery of external speech was also thought to facilitate self-regulation (e.g., by internalizing the instructions of parents and engaging in self-instruction to guide behavior). Sechenov, for example, observed that children made great strides in inhibiting their motoric responses to stimuli (i.e., to regulate their own behavior) when they developed external egocentric speech (i.e., talking aloud to oneself). Subsequently, Sechenov suggested, the central inhibition of motoric responses spread to the external expression of egocentric speech as well, leaving the child with covert egocentric speech as a means of regulating his or her behavior.

Following Sechenov and Vygotsky, motivated and purposeful external speech has become viewed as consisting of several stages: programming (i.e., a goal and plan); implementation of the program; evaluation of the implementation with respect to the plan and goal, which involves obtaining feedback; and adjustments in programming and/or implementation to achieve the goal (e.g., Akhutina, 1978). Although feedback regarding complex speech movements may derive from auditory as well as proprioceptive sources, research by Bernshtein (1969) on the coordination of fine motor movements suggests that proprioceptive feedback alone is fast enough to contribute to the control of external speech. Hence, the kinesthetic sensations from the speech musculature was viewed as an important link between thought and external speech. Any of a variety of symbolic representations (e.g., sign language, gestures, facial expressions) of a message can be used to achieve social communication and self-regulation, but language is a particularly flexible and pervasive selection because sounds are more effective than gestures, especially in darkness or at distances.

To transmit a message effectively to another person using external speech, words must be selected that have a communal meaning. Either normatively endorsed words must be selected or idiomatic expressions must be supplemented by additional signals (not necessarily verbal) that together convey the intended message. Next, these symbols must be organized into a syntactic structure that conveys the subject and predicate (who is doing what to whom, how, and why). Finally, if verbal signals are chosen, the words must be articulated clearly.

In contrast to external speech, inner speech functions primarily to facilitate the development and communication of one's thoughts to oneself, as preliminary drafts of social speech, as a private voice for self-regulation, and as a workspace for formulating overt actions. Inner speech, therefore, can be greatly condensed, since there is nothing to be gained by retaining in inner speech many of the syntactic, semantic, and phonetic attributes of external speech. Vygotsky characterized the syntactic aspects of inner speech as more fitful, fragmentary, and abbreviated than external speech. There is a "simplification of syntax, a minimum of syntactic breaking down, expression of thought in condensed form, a considerably smaller number of words" (1956, p. 359). On the basis of Vygotsky's observations of children, he concluded that the abbreviated form of inner speech is accomplished by "the absolute and complete predicativeness of inner speech . . . it is never necessary for us to name that about which we are speaking, i.e., the subject. We always limit ourselves only to what is being said about this subject, i.e., the predicate. But this is precisely what leads to the dominance of pure predicativeness in inner speech" (Vygotsky, 1956, p. 366). The phonetic aspect of external speech is diminished, as well. "In inner speech we do not need to pronounce a word in its entirety. We understand, by virtue of our very intention, what word we wanted to say.

. . . Strictly speaking, inner speech is almost wordless" (Vygotsky, 1956, p. 368).

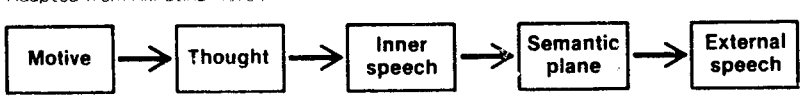
Finally, the semantic aspect of inner speech is viewed as being different than that of external speech. The semantic structure of inner speech is highly idiosyncratic, contextual, "and include[s] not only the objective meaning of words but all the intellectual and affective content connected with it" (Sokolov, 1972, p. 48). Related to the use of idiosyncratic phrases in inner speech is the grouping of semantic units, which reduces the phrases to new or hyphenated words in inner speech. Vygotsky notes that this reduction in phrases in inner speech subsequently leads on occasion to the emergence of new hyphenated words in external speech. In sum, external speech is internalized and transformed ("streamlined") during the development of higher psychological processes to form an efficient, idiomatic signaling system for thought and feelings (see Figure 25-2). The consequences of the development of inner speech include the growth of a "private" side of an individual and the reduction of impulsiveness.

