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THE INTERRUPTION OF VERBAL MONOLOGUE: ITS EFFECT ON GESTURE AND SPEECH

City University of New York PH.D. 1981

THE INTERRUPTION OF VERBAL MONOLOGUE: ITS EFFECT ON GESTURE AND SPEECH

ROGER S. GRADESS

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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Abstract

THE INTERRUPTION OF VERBAL MONOLOGUE: ITS EFFECT ON GESTURE AND SPEECH

by

Roger S. Gradess

Adviser: Professor Stephen Thayer

Sixteen female undergraduate students, evaluated for psychological differentiation and susceptibility to Stroop interference effects, were briefly interrupted during videotaped monologues. Comparisons between pre- and post-interruption intervals were made for rates of various forms of self-touching (body-focused) activity and hypothesized vocal indicators of ANS arousal. Following monologue interruption, an increase in discrete hand-to-hand gestures ($p. = < .05$) and number of syllables per word ($p. = < .05$) was found for the entire sample. Post-interruption increases in discrete self-touching generally were found for less differentiated subjects ($p. = < .025$), and for subjects most susceptible to interference($p. = < .05$). Subjective ratings of monologue difficulty and complexity also produced differential interruption effects. Results were interpreted in relation to Freedman's hypotheses about the role of self-touching in cognitive focusing, and were viewed as supporting an integrated concept of mind and body.

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TABLE OF CONTENTS

Table of Contents - Continued

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

While someone is speaking, interrupt. What takes place? What is the effect of the interruption on the mental activities involved in verbal communication, and how can we investigate such private processes? Are mental events reflected in body movement or voice in such a way that changes in these observables can lead to inferences about private cognitive activity?

The present study is an experimental investigation of the interruption of verbal monologue and its effect on gesture and speech. It will present a structural model of mind, and will suggest that changes in self-touching behavior and speech reflect changes in "arousal" and information processing mechanisms.

A Cognitive Model of Mind

Cognitive psychology is concerned with the manner in which sensory information is perceived, responded to, remembered, and interpreted. Although the positions of the authors to be presented are not in full theoretical agreement, they share the view that mind is composed of hierarchically organized psychological structures or schemata, which include sensations, perceptions, concepts, phonemes, words, behaviors, action sequences, etc. Structures "determine what is sayable, or doable. . . [and] what is selected from the environment - events that cannot be organized in a structure

cannot, in the first instance, be perceived" (Mandler, p. 18). The origin of a structure may be genetic, experiential, or the result of an interaction between the two. One of their functions is to organize past experience. Structure is thus equated with meaning. Mandler calls the network of relationships between structures our "cognitive-interpretive system." It is through this system that we put structure on the world.

This network of relationships has been described by Tart (1975) in terms of organized subsystems of structures, namely, exteroception, interoception, input processing, memory, subconscious, emotion, evaluation and decision making, space/time sense, sense of identity, and motor output. Tart discusses the processes by which particular structures and subsystems are organized, stabilized, disrupted, and reorganized.

Miller, Galanter, and Pribram (1960) suggest that the overriding principle of organization is that of the intentionally created Plan: our knowledge of the world and our ability to act exists in a hierarchical organization whereby simpler elements are embedded in more complex units, each level being understandable in terms of Plans of increasing scope and complexity. Thus, for example, phonemes are embedded in words, which are embedded in concepts, which may serve to accomplish specific goals, such goals existing in a further hierarchy of Plans of still greater scope and complexity.

All inputs to the cognitive-interpretive system are subjected to analyses of their relations to existing structures and Plans. The depth and extent of such "meaning analyses" are functions of the

existing mental structures, the task requirements of the situation, and the amount of attention available.

Structures change primarily via two processes: "In the case of accommodation the structures are changed so that the new events [inputs] become part of the evaluative structure; our view of the world is changed by including the new event as a legitimate part of some new conceptual or perceptual structure or by adapting some action structure to accommodate the new demands of the situation. Alternately, assimilation changes the interpretation of the event or the required action such that existing structures may deal adequately with the problem at hand." (Mandler, p. 173, emphasis added. See, too, Piaget, 1929, and 1954.)

Consciousness refers to a state of structures - a mode of processing structures - which permits decision processes of certain types, as well as the most efficient and comprehensive form of information storage and retrieval, to operate. Consciousness is a limited capacity mechanism, and which particular structures become conscious at a given moment is determined by a variety of pre-attentive processes and interactions with the environment (Neisser, 1976). Consciousness permits "a focusing on the most [individually] important and species relevant aspects of the environment. . . [although] the processes that define such relevance are generally unknown.". . . (Mandler, pp. 57-58).

Presumably, the fact that we perceive and attend to a particular set of environmental stimuli and selectively respond in one of

a finite set of ways is a result of evolutionary processes which acted to develop a brain with particular capacities and capabilities (Young, 1978). Phyllogenetically one can trace the development of sensory systems from those which require direct physical contact with the environment through the emergence of receptors (visual, auditory, olfactory) which allow for perception of stimuli at a distance from the organism. Gregory (1970) has argued that such receptors allow for a delay in responding and thus make possible the anticipation of events. This he sees as the basis for all other forms of thinking, and as leading to the concepts of space and time. It should be noted, however, that tactile perception can also extend over the surface of an object, thus providing an even earlier basis for the development of anticipatory schemata.

Initially, the infant's schema formation occurs within an experiential world of little or no differentiation of itself from the outside world. Its experience is apprehended in terms of rapidly changing biological and affective states, and objects are defined as "pragmatic things-of-action" known through sensory-motor contact (Werner and Kaplan, 1963, p. 44). Our primary representations of the world - our most basic cognitive structures - are thus intimately bound to and defined by our bodily experience.

Werner and Kaplan make a specific distinction between the development of structures which are internal representations of the external world, and structures which are used to depict such internal representations. These two types of structures are created,

to use Werner and Kaplan's terminology, by two separate processes, object formation and symbol formation, respectively, and are carried out by what they term dynamic schematizing activity. Such activity consists of mental, emotional, bodily, and environmental factors, all of which shape the specific nature of an emerging structure. External objects come to form cognitive structures (schemata) our of "a primordial matrix composed of affective, interoceptive, postural, imaginal elements, etc., that is directed or channelized into a full perceptual articulation by the schematizing activity" (Werner and Kaplan, p. 18, emphasis added).

Gradually, as schemata for time and space develop, self and object become more distant from one another, and a functional shift takes place in which the "sensory-motor pattern by which an object is initially grasped is transformed into an internalized cognitive schema: whereas the sensory-motor schema pertaining to the external form of an object is intimately tied to its signal-for-action character, the cognitive schema pertaining to the inner form renders the object amenable to representation in another medium," i.e., to verbal, vocal, body movement, or other means of symbolization (Werner and Kaplan, p. 44). Thus develops the capacity for depicting to others, and to the self, internalized object representations, and for communicating information through body movement. "This representative function does not, however, manifest itself in a discrete and 'pure' fashion in early ontogenesis; rather, the bodily movements and vocal utterances of the infant and

the young child, when they begin to function representatively, remain affective and conative as well; that is, they not only represent some 'object', but also express the child's feelings and desires with respect to it" (Werner and Kaplan, p. 65).

The first stage in depicting objects is seen as a stage of denotative reference to objects. In Werner and Kaplan's view, the characteristic bodily gesture of pointing and the parallel utterances such as "ta" or "da" emerge together from a total organismic matrix and then gradually differentiate (p. 77). Thus "primordial speech forms such as occur in the representational activity of the young child are inordinately interwoven with gross bodily gestures . . . . The medium of representation is really a fusion of bodily states and externalized vehicular [symbolic] forms, in which the speech vehicle typically carries only a portion of the total representation" (p. 77).

The developmental process by which cognitive schemata become increasingly more clear and well-defined have been referred to as psychological differentiation (Witkin, Dyk, Faterson, Goodenough, and Karp, 1974).

> Specifically, the differentiation hypothesis proposes an association among the characteristics of greater or more limited differentiation, identified in comparison of early and later functioning in each of several psychological areas: degree of articulation of experience of the world; degree of articulation of experience of the self, reflected particularly in nature of the body concept and extent of development of specialized, structured controls and defenses. Implicit in this hypothesis is the view that

> greater inner differentiation is associated with greater articulation of experience of the world. (Witkin, et. al., p. 16).

Webster's New Collegiate Dictionary (1959) defines articulate as "expressed or formulated clearly or systematically; distinct. . . . Distinct implies such sharpness of outline or of definition that the thing requires no effort of eyes to see, of ears to hear, or of mind to apprehend or comprehend."

The concept of psychological differentiation developed out of the finding that people differ in terms of how they orient themselves in space. Witkin and his co-workers found that individuals' perceptions of verticality were, for some, based on inner, somatic experience, while others used external, visible cues as standards of reference. "It became clear. . .that the way in which each person orients himself in space is an expression of a more general preferred mode of perceiving which, in turn, is linked to a broad and varied array of personal characteristics involving a great many areas of psychological functioning" (Witkin, et. al., p. 1). Psychological differentiation reflects, among other things, the degree of an individual's "cognitive clarity", the "extent to which information and impressions are discrete, structured, and assimilated, or blurred, confused and unassimilated" (Witkin, et. al., p. 104).[1]

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[1] The degree of an individual's psychological differentiation may be assessed by a variety of perceptual tests of field dependence/independence such as the rod-and-frame test, the tilting-room-tilting-chair tests, and the embedded figures test. The first evaluates an individual's perception of verticality of an item within a limited visual field, and whether internal cues are used to form a judgment, or if he is influenced by aspects of the field itself. The second test

Not only do individuals vary in terms of their ability to receive and process information in an articulated fashion, but they also vary in terms of the efficiency of the reception process itself. Individuals have been found to be differentially susceptible to the interfering effects of distracting stimuli on focal attention. One measure of a person's ability to resist such interference is the Stroop Color-Word Test (Stroop, 1935). This instrument compares a subject's time score on three different tasks. Most commonly, in the first condition, the subject is required to rapidly read a series of color names, printed in black letters on a white background card. This card is designated Card W (Word). Next, the subject is shown a similar card containing stimuli which are non-word color patches and is required to name the colors as quickly as possible. This is Card C (Color). Finally, the subject is again presented with color names, but this time the names are printed in non-corresponding color ink. The subject must continue to name the colors of the stimuli, i.e., name the colors of the inks used, while ignoring the color names printed on the card. This is condition CW (Color-Word). The difference between C and CW scores provides a highly stable measure of a subject's susceptibility to interference.

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evaluates an individual's perception of verticality of his own body and its surrounding environment under conditions in which the position of each can be separately manipulated. The third test also requires the separation of an item from the field in which it is incorporated, in this case, the locating of a simple figure within a more complex one. The more field independent a person proves to be, the greater is his degree of psychological differentiation.

Subjects taking the Stroop test invariably experience marked difficulty with the CW task, the written color names acting as extremely interfering stimuli. The nature of this interference process has generally been interpreted in terms of response conflict. The different stimilus dimensions, color and word, appear to be processed at different rates, reading occurring faster than naming.

It is interesting to note that in tasks requiring the counting of specific colors in an array (Derks and Calder, 1969), the making of same-different color judgments (Egeth, Blecker, and Kamlet, 1969), or the sorting of cards on the basis of same-different colors (Treisman and Fearnley, 1969), no decrement in performance is found when stimuli incorporate irrelevant or conflicting words. Nevertheless, in tasks which require color naming such as the Stroop, a strong interference effect is produced. It would appear that selective attention can gate irrelevant words only under specific conditions, and is able to do so in a color naming task. As one might suspect, subjects who show strong Stroop interference effects have also been shown to be relatively less psychologically differentiated. This relationship is particularly strong among women. (See Gardner, Holzman, Klein, Linton, and Spence, 1959; Callaway, 1959; and Uhlmann, 1962). Stroop effects have also been correlated with memory span, short-term retention, and learning and retention (Jensen, 1965; Uhlmann, 1962). The preceding studies are discussed in the excellent reviews of Stroop research by Jensen and Rohwer (1966), and Dyer (1973).

In summary, the preceding cognitive view of mind proposes hypothetical "structures" or "schemata" which correspond to hierarchically organized units of "meaning" of different levels of scope and complexity (Plans). It is suggested that individuals differ in the degree to which such structures are clearly articulated and systematically formulated, and that such differences are reflected in the degree of articulation with which individuals perceive the world. Individuals also appear to differ in their ability to process information in the presence of distracting stimulation. Cognitive structures are seen as developing first through sensory-motor contact with the world, and in all cases their formation involves a complex interaction of mental, emotional, bodily, and environmental factors. Just as the process of structuring our experience of the external world is, thus, a "whole body" process, the process of symbolically communicating is one in which bodily state and activity are intimately connected with the production of verbal forms.

Critical to the analysis of mind and the formation and activation of cognitive structures is the concept of arousal. Mandler suggests that certain sensory inputs, when subjected to meaning analysis, will trigger the autonomic nervous system (ANS), while other inputs, such as the sensation of suddenly falling, or hearing a sudden, loud noise, will produce arousal directly as a result of reflexive, "prewired" connections uninvolved with meaning analysis.[1] ANS arousal

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[1] Autonomic arousal, according to Mandler, may function as a "secondary support system for initiating an evaluation of situations that require a meaning analysis" (p. 117). ANS arousal may occur as a result of preliminary, possibly preattentive, analysis, giving warning "that something is going on, something needs to be done." Although the initial meaning analysis may have been completed before

may be seen as accompanying "attention-directing activity," and an aroused organism is thus "more likely. . . [to] respond more quickly, scan the environment more effectively, and eventually respond adaptively" (Mandler, pp. 120-121).

Kahneman (1973) discusses various measures which may be used to identify arousal level such as pulse rate, pupil diameter, and skin conductance, noting Lacey's (1967) observations that such indices do not appear to reflect a unitary dimension. The concept of "arousal," therefore, is best understood as a hypothetical construct rather than a specific physiological process. This admonition should be kept in mind when considering the role of arousal in the present research, or as the findings of other researchers are here presented.

Despite the difficulties involved in adequately defining arousal, different investigators have experimentally linked its manifestations to attentional processes. Lacey and Lacey (1974), and Lacey, Kagan, Lacey, and Moss (1963) suggest that cardiac deceleration (a parasympathetic, ANS response) results in heightened attentional activity, while cardiac acceleration reduces attention. They relate the former to situations in which there is a "need to accept" stimuli, as when listening to an actor, and the latter to a "need to reject" stimuli, as when doing mental arithmetic.

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the perception of ANS arousal, which may have a 1-2-second latency, if meaning analysis is still continuing, the arousal may serve to initiate further analysis. Thus, Mandler refers to it as a "secondary" support system.