Soviet theoretical work on inner speech since Vygotsky (1956) has led to a few revisions (cf. Akhutina, 1978; Sokolov, 1969, 1972). One of the most important revisions concerns the phonemic reduction in inner speech. Anan'ev (1960) holds that phonemic reduction in inner speech is accomplished primarily through the dropping of vowels. There were by this time observations indicating that inner speech typically included the initial sounds or letters of words and that it often was similar in form to the abbreviations of words used in the written language. (Recall, however, that we are speaking of the Russian written language. There are no comparable observations for the English language, for instance.) Finally, the *absolute* predicativeness of inner speech was rejected, as instances in which it was substantive were found. "Inner speech based on a certain concreteness of thought is predicative. When, on the other hand, an object is as yet not recognized and identified in perception, not outlined in thought, inner speech is substantive" (Anan'ev, 1960, p. 336).

Although other models of inner speech have been proposed (e.g., Komlev, 1980–1981; Leont'ev, 1969), the models reviewed above are classics in Soviet psychology and form the foundation for empirical work in this area.

The survey of differences between external and inner speech, which as we noted are based largely on the social nature of the former and the

FIGURE 25-2. Schematic diagram of Vygotsky's model of the development of an utterance. Adapted from Akhutina (1978).



idiosyncratic nature of the latter, may appear a bit tedious from the view of a social psychologist or psychophysiologist. These differences are important to consider, however, if the postulated cognitive processes common in social psychological theories are to be assessed objectively using, for instance, electromyographic recording procedures. For instance, if the stream of reportable states is viewed theoretically as mirrored in a sequence of discrete electromyographic events, it should be difficult to find a normative or prototypical waveform that accurately characterizes different individuals' expression of a common thought or idea in inner speech since their condensed representation of the thought or idea is likely to vary. Moreover, the nature of the inner dialogue accomplishing a given sequence of thoughts may vary within individuals across situations because of contextual differences (e.g., different idioms may be selected). The task of extracting information about covert information processing, however, can proceed systematically once these factors are taken into account. For example, one implication is that it may be especially informative to include a "calibration signal" in experimental designs wherein the electromyographic patterns accompanying known psychological responses (e.g., responding to a personally relevant counterattitudinal communication) are recorded.[2]

Sokolov (1969, 1972) has contributed a great deal to this area, particularly to our understanding of what features of the stream of electromyographic signals accompany different aspects of inner speech. We turn next to Sokolov's electromyographic investigations of thought and inner speech.[3]

2. The inclusion of such a "calibration" signal is not new in Soviet studies. Recall that Putlyaeva (1980) reported that Soviet investigators using autonomic measures of emotional reactions determined their subjects' idiosyncratic heart rate response to positive and negative stimuli before proceeding.

3. Electromyographic recording is but one technique used to study inner speech. Other methods include auditory distraction (e.g., ordinal counting while listening to someone speak) and mechanical retardation of articulation (e.g., by clamping the lips and tongue between the teeth), both of which interfere with the normal dynamics of inner speech, and external articulation (e.g., reading aloud), which presumably facilitates the processes of inner speech (cf. Sokolov, 1969, 1972). Among some of the major findings obtained using these procedures is that the most important distinction between inner and external speech is not the "soundlessness" of the former, but rather its fragmentariness and its possible support through graphic representation. The results found using EMG recordings are representative and, in many instances, less artifactual (e.g., the distraction, distress, and apprehension subjects may experience when their tongue and lips are clamped between their teeth are avoided by the EMG recording procedure). Hence, we have restricted our summary of the empirical work on assessing objectively inner speech to that employing electromyography. The interested reader may wish to consult Akhutina (1978), Chuprikova (1972), Komlev (1980–1981), or Sokolov (1969, 1972) for more detail about the varieties of Soviet psychological analyses of inner speech.

EMG, Thought, and Inner Speech

In the research summarized by Sokolov (1969, 1972), surface electrodes for EMG recording are placed on the tongue and lower lip. Subjects, who ranged from students at Moscow University to scientific personnel and young schoolchildren, were tested while seated in a reclining position in an electrically shielded chamber. Subjects received preliminary training in what apparently amounts to progressive relaxation, and an adaptation period preceded the introduction of experimental stimuli. Task instructions were presented aurally; tasks included vocalizing or silently articulating words, performing mental arithmetic, reading to oneself, listening to someone speaking, memorization and recollection of verbal material, and mental manipulation of graphic material.