Not only does arousal appear to influence the amount of attention available, but it has also been related to the manner in which attention is deployed. Thus, Esterbrook (1959), after studying subjects' awareness of lights in the periphery while engaged in a pursuit rotor task, suggested that "the number of cues utilized in any situation tends to become smaller with increase in emotion" (p. 197). Bacon (1974), using signal-detection analysis of a similar, but more elaborated experiment, found that "arousal narrows the range of stimuli that are processed by impairing the memory traces of those signals which initially attract less attention" (p. 86).[1]

In addition to the various physiological indices which purport to measure changes in arousal level, such arousal changes may also be reflected in specific vocal parameters. Increased pausing has been shown to occur under conditions of increased anxiety, as during a stressful interview (Cassota, Feldstein, and Jaffe, 1967), or during speech which elicits topical anxiety (Mahl, 1956). Other investigators (e. g., Kanfer, 1959) have concluded that anxiety has a

---

[1] Tomkins (1962), indeed, holds that the entire range of affective experience can be elicited solely through innate arousal mechanisms. His theory of emotion posits that every variety of affect can be discretely produced as a result of variations in the intensity gradient of stimulation, i. e., whether stimulation remains constant, increases or decreases, its rate of change, and its absolute intensity. While cognitive, evaluative factors can, and usually do, play a role in emotion production, Tomkins holds that emotion can occur in the absence of cognition as a pure response to the stimulus intensity gradient, providing a "blueprint" for subsequent action and cognition. His theory thus suggests that Mandler's "meaning analysis" is not necessary for the elicitation of ANS arousal and a subsequent affective response.

facilitating effect on verbal productivity. Ekman, Friesen, and Scherer (1976) found that subjects engaged in verbal deception showed an increase in fundamental voice frequency.

Mandler hypothesizes that "interruption is a sufficient and possibly necessary condition for the occurrence of autonomic nervous system arousal" (p. 153, emphasis added). When an organized cognitive or action sequence is interrupted, there is a tendency for it to continue toward completion following the interruption, either by resumption of the original sequence or through the substitution of an alternate organized response. Zeigarnik (1927) explained this phenomenon in terms of goal-directed activities activating a "tension system" which is discharged upon completion. Similarly, Lewin (1951) viewed organized behavior as involving "intentions" which imbue its components with "positive valence" which is reduced only when the behavior is completed.

Miller, Galanter, and Pribram (1960) use the term "intent" in reference to "the uncompleted parts of a Plan whose execution has already begun" (p. 61, emphasis in original). They "tolerate" unconscious intentions. For them, "a motive is comprised of two independent parts: value and intention. A value refers to an Image [the individual's total knowledge of himself and the world], whereas an intention refers to a Plan" (p. 62). They reject the idea that Plans have dynamic properties, that they operate in order

to achieve a state that "will reduce unpleasant tensions, etc." (p. 62). "These 'states', 'goals', 'tensions', if they exist at all, must be represented in the Image, not in the Plan" (p. 64). They contend that interrupted tasks which place no load on "working memory" are merely terminated and show no tendency to be resumed or especially well remembered. For example, they state, stringing thirty beads on a string is a different task from stringing all the beads in a pile. The former Plan includes a memory requirement and would thus produce cognitive or behavioral effects if interrupted. They also discriminate between flexible and inflexible Plans, the latter requiring a fixed sequence of actions, thus making relatively greater memory demands. In a flexible Plan the order of steps (parts) is unimportant. They suggest further:

> A rule that most people seem to learn, probably when they were very young, is: When in the execution of a Plan it is discovered that an intended subplan is not relevant or feasible, the smallest possible substitutions of alternative tactical subplans are to be attempted first, and the change in strategy is to be postponed as long as possible. Whatever the mechanism, if the person becomes planless rather suddenly, marked mood swings are apt to occur: the person is said to become "emotional". The activation appears to result directly from the suddenness in the alteration [interruption] of Plans; the interpretation of the increase in "emotion", that is, the way the person feels, appears more related to the extent to which the Plans are pruned, that is, whether only tactics are affected or entire strategies have to be abandoned (p. 114, emphasis added).
>
> For whatever reason, whether it be a threat to a person's Image or intrinsic to the wholesale abandonment of large segments of Plans, the more or less sudden realization that an enduring plan must be changed at a strategic level is accompanied by a great deal of emotional excitation. When this excitation can find no

> focus in either the Image or in action, the person experiences "anxiety" (p. 116).

Thus Miller, Galanter, and Pribram lend support to the idea that interruption is innately arousing.

Three general principles are suggested by Mandler which relate characteristics of an interruption to the degree of ANS arousal which it would produce:

> Degree of organization . . . will be reflected in degree of ANS arousal when the structure is interrupted. [That is, the successful interruption of a highly organized sequence should be maximally arousing.]
>
> Degree of arousal will vary with the discrepancy between the interrupting event and the interrupted structure. Discrepancy is partly a function of the degree to which structures are available that can integrate the interrupted structure and the new event or behavior. Thus, substitute behaviors available at the time of interruption may decrease arousal effects.
>
> The more highly organized behavior and plans will also more likely be the ones that are resumed if the situation permits it. Thus, while the degree of arousal may be high, it is also more likely to be short-lived under conditions of organization and non-continuing interruption (p. 162).

The preceding cognitive model of mind appears to inescapably raise a fundamental question - the nature of personal identity. Do we identify with our conscious experience alone, or are we able to include schemata such as our understanding of "preattentive processes" and "unconscious, hierarchical Plans" in our notion of who we are? Still unformed within cognitive theory is a consistent understanding of the point from which our identity rises, the <u>user</u>

of conscious, unconscious, and bodily processes, who initiates memory searches and selects objects of attention using adaptive criteria. Research into the functional asymmetry of the brain, nonverbal modes of knowing and communicating, and the interrelationship of gesture and thought, of mind and body, demand a broadened view of human identity. Examples of current efforts at achieving such an integrated schema may be found in Walsh (1977, 1978), and Wilbur (1977).

The Role of Body Movement in Information Processing

There is now a substantial body of research (e.g., Freedman, Barroso, Bucci, and Grand, 1978a; Barroso, Freedman, Grand, and Van Meel, 1978; Freedman, 1976; Freedman, O'Hanlon, Oltman, and Witkin, 1972) which considers interpersonal communication as comprising two basic processes, namely, representing and focusing, each of which is supported and maintained by distinctive kinesic activities.

Representing refers to the symbolic process whereby we represent to others our internal, private images, primarily by means of communicative speech. This process is sustained by a class of gestures which reflect an intention to communicate and which thus entail an object relationship. Freedman and his colleagues term such movements object-focused. Object-focused movements are characterized by their close linkage to the formal or content

aspects of speech. They may be broken down into two major classes. The first class, speech primacy, object-focused movements, refers to gestures which are clearly subservient to the spoken word, and which closely parallel the formal and rhythmic properties of speech. They include movements which punctuate, emphasize, or qualify what is being said while carrying no additional information content. In contrast, the second class, motor-primacy, object-focused movements, may also be rhythmically phased in with the flow of speech, but additionally, carry some independent content of their own. A broad range of gestures fall within this category: representational gestures (e.g., the hand motion used while describing a spiral staircase); concretization movement used to express feeling states (e.g., rotating both hands while describing feeling mixed up); pointing; and the groping movements associated with speech failures, i.e., when one is struggling to find the proper word.

Focusing, the second communicative process, refers to the internal readying of one's thoughts and perceptions prior to representing them. It includes receiving and understanding information coming from the external environment as well as from memory storage and the somatic senses. This complex process continues until the ideas to be communicated have become "focused". Thus, focusing would appear to include the activity which Mandler refers to as meaning analysis and which Werner and Kaplan term dynamic schematizing activity. Freedman (e.g., 1976) has hypothesized that the process of focusing requires a temporary disembedding of

the individual from his object relationships, and the re-establishment of the sense of self and nonself through the tactile confirmation of body boundaries.

Focusing is held to be supported by that class of gestures which have been defined as body-focused. These are hand movements which are involved in the tactile stimulation of the body and may involve hand-to-hand squeezing or rubbing, stroking parts of the head, arms, legs, or trunk, or the manipulation of clothing or bodily adornments, e.g., jewelry, pens, pipes, etc. Body-focused movements may be subdivided in terms of being either continuous or discrete (e.g., stroking vs. briefly touching a body part) on the basis of the part of the body touched (e.g., hand-to-hand or hand-to-face gestures), on the basis of being direct or indirect (e.g., touching one's body directly vs. manipulating an adornment), or on the basis of laterality (whether left, right, or both hands are employed).

"Body-focused" movements represent a category of gesture very much akin to what Ekman and Friesen (1969) refer to as self-adaptors. These are movements, they suggest, which "were first learned (usually in childhood) as part of a total adaptive pattern where the goal of the activity was obvious. When these actions are emitted by an adult, particularly during social conversation, only a fragment of the original adaptive behavior is seen" (p. 84). They hold that self-adaptors can act to block sensory input, but suggest a variety of other functions as well. Thus "the hands may wipe around the corner of the eye, a self-adaptor which would remove

tears; but it may be shown by the adult with no tears present when grief or sadness is felt or anticipated" (p. 86). In general, Ekman and Friesen are concerned with the symbolic significance of gestures of this type, rather than their role in information processing.

While the descriptive categorization of Freedman et. al.'s body-focused movement is well-developed, their function has been explained mainly on the basis of indirect inference. Body touching has been hypothesized by Freedman and his associates as a kinesic information filter which screens "irrelevant" or "arousing" stimuli out of awareness, improving listening, actively modulating arousal level, and allowing for the optimum deployment of attention toward efficient meaning analysis. Developmental research has established possibly functional associations between body movement, self-touching, and the development of focal attention (e.g., Bruner, 1969). Psychoanalysis has argued for the role of kinesthetic experience, and the establishment of a sense of body boundary, in the development of the capacity for object relatedness (e.g., Mahler, Pine, and Bergman, 1975; Spitz, 1965). Experimental support for the hypotheses that body-focused gestures are related to information filtering and the modulation of arousal will be examined in Chapter Two.

The preceding theoretical presentation has suggested a model of mind in which mental structures, including those involved in communication and information processing, develop out of an intimate relationship between mental and bodily processes and activity. The degree to which an individual's perception provides an articulated view of the environment is reflected in the articulation of his structural

organization. The relationships between attention, arousal, and the communicative processes of representing and focusing have been discussed vis-a-vis two types of body movement, object-focused and body-focused gesture. Lastly, the role of interruption as a stimulus for arousal and body-focused gesturing has been suggested.

Research Design and Hypotheses

The present research investigates the effects of the brief interruption of a monologue based upon recently memorized material. It was hypothesized that such an interruption would result in an increase in the level of the subjects' arousal due to two factors. First, the interruption would require the subject to modify the ongoing monologue Plan and to hold its uncompleted portions in working memory, thus increasing the degree of cognitive effort and arousal required. Second, interruption was viewed as representing an increase in external stimulation which had to be processed, thus also increasing cognitive load and arousal. Since it has been suggested that body-focused movements (self-touching) are responsive to changes in arousal level, it was hypothesized that the interruption of verbal monologue would result in an increase in subsequent body-focused activity.

Studies of psychological differentiation suggest that individuals vary in their ability to form and maintain clearly-defined, well-articulated mental structures, including those which underlie speech

and memory. It was anticipated that subjects who were less capable of forming well-organized monologue structures would less easily hold such structures in working memory during an interruption. Interruption would therefore produce greater arousal and a greater gestural response.

In considering the impact of an interruption it was necessary not only to consider individual differences in subjects' cognitive capabilities, but also to look at the nature of the interrupting stimuli and the material upon which the subjects' monologues were based.

Subjects can be interrupted in a variety of ways which could, in and of themselves, easily initiate emotional arousal independent of their effect on memory processes. It was therefore decided that the interrupting stimuli would be very low-key and non-obtrusive, so that any effects they produced could reasonably be ascribed to the cognitive factors suggested above.

When one looks at material upon which monologues can be based, it is apparent that it can vary in nature regarding the ease with which it can be structured in memory. It is equally obvious that it can vary in the degree to which it can be an independent source of emotional arousal. In order to control for these sources of variability, four different memorization tasks were employed, constructed so as to vary systematically in terms of memory requirements and emotional value.

Lastly, although it was anticipated that interruption would

produce arousal-related changes in body-focused activity, it was possible that the degree of arousal produced by the experimental procedure would be insufficient to activate this gestural response. For this reason, vocal parameters involving speech timing and pitch, both of which appear to be sensitive to changes in arousal level, were recorded. Variations in speech productivity parameters and fundamental voice frequency were anticipated in response to the experimental interruptions.

In order to make the testing of the above hypotheses as ecologically valid as possible, subjects in the experiment were told that they were participating in a study designed to evaluate differences in how people give testimony in court. They were asked to study and attempt to memorize four short (250-word) stories, written in the second person, and after each memorization they were asked to "testify" to what they had "witnessed." Testimony was videotaped.

Instructions to the subjects emphasized that the research was expressly concerned with studying individual differences in memory ability, and they were asked to try neither to add facts which were not in the story studied, nor to omit any details. Such instructions were intended both to make most salient the cognitive processes under investigation, and to provide a plausible rationale for the experimental procedure.

Interruptions were infrequent, occurring only once during two non-consecutive monologues, and were carried out in such a manner

that the subject would not view them as intentional parts of the experimental procedure. In addition, the nature of the two interrupting stimuli was varied slightly.

Although a priori estimates were made of each story's degree of complexity and emotionality, subjects' personal estimates were considered definitive. Subjects rated each story in terms of how much effort it had taken to recall, how much difficulty they had expected to have in recalling it, their confidence in their expectation, their evaluation of how emotionally arousing it had been, and how complex they had found it to be in comparison to the other three stories.

Following the monologue and rating tasks, subjects were given the Embedded Figures Test to assess their degree of psychological differentiation, and the Stroop Color-Word Test to evaluate their susceptibility to distraction.

Experimental data were gathered from the 30-second intervals preceding and following each interruption, which occurred 50 seconds into each scheduled monologue. Each interval was further subdivided into 15-second blocks for more detailed analysis. During each time block, self-touching was scored according to Freedman, et. al.'s criteria for body-focused movements, and comparisons were made between pre- and post-interruption intervals. Voice and speech measures were analyzed and compared for these identical intervals.

Control data from each subject's non-interrupted monologues

were collected and analyzed in a similar fashion, and were taken from time intervals paralleling those in the interrupted stories. Comparisons were thus made between intervals prior to the point where an interruption might have occurred, and the intervals following that point.