Vocalizing and silently enunciating letters (e.g., "O") and words (e.g., "one," counting from one to five) revealed that, when vocalizing discrete sounds, adults display action potentials in the perioral region (e.g., in the area of the tongue and lower lip) that precede phonation by approximately 350 to 700 msec. This latent period of phonation is slightly exaggerated in schoolchildren, lasting approximately 500 to 1000 msec. With repeated vocalization of the same phoneme or word, the latent period diminishes slightly, but the latent period is condensed most when a string of phonemes is vocalized. The speed of external speech, therefore, affects the form of the preliminary perioral EMG activity.

The phonemic structure of words silently enunciated was also found to alter the underlying perioral EMG activity. In experiments where subjects silently articulated labial and nonlabial Russian vowels, the degree and temporal characteristics of tongue and lip EMG activity were clearly distinctive when a rapid scanning rate was used (cf. McGuigan & Winstead, 1974). Specificity in electromyographic responding was found too when the activity at the hands was considered. Unlike perioral EMG activity, the EMG activity at the hands did not distinguish the phonemic attributes of sounds and words; moreover, an increase in EMG activity was observed when concentrated mental activity was "relatively prolonged" (Sokolov, 1972, p. 170—cf. Cacioppo & Petty, 1981b). Lastly, Sokolov (1972) compared the spectra of the action potentials of the perioral muscles when the same words were spoken aloud and silently. He found that the spectra for silently pronounced words was narrower than that observed in words spoken aloud or in a whisper (which resulted in similar spectra). This difference was especially notable for low-amplitude action potentials, while the bandwidth of the majority of the action potentials was stable and ranged between 30 and 200 Hz.

Analyses of EMG activity during mental arithmetic resulted in a number of additional findings that generalize to silent verbal processing as well. When a subject first begins to count silently, phasic EMG activity increases in the perioral region. Shortly thereafter, the subject's continued

counting to himself or herself is accompanied by a return of perioral EMG activity to basal levels. Moreover, repeated counting is not accompanied by the same intensive burst of EMG activity that characterized its initiation. If the stereotypy of the counting is altered (e.g., decrementing by 3 rather than 1), an increase in perioral EMG activity is again noted.

In a related fashion, solving a mathematical problem (e.g., deriving the square root of 225) is not accompanied by a substantial increase in perioral EMG activity if the answer is already known to a subject. If the answer must be derived from the information provided in the problem, intermittent bursts of perioral EMG activity are evident, but particularly when the problem is being formulated, the calculations (i.e., manipulation of symbols) are being performed, and the final answer is being organized for presentation. These intermittent bursts of muscle action potentials appear in the integrated EMG as a clear waxing and waning of perioral muscular activity:

> Such intensity fluctuations of motor speech excitation represent a rather characteristic pattern of the neurodynamics of mental problem solving. This pattern may undergo considerable changes, depending on the complexity of the given task and the acquired habits of problem solving, but the main factor—the alternating waxing and waning of the level of motor speech excitation—is there whenever the task presented offers difficulties of any kind for the subject's reasoning capacity. (Sokolov, 1972, pp. 196–197).

When Sokolov analyzed the EMG activity exhibited by an individual who was slow as compared to one who was fast (but, apparently, no more accurate) at mathematical calculations, he found several interesting differences. The former individual, of course, took longer to perform a given mathematical problem, and the total EMG activity that was evinced during the calculation of the answer was greater for this individual than for the individual who performed mathematical calculations rapidly. When the amount of EMG activity that each individual displayed was expressed per unit time (e.g., microvolts per second that the individual calculated an answer), however, fewer significant differences in EMG activity were evident (cf. Cacioppo & Petty, 1981a). This, Sokolov (1972) contends, is attributable to the especially high variability in perioral EMG activity characterizing the slow problem solver. These findings are illustrated schematically in Figure 25-3.

Further tests using these and other subjects comparing the responses to complex and simple (almost automatized) tasks revealed differences in time of solution (the former took longer), intensity of perioral EMG activity (the former elicited more frequent and larger amplitude action potentials), and variability (the former appeared to be accompanied by a more extreme waxing and waning of perioral EMG activity). Sokolov (1972) drew several

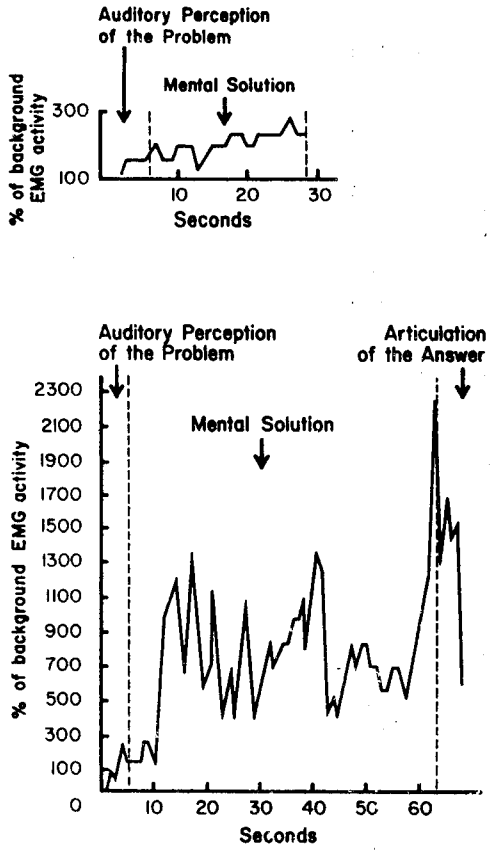


FIGURE 25-3. Graphic representation of the integrated EMG activity obtained over the perioral musculature during mental arithmetic [e.g., (23 × 13)/4]. The record of a subject who solved mathematical problems quickly is displayed in the top panel, whereas the record of a subject who solved mathematical problems slowly is displayed in the bottom panel. Adapted from Sokolov (1972).

inferences from his observations. He concluded that the intensity of localized perioral EMG activity is a direct function of the number of mental operations required to perform the task (p. 197) and of the number of "switchings to other operations required for solution" (p. 201), and that the intensity of perioral EMG reflects a "generalization of the excitatory process and its spreading to a broader region of the cerebral end of the motor speech analyzer" (p. 198).

> It should also be emphasized that even when the automatism of mental operations is at a maximum, motor speech excitation does not disappear completely: it remains, as it were, on guard for protection of automatism, manifesting itself whenever the latter is disturbed and whenever there is transition to novel mental operations. (Sokolov, 1972, p. 202)

Finally, Sokolov argued that the mode of stimulus presentation exerts a strong influence on the intensity of perioral EMG activity. Audio presentations (i.e., a mathematical problem announced using a microphone) resulted in more intense perioral EMG activity than visual presentations (i.e., the same problem presented in written form). Unfortunately, the memorial requirements of the task were confounded with the mode of presentation (i.e., acoustically presented material had to be rehearsed if it was to be retained, whereas visually presented material was available for reinspection as needed). Hence, clear conclusions about the effect of the mode or presentation per se cannot be drawn.

Sokolov's (1969, 1972) analysis of perioral EMG activity during verbal processing, reading to oneself and listening to speech, revealed the same principles as outlined above for mental arithmetic. A brief mention of a few studies should be illustrative.

In one of the simpler studies, a subject was asked to "Try to figure out on what day of the week will September 1 of this year fall" (Sokolov, 1972, p. 182). While the subject developed an answer to the question, large increases in perioral EMG activity were observed. When 4 days later the same question was asked of the subject, there was no increase in perioral EMG activity. In another study, subjects silently read either a series of short Russian phrases (e.g., "There is not enough sunshine; The snow is everywhere; The trees are without leaves . . .") or complicated Russian sentences (e.g., "Whispering to one another, the boys stood beside the pipe into whose orifice Pet'ka had stuck his head"). The short phrases were generally unaccompanied by significant increases in perioral EMG activity, whereas the complicated sentences resulted in increases in perioral EMG activity. Reading a text in a foreign language (e.g., English), which was much more difficult for the subjects, was, as might be expected, accompanied by more intense perioral EMG activity. These and related findings are depicted schematically in Figure 25-4.

In yet another study, subjects were asked to listen to an excerpt from a fictional story, then to think of a title for the excerpt, and subsequently to "mentally reproduce the text." In each instance, perioral EMG activity appeared greater than basal levels, particularly during the latter two tasks.