CHAPTER TWO

EMPIRICAL STUDIES OF OBJECT-FOCUSED AND BODY-FOCUSED MOVEMENT

Gesture, Psychological Differentiation, and Emotional Communicative Context

The kinetic behavior of field dependent and field independent subjects was examined (Freedman, et. al., 1972) under three conditions: during a monologue with a "cold" listener, during a monologue with a "warm" listener, and during a dialogue with a "warm" listener. Field dependent (as opposed to field independent) individuals, it may be recalled, are considered to be less capable of analyzing their experience of themselves and of the external world into organized, well-articulated, and highly differential structures (Witkin, et. al., 1962). Field dependent subjects had more hand-to-hand, body-focused movements in both monologue conditions, as well as more motor-primacy, object-focused movements during the dialogue condition. They exhibited, as well, a high level of body touching in both warm and cold emotional contexts. These findings were interpreted as being the consequence of the relatively greater difficulty which field dependent subjects presumably have in representing and in encoding thoughts into words, the increased arousal which such difficulty engenders, and the relatively greater amount of unverbalizable meaning which they needed to communicate.

A "cold" context had the effects of reducing both speech- and motor-primacy, object-focused movements among all subjects, and of increasing body-focused movements among field independent subjects. This context was understood as being an "interference" condition which, by failing to provide warm and empathic listener responses, resulted in a diminished "effort to reach" on the part of the subjects, and a corresponding decrease in object-focused gestures. The increase in body touching among field independent subjects was attributed to an increase in informational demand imposed by the "cold" condition and a resultant increase in situational stress and arousal. That gestural differences have been clearly linked to the degree of an individual's psychological differentiation, which increases with age, is a finding relevant to the developmental research to be next considered.

Developmental Studies of Gesture

Age-related changes in the use of object- and body-focused gestures have been demonstrated in children aged 4 through 14. Under experimental conditions in which children were asked to give verbal definitions to a list of abstract and concrete words (e.g., "What is a hammer? vs. "What does the word 'fear' mean?"), the incidence of object-focused movements was found to increase in a linear fashion for the 4-, 6-, 10-, and 14-year-olds studied. The incidence of body-focused movements was found to increase up to age 10, and then to decline. Within the category of object-focused movements, with successive age levels the rate of repre-

sentational (motor-primacy) movements declined, while speech-primacy movements increased; within the category of body-focused movements there appeared a developmental sequence beginning with bilateral, continuous motions prevalent among 4 and 6-year olds, passing through bilateral, finger-hand motions among 8 and 10-year-olds, and culminating in lateral body-focused movements from age 12 on (Freedman, 1976).

The temporal relationship between gesture and speech at different age levels has also been investigated, i.e., whether the gesture occurs before, during, or after the onset of verbalization (Freedman, 1976; Freedman and Steingart, 1975). At all age levels, body-focused movements were most often found to occur prior to verbalization in the word definition task; during ongoing speech sequences body-focused movements generally occurred during pauses prior to clause onset. Object-focused movements preceded verbalization only among 4-year-olds, where they appeared to serve the functions of substitution or rehearsal; at the 10-year-old level such gestures occurred simultaneously with speech onset and lasted throughout the utterance, serving the functions of supplementation and redundancy; at the 14-year-old level the gestures were associated with single words of the utterance and were clearly subservient to the spoken word.

Freedman and Steingart have also shown that there is a significant relationship between the types of body-focused gesture used and the complexity of language employed. The highest level

of language complexity and skill was associated with discrete body touching; simpler language construction and use was associated with continuous body touching; finger-to-hand motions were linked to low clause production. In children, language complexity and skill presumably increase with age and are thus probably important determinants of the developmental changes which have been found in object-focused movements.

Gesture and Cerebral Hemispheric Specialization

Barroso and Freedman (manuscript in preparation) studied the laterality, i.e., preference for the use of left or right hand, in the communicative gestures of children through age 12. Their findings suggest that representing behavior (object-focused gesturing) is carried out by the dominant (usually left) cerebral hemisphere, while focusing behavior (body-focused gesturing) is carried out through the nondominant (usually right) hemisphere. These results are congruent with research which associates "left brain" activity with a preference for analytic, sequential, and referential processing, and the use of language, while "right brain" activity is associated with non-referential, integrative, visual processing (Watzlawick, 1978).

Gesture and Regulation of Attention

A basic theoretical concept underlying the body movement research of Freedman and his colleagues is that if the maintenance of focal attention is interfered with, an internal state of arousal is produced, as well as a demand for the regulation of such arousal

(Freedman, 1976). Body-focused movements have been observed to increase under conditions of attentional interference, and are thus hypothesized as being a mechanism for regulating the deployment of attention, as well as for the modulation of arousal (Freedman, O'Hanlon, Oltman, and Witkin, 1972; Freedman, 1976; Barroso, Freedman, Grand, and Van Meel, 1978; Freedman, Barroso, Bucci, and Grand, 1978a).

The most direct test of a link between body touching and interference was obtained by Barroso, et. al. (1978) using the Stroop Color-Word Test. The most difficult aspect of this test is the requirement that subjects rapidly name the color ink used to print conflicting color names, e.g., the color name BLUE printed in red ink. Subjects were found to employ more body-focused gestures during this interference condition.

Freedman, Barroso, Bucci, and Grand (1978b) have shown that effective listening is related not only to how adequately information is received and understood (resistance to interference), but also to how adequately it is then refocused, i.e., actively integrated with pre-existing schemata. High receiving ability was correlated with resistance to Stroop interference effects, while high refocusing ability was correlated with field-independence. The term shielding was applied to the cognitive process of information filtering, and was associated with bilateral body touching and good receiving. The term contrasting was used to refer to an event sequence beginning with a "discharge" movement and ending with a lateral body

touch; it was associated with good refocusing when it occurred at the cessation of a period of shielding. Three different "modes of listening" were suggested, based upon observed patterns in the subjects' use of shielding and contrasting, and certain qualitative differences in their verbal responsiveness.

Lastly, clinical support for the existence of a relationship between body touching and the regulation of attention is provided by studies of chronic schizophrenic patients. These individuals, who are known to be highly vulnerable to interference with focal attention, show pervasive body touching. These clinical findings and others will be reviewed below.

Gesture and Clinical State

Freedman and Hoffman (1967), Freedman (1972), and Freedman, et. al., (1978b) have studied the relationship between gesture and clinical state. Acute paranoid conditions have been shown to be marked by a prevalence of motor-primacy, object-focused movements, while acute depressive conditions have been distinguished by a prevalence of direct body-focused movements. Improvement in both clinical conditions was reflected in an increase of speech-primacy, object-focused movements, and in indirect body-focused movements (i.e., the manipulation of "things" rather than direct body touching). These gestural differences were hypothesized as being related to varying degrees of communicative intent, anxiety level, and the amount of unverbalized thought which was demanding expression. Chronic schizophrenia, narcissistic

depression, and borderline state have also been differentiated on the basis of body movements. Chronic schizophrenic patients showed the highest incidence of bilateral finger-hand movements, patients in the narcissistic depression group showed the highest incidence of lateral continuous body touching, while borderline patients showed the highest incidence of lateral discrete body touching. These data were interpreted in terms of representing different forms of splitting and different strategies of information filtering.

CHAPTER THREE

EXPERIMENTAL METHOD

Subjects

Sixteen female undergraduate students at The City College of The City University of New York served as subjects. All were enrolled in basic psychology courses and ranged in age from 20 to 33; mean age was 24. English was the native language for 3/4 of the sample; those whose native language was other than English had been speaking English for at least 6 years. All spoke English fluently. All were right-handed, and none had any rash or skin condition which would have artifactually increased their degree of self-touching. Each was paid $6.00 for participation lasting approximately 1-3/4 hours.

Subjects were recruited by the investigator, who made a standard presentation in various 1980 summer semester classes. He indicated that he was conducting doctoral research into "factors which influence how people give testimony in court". He stated that it was known that some individuals who witness events are later unable to testify to all the relevant details they initially observed, while others tended to report facts which they never really saw. He stated that his study was designed to investigate the psychological

factors influencing such subject differences. A description of this fabricated study was distributed (see Appendix 1), and interested students were then asked to leave their names and telephone numbers with the investigator. They were subsequently contacted by telephone and appointments were scheduled for their experimental sessions.

Equipment and Materials

Four 250-word stories were prepared for subjects to memorize and testify to. The stories were designed to vary on two dimensions, complexity and emotionality. Complexity was varied primarily by varying memory demands. Stories presumed to be "high complexity" contained approximately 50% more details than those presumed to be "low complexity". Emotionality was varied by varying the content of the stories. Those presumed to be "high emotionality" dealt with danger and physical injury, while "low emotionality" stories were more impersonal and did not include such stimulation. All stories were written in the second person.

Flood described the subject taking a walk, discovering the flooded showroom of a furniture store, and calling the owner to report the damage. It was presumed to be low complexity/low emotionality.

Watch described the subject returning a defective watch to the manufacturer. It was presumed to be high complexity/low emotionality.

Subway described the subject witnessing a subway passenger

having a siezure and inadvertently injuring a bystander. It was presumed to be low complexity/high emotionality.

Mountain described the subject coming upon the scene of a motorcycle accident, attempting to help, and witnessing a second accident before being able to do so. It was presumed to be high complexity/high emotionality.

Stories were pretested using 12 pilot subjects, each of whom rated the stories on the emotionality and complexity scales found in Appendix 2. Table 1 presents the mean, range, and standard deviations of the pretest ratings. T-tests performed of stories rated low and high emotionality, and low and high complexity, confirmed that the stories could be discriminated on these dimensions. Texts of the stories may be found in Appendix 3. As shown, the tests include virgules setting off separate memory items. Copies of the stories given to the subjects to study were not, of course, subdivided in this way.

Seven-point Story Rating Scales were prepared for subjects to rate each story in terms of the effort required to remember it, its degree of complexity, and the emotional reaction it induced. Subjects were also asked to estimate their expectations, immediately after studying each story, of how difficult they thought it would be to testify to, and their confidence in these estimates. A Posttest Questionnaire was also constructed to obtain various personal data and to assess each subject's reaction to the experimental procedure. The Story Rating Scales and Posttest Questionnaire may be found in Appendix 2.

TABLE 1

Mean, Range, Standard Deviation, and Comparisons of Pretest Story Ratings of Complexity and Emotion

	Stories			
	Flood	Subway	Watch	Mountain
Complexity				
Flood	-	n. s.	6.18***	5.24***
Subway	-	-	3.32**	3.18**
Watch	-	-	-	n. s.
Mean	2.33	3.42	5.08	4.58
Range	1-5	1-6	3-7	2-6
S. D.	1.37	1.38	1.31	1.24
Emotion				
Flood	-	4.91***	n. s.	5.94***
Subway	-	-	2.71**	n. s.
Watch	-	-	-	2.60*
Mean	2.92	5.08	3.83	5.50
Range	1-5	4-7	1-7	3-7
S. D.	1.44	0.79	1.85	1.45

Note. Comparisons of story ratings employ t calculated for paired observations.

*p = <.05.
**p = <.01.
***p = <.001.

Subjects' monologues were videotaped using a Sony AV3650 half-inch, reel-to-reel video recorder and portable camera. The reel-to-reel videotapes were then commercially copied onto half-inch VHS cassettes. During this copying, a visual time code was "burned in" in the upper left-hand corner of the frame, providing a continuously running time reference in hours, minutes, seconds, and frames (30 frames per second). The time code was begun at zero at the start of the first subject's monologue and continued without resetting through the end of the last subject's monologue. This made possible assigning, during the gestural coding (see below), a unique time reference for the beginning and end of every gesture of every subject.

Audio recording was accomplished using an AKG D330BT hypercardioid microphone, with tone controls set at 0 db., fed into the Sony videotape recorder. Once the video cassette with time code was produced, audio portions exactly corresponding to the analyzed video segments were copied at 7-1/2" per second onto a master audiotape, using a Tandberg 3000x reel-to-reel recorder. This master audiotape was then copied onto an audio cassette which could be played on the automated speech processing equipment used (see Data Collection and Analysis, below).

All subjects were given the Embedded Figures Test, Form A, designed by Witkin, Oltman, Raskin, and Karp (1971), and the Stroop Color-Word Test. As there is no standard form of this instrument, it was prepared as follows: Heavy weight 15"x 20"

white illustration boards were used for the three cards. Each card contained a total of 80 stimuli, arranged in 10 rows, using 1/4" self-adhering vinyl Helvetica capital letters (E-Z Letter Quick Stick, P. O. Box 829, Westminster, Maryland 21157). Card W used black letters; Card CW used blue, red,and green letters. Card C, which consisted of simple color patches, was prepared from 1/4"x 1" vinyl strips cut from the edges of the push-out lettering material. Since the color names contain unequal numbers of letters, it was recognized that the pattern of eye movements required to scan Cards W and CW was irregular. The color patches on Card C were spaced so as to duplicate this irregularity. The lettering material chosen provided high color saturation, excellent color discrimination, and excellent letter clarity. In addition to the 80-character W, C, and CW cards, three smaller practice cards were prepared containing a single W, C, or CW line. Order of the stimuli may be found in Appendix 4.

Procedure

At the time of each subject's scheduled appointment, she was met by the investigator at the room in which the entire procedure was conducted. The floor plan of this room, which opened onto the main, first floor corridor of the building which houses The City College's Psychology Department, is shown in Figure 1.