Examination of perioral EMG activity during listening to another person speak revealed two instances in which activity deviated most (in the direction of greater excitation) from basal levels: "The moment of intense attention to the speaker's utterance and its fixation and whenever diffi-

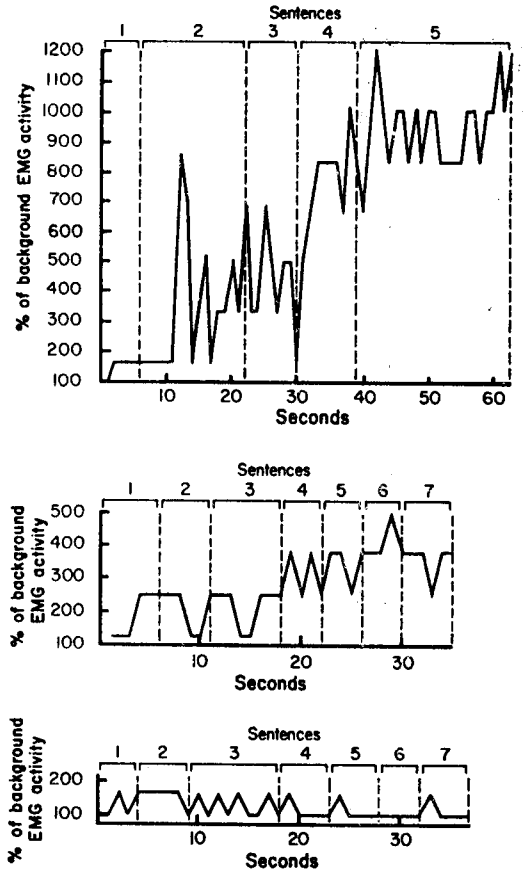


FIGURE 25-4. Graphic representation of the integrated EMG activity obtained over the perioral musculature during silent reading of text. The momentary halt in silent reading that occurred between each sentence is marked by vertical dotted lines. The record of a subject reading a foreign (English) text is displayed in the top panel, an initial reading of a text in the native language (Russian) is displayed in the middle panel, and a repeated reading of the Russian text is displayed in the bottom panel. Sokolov (1972) noted that following the production of the bottom record, a record as seen in the middle panel was again produced when the subject was instructed to "Reread it more attentively." Adapted from Sokolov (1972).

culties are experienced as regards comprehension of the speaker's utterance and its subsequent logical processing" (Sokolov, 1972, p. 179). The enhanced perioral EMG activity we have observed in response to counter-attitudinal in contrast to neutral and proattitudinal communications (Cacioppo & Petty, 1979; see Chapter 3) is clearly in accord with the Soviet research on covert information processing.

Finally, investigations of perioral activity during visual problem solving have produced more conflicting results. Zinchenko, Nunipov, and Gordon (1973–1974) monitored lip EMG, EEG alpha blocking, and oculomotor responses during the performance of three types of visual tasks (i.e., maze, square, and compass tests). They found that as subjects worked on more difficult problems, external scanning diminished somewhat, whereas "internal scanning" (comparison of an image with a standard) increased in importance (as indicated by EEG and oculomotor changes). Perioral EMG activity, however, showed the same pattern for all the visual problems. This led Zinchenko *et al.* (1973) to suggest that "inner speech performed merely the function of planning activity and establishing the results obtained" (p. 86). In other words, perioral EMG activity did not reflect the manipulation of visual images or switching from one to another visual image. Sokolov (1972) found that constructing an image (e.g., of a ship) was unaccompanied by perioral EMG activity, although he did find evidence of increasing perioral EMG activity as subjects performed more and more complex maze tasks. Sokolov concluded, contrary to Zinchenko *et al.* (1973), that the localized EMG activity in the perioral region reflected the logical operations on concrete (visual) objects. This point, so far as we could tell, has remained unresolved in the Soviet literature.

CONCLUSION

Western social psychologists have been concerned with a broad range of topics dealing with human association. The demands of a discipline so wide in scope have led to such a specialization in social psychology that investigators from related areas of research (e.g., attraction, attitude formation) may be largely unfamiliar with each other's work (cf. Wyer, 1978). In addition, as was noted at the outset of this book, many of the theories in social psychology have either incorporated an almost entirely "conceptual" nervous system or ignored the influence of physiological processes altogether. To some extent, this is understandable given the demands of experimental social psychology as a discipline and the technology that existed in the past for investigating psychophysiological processes. However, as the contributors to the present book have demonstrated, psychophysiological technology has become increasingly accessible to researchers, and psychophysiological data are increasingly available to develop, assess,

and refine the "conceptual" nervous systems in social psychological theories.

The Soviet psychological research bears on both the theoretical approaches taken and the methods employed in social psychophysiology. In this chapter we have reviewed a variety of specific procedures that might prove to be useful indices of social processes (e.g., perioral EMG activity; classically conditioned indices of attitudes), and we have surveyed the general, theoretical perspective advanced in Soviet psychology. It is interesting to note, though, that Soviet *social* psychology, which is still an emerging area within Soviet psychology, has apparently drawn some criticism for *not* delving deeper into the role of psychophysiological processes in human social behavior.