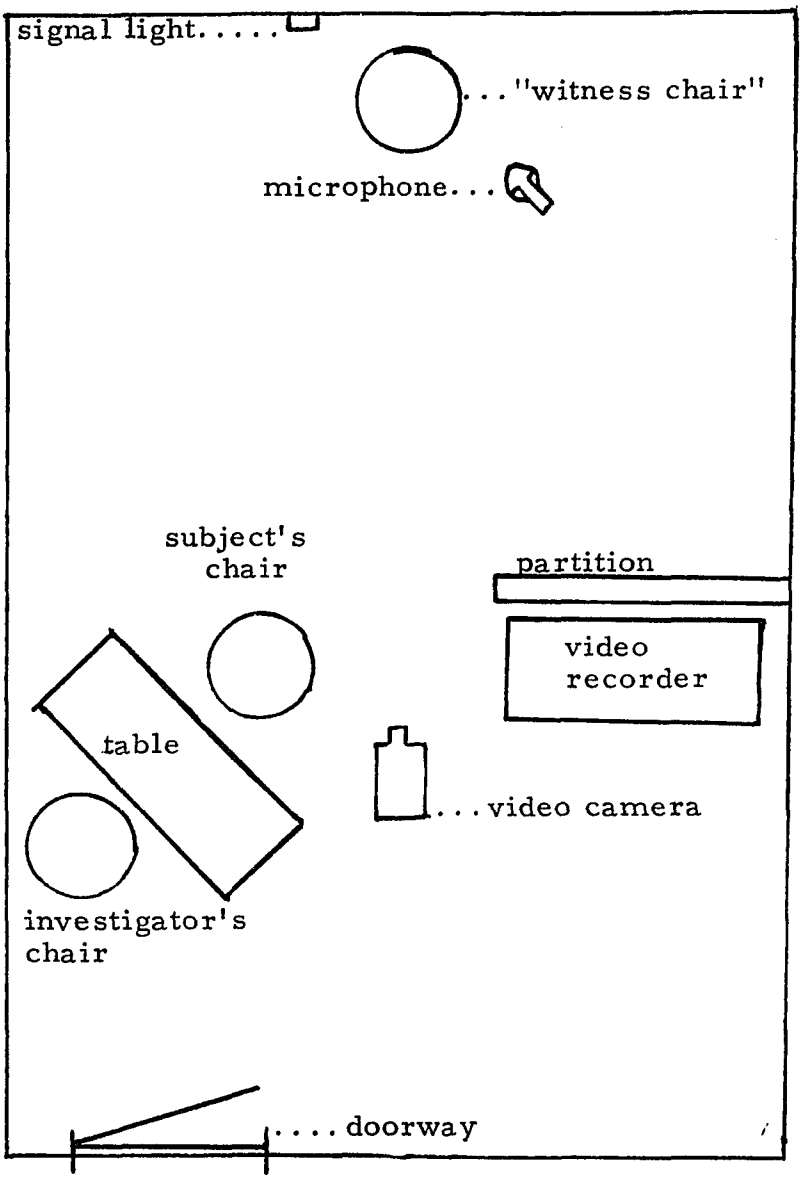

Figure 1. Layout of Experimental Room.

Subject and investigator took their seats at the table and the following instructions were given:

> As you know, we are interested in the way in which people give testimony in court. We wish particularly to investigate factors which influence a person's accuracy in reporting what they have witnessed.
>
> In real life persons tend often to omit many details which turn out to be important in establishing what took place, sometimes even incorrectly reporting what they actually saw. You probably know how unreliable physical descriptions of persons tend to be: A person observed committing a crime may be described by one witness to be short, in his twenties, with dark hair and a moustache, while a second witness may recall him as tall, middle-aged, and graying. We wish to look at some of the factors which influence a person's ability to accurately report events which he has witnessed.
>
> In order to control the information in the situations we wish you to testify about, we have prepared four stories which contain a known number of specific facts and details. You will have an opportunity to study each story at length and will then be asked to recall, as accurately as you can, both the main facts and the details of what took place: who was involved, the setting, how you felt, the sequence of events. We want you to recall the stories as completely as possible, trying not to leave out any details. At the same time, we want you to try to avoid adding to your testimony anything which was not in the original story.
>
> Following your testimony, we will judge how completely you recalled the facts of your case, and how accurately you testified to them. We do not expect anyone to remember everything, or to be able to give a verbatim reproduction of what was written. However, the closer you can come to such complete recall the better.
>
> Here is the first of the four stories that we wish you to testify to. Please make yourself comfortable and read the story over as often as you like. Try to fix the main facts as well as the details in your mind. Try to remember the sequence of events and the emotions involved. You may take notes if you wish, but you may not use them during your testimony.

The order of presentation of the stories was either Flood, Watch, Subway, Mountain, or the reverse sequence, half of the subjects receiving each order. After studying the story for five minutes, the subject was asked to take her seat in the "witness chair", approximately 15 feet in front of the video camera. The investigator turned on the video recorder, resumed his seat at the table, placed before himself a text of the story, and asked the subject to begin her testimony.

The investigator timed the subject's monologue with a stopwatch, and feigned that he was checking the accuracy of her testimony by following the text with a pencil. He was thus primarily involved in looking at that text, and only infrequently looked up to the subject. (The subjects, in general, rarely looked at the investigator. The memory requirements of their task appeared to foster gazing at the wall behind the investigator.) The manner of the investigator was neutral throughout, and any listener responses which he provided, i.e., head nods, were accompanied by a neutral facial expression which showed neither special approval nor interest, but merely acknowledged that he was hearing and understanding what was being said.

Two of each subject's four monologues were experimentally interrupted 50 seconds after they began. Interruptions were of two types, low level and high level, each designed to effect a pause in the subject's verbalization. For half of the subjects, interruptions occurred in the first and third monologues; for half, in the second

and fourth. In both cases, the low level preceded the high level interruption half of the time, and half of the time the reverse order was followed. Subjects were randomly assigned to experimental groups.

A low level interruption took place as follows: Fifty seconds into the monologue, the investigator appeared to lose his place as he followed the subject's testimony in the text. He assumed a confused expression, raised his hand with palm toward the subject and said, "Wait just a moment," while he appeared to search for and find his place in the text. He then told the subject, "O. K.," and resumed his previous behavior and attitude. Subjects then invariably recommenced speaking. The duration of the interruption was timed with the stopwatch and was always 5-6 seconds. A high level interruption was identical to a low level interruption except that the investigator preceded his instruction to wait just a moment with the subject's first name.

At the same time the investigator told the subject to wait, he also pressed a pushbutton unobtrusively mounted in the right side of his table and concealed from the subject's view. This button turned on a small light which was placed behind the subject and which she never noticed. He kept this light on throughout the interruption, releasing the pushbutton as he told the subject, "O. K.". The light thus provided a precise, visibly-recorded indication of the beginning and end of the interruption.

A critical aspect of the experimental design was that the

interruptions were kept as "low key" as possible. They were initiated in a gentle tone of voice and were intended to avoid startling the subject or arousing her anxiety. The only effect intended was to force a halt in her verbalization.

When the subject had reported all she could remember of a given story, the video recorder was switched off, she returned to her seat at the table, and completed the Story Rating forms. Following this, she was given the text of the next story, and the memorization-testimony-story rating sequence was repeated until all four stories had been presented. After rating the final monologue, the subject was given the final scale which required that all four stories be compared to each other in terms of their overall complexity. The Posttest Questionnaire was administered.

At this point, most subjects were scheduled for a second experimental session during which they took the Embedded Figures Test, followed by the Stroop Color-Word Test, both of which were administered in standard fashion. The second experimental sessions were usually conducted by the investigator's research assistant. In a few instances, due to scheduling constraints, the second session was conducted by the investigator, sometimes immediately after the monologue procedure was completed. Following the second experimental session, the subject's responses to the Posttest Questionnaire were discussed. The subject was informed of the true nature of the study, was permitted to ask questions, and was told that she would receive a summary of the experimental results and her individual

test performance after the study was completed. She was then paid and cautioned not to discuss the study with any of her other classmates.

Data Collection and Analysis

Videotapes of each subject were analyzed in four 15-second time blocks, designated A, B, C, and D. In the interrupted stories, Blocks A and B occurred immediately prior to the start of the experimental interruption, and Blocks C and D immediately followed its termination. During non-interrupted stories, Blocks A and B preceded a point 50 seconds into the monologue, while Blocks C and D represented the following two 15-second intervals.

For each time block, every body-focused gesture was recorded, along with its duration in seconds. Following Freedman, et. al. (1972), discrete gestures were considered to be movements of less than 3 seconds' duration, while movements lasting 3 seconds or longer were considered to be continuous. The latter categorization was further refined so as to specify scoring rules covering momentary discontinuities in otherwise continuous movements. These scoring rules may be found in Appendix 5. Discrete gestures were tabulated in terms of their frequency of occurrence; continuous gestures in terms of time scores. All time scores were transformed using a square root transformation ($\sqrt{x + .5}$) to counteract for skewness (see Edwards, 1968).

Although gestures were coded to reflect the part of the body touched, i.e., head, trunk, arm, leg, or hand, only the latter location subcategory yielded sufficient data for statistical analysis.

Comparisons were therefore limited to overall self-touching, without regard to touch location, and hand-to-hand self-touching, the most common location subcategory.