> Of course, contemporary psychological research provides more and more new evidence of the social factors that determine man's mental development. But at the same time, we have acquired a deeper understanding of the natural factors underlying this development. Over the past few decades our knowledge of the properties of the nervous system as the natural underpinnings of individual psychological differences has widened significantly. Hence to opt for any set of new facts in one area to the exclusion of all the others will yield only a one-sided solution to the question. Ultimately, of course, the only solution must lie in a dialectical approach in which new facts can be immediately fit into a unified theory and perceived in their interrelationships. (Budilova, 1973, p. 33)

It seems that in this regard Western social psychologists and psychophysiologists are beginning cooperatively to make significant, if not unique, advances in the scientific study of social behavior (Cacioppo & Petty, in press).

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REFERENCES

Akhutina, T. V. The role of inner speech in the construction of an utterance. *Soviet Psychology*, 1978, *16*, 3-30.

Anan'ev, B. G. On the theory of inner speech in psychology. In *The psychology of century cognition*. Moscow: Academy of Pedagogical Science, RSFSR Press, 1960.

Anokhin, P. K. Cybernetics and the integrative activity of the brain. In M. Cole & I. Maltzman (Eds.), *A handbook of contemporary Soviet psychology*. New York: Basic Books, 1969.

Barber, T. X. Experiments in hypnosis. *Scientific American*, 1957, *196*, 54-61.

Beritashvili, I. S. Concerning psychoneural activity of animals. In M. Cole & I. Maltzman (Eds.), *A handbook of contemporary Soviet psychology*. New York: Basic Books, 1969.

Berkowitz, L. *Cognitive theories in social psychology*. New York: Academic, 1978.

Bernshtein, N. A. Methods for developing physiology as related to the problems of cybernetics. In M. Cole & I. Maltzman (Eds.), *A handbook of contemporary Soviet psychology*. New York: Basic Books, 1969.

Bliznitchenko, L. Hypnopaedia and its practice in the USSR. In F. Rubin (Ed.), *Current research in hypnopaedia*. London: Macdonald, 1968.

Boring, E. G. *The history of experimental psychology* (2nd ed.). New York: Appleton-Century-Crofts, 1950.

Brown, J. S. *The motivation of behavior*. New York: McGraw-Hill, 1961.

Budilova, E. A. The relationship between psychology and physiology. *Soviet Psychology*, 1973, *11*, 23-34.

Budilova, E. A. N. G. Chernyshevsky and materialistic psychology. *Voprosy Psikhologii*, 1978, 5, 29-30. (English summary)

Budzynski, T. H. Biofeedback and the twilight states of consciousness. In G. E. Schwartz & D. Shapiro (Eds.), *Consciousness and self-regulation: Advances in research* (Vol. 1). New York: Plenum, 1976.

Cacioppo, J. T., & Petty, R. E. Attitudes and cognitive responses: An electrophysiological approach. *Journal of Personality and Social Psychology*, 1979, *37*, 281-299.

Cacioppo, J. T., & Petty, R. E. Electromyograms as measures of extent and affectivity of information processing. *American Psychologist*, 1981, *36*, 441-456. (a)

Cacioppo, J. T., & Petty, R. E. Electromyographic specificity during covert information processing. *Psychophysiology*, 1981, *18*, 518-523. (b)

Cacioppo, J. T., & Petty, R. E. A biosocial model of attitude change. In J. T. Cacioppo & R. E. Petty (Eds.), *Perspectives in cardiovascular psychophysiology*. New York: Guilford, 1982.

Cacioppo, J. T., & Petty, R. E. Social processes. In M. G. H. Coles, E. Donchin, & S. W. Porges (Eds.), *Handbook of psychophysiology*. New York: Guilford, in press.

Cacioppo, J. T., & Sandman, C. A. Psychophysiological function, cognitive responding, and attitudes. In R. E. Petty, T. M. Ostrom, & T. C. Brock (Eds.), *Cognitive responses in persuasion*. Hillsdale, N.J.: Erlbaum, 1981.

Chuprikova, N. I. The completion of temporary connections through speech. *Soviet Psychology*, 1972, *10*, 276-302.

Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (Eds.). *L. S. Vygotsky: Mind in society*. Cambridge, Mass.: Harvard University Press, 1981.

Cole, M., & Maltzman, I. (Eds.). *A handbook of contemporary Soviet psychology*. New York: Basic Books, 1969.

Cooper, L. M., & Hoskovec, J. Personal communication, 1967. (Cited in F. Rubin, *Learning and sleep*. Baltimore: Williams & Wilkins, 1971.)

Corson, S. A., & Corson, E. O. (Eds.). *Psychiatry and psychology in the USSR*. New York: Plenum, 1976.

Cropsey, J. Karl Marx. In L. Strauss & J. Cropsey (Eds.), *History of political philosophy* (2nd ed.). Chicago: Rand McNally, 1972.

Felipe, A. *Attitude change during interrupted sleep*. Unpublished doctoral dissertation, Yale University, 1965.

Fenz, W. D., & Epstein, S. Gradients of physiological arousal in parachutists as a function of an approaching jump. *Psychosomatic Medicine*, 1967, *29*, 33-51.

Gergen, K. Social psychology as history. *Journal of Personality and Social Psychology*, 1973, *26*, 309-320.

Grimak, L. P., & Ponomarenko, V. A. Types of human autonomic shifts induced by emotional stress. *Zhurnal Vysshei Nervnoi Deyatel'nosti Imeni I. P. Pavlova*, 1967, *17*, 408-412. (Described in *Sleep learning in the USSR*, ATD Report No. 68-91-108-6. Washington, D.C.: Aerospace Technology Division, Library of Congress, February, 7, 1969.)

Grings, W. W., & Dawson, M. E. *Emotions and bodily responses*. New York: Academic, 1978.

James, W. What is emotion? *Mind*, 1884, *9*, 188-204.

Kagan, J., Haith, M. M., & Caldwell, C. (Eds.). *Psychology: Adapted readings*. New York: Harcourt, 1971.

Komlev, N. G. A linguistic interpretation of thought in relation to speech. *Soviet Psychology*, 1980–1981, *19*, 3–22.

Kornilov, K. N. Psychology in the light of dialectical materialism. In C. Murchison (Ed.), *Psychologies of 1930*. Worcester, Mass.: Clark University Press, 1930.

Krauss, R. M. Social psychology in the Soviet Union: Some comments. In S. A. Corson & E. O. Corson (Eds.), *Psychiatry and psychology in the USSR*. New York: Plenum, 1976.

Kurtsin, I. T. *Theoretical principles of psychosomatic medicine*. Toronto: Wiley, 1976.

Lange, C. The emotions. In K. Dunlap (Ed.), *The emotions*. Baltimore: Williams & Wilkins, 1922. (Originally published, 1885).

Leont'ev, A. A. Psycholinguistic units and the production of verbal utterances, 1969. (Cited in T. V. Akhutina, The role of inner speech in the construction of an utterance, *Soviet Psychology*, 1978, *16*, 3–30.)

Levy, C. M. Personal communication, 1969. (Cited in F. Rubin, *Learning and sleep*. Baltimore: Williams & Wilkins, 1971.)

Lomov, B. F. Sixty years of Soviet psychology. *Soviet Psychology*, 1978–1979, *17*, 68–82.

London, I. D. Theory of emotions in Soviet dialetic psychology. In M. L. Reymert (Ed.), *Feelings and emotions*. New York: McGraw-Hill, 1950.

Luria, A. R. The quantitative assessment of levels of wakefulness. *Soviet Psychology*, 1973, *12*, 73–84.

Luria, A. R., & Vinogradova, O. S. An objective investigation of the dynamics of semantic systems. *British Journal of Psychology*, 1959, *50*, 89–105.

Mackay, C. J. The measurement of mood and psychophysiological activities using self-report techniques. In I. Martin & P. H. Venables (Eds.), *Techniques in psychophysiology*. Chichester: Wiley, 1980.

McGuigan, F. J., & Winstead, C. L., Jr. Discriminative relationship between covert oral behavior and the phonemic system in internal information processing. *Journal of Experimental Psychology*, 1974, *103*, 885–890.

McLeish, J. *Soviet psychology: History, theory, content*. London: Methuen, 1975.

Merlin, V. S. The unique features of the galvanic skin parameter of a conditional response in the presence and absence of an orienting component. *Zhurnal Vysshei Nervnoi Deyatel'nosti Imeni I. V. Pavlova*, 1960, *10*. (Cited in L. V. Putlyaeva, The functions of emotions in the thought process, *Soviet Psychology*, 1980, *18*, 21–35.)

Moruzzi, G., & Magoun, H. W. Brainstem reticular formation and activation of the EEG. *Electroencephalography and Clinical Neurophysiology*, 1949, *1*, 455–473.

Ol'shannikova, A. E. Some physiological correlates of emotional states. In *Problems of differential psychology* (Vol. 4). Moscow: 1969. (Cited in L. V. Putlyaeva, The functions of emotions in the thought process, *Soviet Psychology*, 1980, *18*, 21–35.)

Oswald, I. *Sleep*. Baltimore: Penguin Books, 1966.

Pavlov, I. P. *Conditioned reflexes*. New York: Oxford University Press, 1927.

Petrovskiy, A. V. Some problems of research in social psychology. *Soviet Psychology*, 1971, *9*, 382–398.

Petty, R. E., & Brock, T. C. Thought disruption and persuasion: Assessing the validity of attitude change experiments. In R. E. Petty, T. M. Ostrom, & T. C. Brock (Eds.), *Cognitive responses in persuasion*. Hillsdale, N.J.: Erlbaum, 1981.

Petty, R. E., & Cacioppo, J. T. *Attitudes and persuasion: Classic and contemporary approaches*. Dubuque, Iowa: W. C. Brown, 1981.

Petty, R. E., Wells, G. L., & Brock, T. C. Distraction can enhance or reduce yielding to propaganda: Thought disruption versus effort justification. *Journal of Personality and Social Psychology*, 1976, *34*, 874–884.

Putlyaeva, L. V. The function of emotions in the thought process. *Soviet Psychology*, 1980, *18*, 21–35.

Rahmani, L. *Soviet psychology: Philosophical, theoretical, and experimental issues*. New York: International Universities Press, 1973.

Razran, G. The observable unconscious and the inferable conscious in current Soviet psychophysiology. *Psychological Review*, 1961, *68*, 81–147.

Romer, D. Distraction, counterarguing, and the internalization of attitude change. *European Journal of Social Psychology*, 1979, *9*, 1–18.

Rubin, F. (Ed.). *Current research in hypnopaedia*. London: Macdonald, 1968.

Rubin, F. *Learning and sleep*. Baltimore: Williams & Wilkins, 1971.

Schachter, S., & Singer, J. E. Cognitive, social and physiological determinants of emotional state. *Psychological Review*, 1962, *69*, 379–399.

Sechenov, I. M. *Biographical sketch and essays*. New York: Arno, 1973.

Shikhirev, P. N. Some aspects of methods used in social psychology research in the USA. *Soviet Psychology*, 1980, *19*, 73–92.

Simon, C. W., & Emmons, W. H. Learning during sleep? *Psychological Bulletin*, 1955, *52*, 328–342.

Sokolov, A. N. Studies of the speech mechanisms of thinking. In M. Cole & I. Maltzman (Eds.), *A handbook of contemporary Soviet psychology*. New York: Basic Books, 1969.

Sokolov, A. N. *Inner speech and thought*. New York: Plenum, 1972.

Strickland, L. H. *Soviet and Western perspectives in social psychology*. Oxford: Pergamon, 1979.

Strickland, L. H. Social psychology in the Soviet Union. *Personality and Social Psychology Bulletin*, 1980, *6*, 353–360.

Sviadoshch, A. N. The history of hypnopaedia. In F. Rubin (Ed.), *Current research in hypnopaedia*. London: Macdonald, 1968.

Vygotsky, L. S. Thought and language. In *Selected psychological investigations*. Moscow: Academy of Pedagogical Science, RSFSR Press, 1956.

Wertsch, J. V. *The concept of activity in Soviet psychology*. Armonk, N.Y.: Sharpe, 1981.

West, S. G., & Wicklund, R. A. *A primer of social psychological theories*. Monterey, Calif.: Brooks/Cole, 1980.

Wyer, R. S., Jr. Excerpts from letters received by Bibb Latane. *Personality and Social Psychology Bulletin*, 1978, *4*, 29–30.

Yaroshevskiy, M. G. I. M. Sechenov and the psychology activity. *Voprosy Psikhologii*, 1979, *4*, 107–108. (English summary)

Zinchenko, V. P., Nunipov, V. M., & Gordon, V. M. The study of visual thinking. *Soviet Psychology*, 1973–1974, *12*, 72–89.