General scoring was carried out by the investigator and involved the repeated viewing of small segments of the subjects' videotaped behavior. In order to check the investigator's scoring, the data from four randomly selected subjects were independently scored by a second judge.

The speech portion of the videotape data was subjected to automated audio analysis using computer programs and equipment provided by Dr. Jack Martz at Milhauser Laboratories, N. Y. U. Medical Center. The 15-second speech segments were analyzed for average fundamental frequency, number of words, mean word duration, number of syllables per word, and mean syllable duration. Words were considered to be utterances interrupted by breaks of no greater length than 20 msec., while syllables were considered to be indicated by amplitude peaks of at least 10 msec. Pitch was measured in hundredths of octaves above A = 27 Hz.

CHAPTER FOUR

RESULTS AND DISCUSSION

Reliability of Gestural Coding

Reliability analysis confirms the validity of the gestural coding. Table 2 shows the degree to which the investigator and the independent judge concur in their observations of the 80 time blocks containing scorable movements, including the 5-second interruption intervals. These 5-second time blocks are excluded from subsequent analysis because of the overall inhibition of vocal and gestural activity they reflect. There is 87.5% inter-judge agreement as to the occurrence or non-occurrence of scorable movements in a given time block. Cohen's Kappa (Cohen, 1960) is applied to evaluate the extent of agreement after coincidence based upon chance is excluded. Kappa (.73), in this instance, is equal to ϕ, because of the identity of the marginal values (see Cohen, p. 43). Analysis of individually scored gestures reveals that Judge B, the investigator's research assistant, failed to observe 17.6% of the gestures observed by the investigator, but recorded an additional 5 gestures (3.7%). Both judges jointly observed 136 gestures. Of these, 93.4% were assigned to the same subcategory of body-focused gesture by both judges.

Experimental Results

It was predicted that levels of body-focused activity would

TABLE 2

Number of Time Blocks Identified as Containing Scorable Movements, Judge A vs. Judge B

	Judge A		
Judge B	Time blocks containing no scorable movements	Time blocks containing scorable movements	Total
Time blocks containing no scorable movements	24	5	29
Time blocks containing scorable movements	5	46	51
Totals	29	51	80

Note. Kappa = .73.

increase as a result of the experimental interruptions, the extent of the increase being reflected in increased frequency of discrete movements, and increased total duration of continuous movements, when pre- and post-interruption time blocks were compared. The ranked differences for all subjects and for various subject groups in the interrupt and non-interrupt conditions are analyzed using the Wilcoxon Matched-Pairs Signed-Ranks Test. For the purpose of computing T. -values, N represents the number of monologues for which comparisons are made, since each subject provides two monologues in both interrupt and non-interrupt conditions.

Results for the B vs. C time block comparisons in the interrupt condition are presented in Table 3, and for the AB vs. CD comparisons, in Table 4. Results for the AB vs. CD comparisons in the non-interrupt, control condition are shown in Table 5. No significant differences were found between time blocks B and C in the non-interrupted stories. No significant differences were found between low and high level interruptions, and they have been combined in the present analysis. The mean, range, and standard deviations for gestures are presented by time block and interrupt status in Appendix 6.

In line with predictions, Table 3 shows that there is an increase in hand-to-hand discrete gestures across all subjects during the 15-second intervals following an experimental interruption. It further shows that for the 5 subjects who obtained the highest scores on the Stroop Color-Word Test (slightly less than 1/3 of the sample)

TABLE 3

T-Values of Significant Pre- and Post-Interruption Differences

Subjects x Gestural Type, Time Blocks B vs. C

Group	n[a]	Gestural type			
		Discrete	Continuous	Hand-to-hand discrete	Hand-to-hand continuous
Subjects					
All	16(32)	-	-	- 24.5**	-
High Stroop	5(10)	- 0.0*	-	- 0.0***	-
Low Stroop	5(10)	-	-	-	-
High EFT	8(16)	-17.0*	-	- 4.5**	-
Low EFT	8(16)	-	-		-
Stories					
High difficulty	10(9)	-	-	-	-
Low difficulty	3(6)	-	-	-	-
High emotion	11(16)	-	-	-	-
Low emotion	9(10)	-	-	-	-
High complexity	11(12)	-	-	-	-
Low complexity	11(14)	-	-	+ 0.0+++	-

Note. Signed T-values reflect the smaller of the sums of like signed ranks. A negative value indicates a preponderance of increased scores in time block C.

[a]Numbers in parentheses indicate the number of monologues in each group.

*p = .05, 1-tailed test.
**p = < .05, 1-tailed test.
***p = .025, 1-tailed test.
****p = < .025, 1-tailed test.
+++p = < .025, 2-tailed test.

TABLE 4

T-Values of Significant Pre- and Post Interruption Differences

Subjects x Gestural Type, Time Blocks AB vs. CD

Group	n[a]	Gestural type: Discrete	Continuous	Hand-to-hand discrete	Hand-to-hand continuous
Subjects					
All	16(32)	-	-	-	-
High Stroop	5(10)	-	-	-2.5^{*}	-
Low Stroop	5(10	-	-	-	-
High EFT	8(16)	-17.0^{***}	-	-7.0^{**}	-
Low EFT	8(16)	-	-	-	-
Stories					
High difficulty	10(9)	-	-0.0^{*}	-	-0.0^{*}
Low difficulty	3(6)	-	-	-	-
High emotion	11(16)	-	-	-	-
Low emotion	9(10)	-	-	-	-
High complexity	11(12)	-	-	-	-
Low complexity	11(14)	-	-	-	-

Note. Signed T-values reflect the smaller of the sums of like signed ranks. Thus, a negative value indicates a preponderance of increased scores in time block CD.

[a]Numbers in parentheses indicate the number of monologues in each group.

*p = .05, 1-tailed test.
**p = <.05, 1-tailed test.
***p = <.025, 1-tailed test.

TABLE 5

T-Values of Significant Differences, Control Condition

Subjects x Gestural Type, Time Blocks AB vs. CD

Group	n[a]	Gestural type: Discrete	Continuous	Hand-to-hand discrete	Hand-to-hand continuous
Subjects					
All	16(32)	-	-	-	-
High Stroop	5(10)	+0.0**	-	-	-
Low Stroop	5(10)	-	-	-	-
High EFT	8(16)	-	-	-	-
Low EFT	8(16)	-	-	-	-
Stories					
High difficulty	10(14)	-	-7.0**	-	-
Low difficulty	3(4)	-	-	-	-
High Emotion	11(15)	-	-	-	-
Low Emotion	9(10)	-	-	-	-
High complexity	6(9)	-	- 0.0*	-	-
Low complexity	11(14)	-	-	-	-

Note. Signed T-values reflect the smaller of the sums of like signed ranks. Thus, a negative value indicates a preponderance of increased scores in time block CD.

[a]Numbers in parentheses indicate the number of monologues in each group.

*p = .05, 2-tailed test.
**p = .05, 2-tailed test.

there is also an increase in discrete movements during the same interval. Low Stroop scorers show no significant effect. Thus subjects more susceptible to Stroop interference effects prove most vulnerable to interruption. When the sample is divided into the 8 highest and the 8 lowest scorers on the Embedded Figures Test, the high scorers also show an increase in discrete movements following the interruption, while no change is observed among the low scorers. Thus, field-dependency appears to increase interruption effects.

A comparison of Table 3 with Table 4 shows that the increase in hand-to-hand discrete movements for all subjects is observable only in the A vs. B comparisons, i.e., within 15 seconds of the interrupting stimulus. This is also true for the increase in discrete gestures manifested by the high Stroop scorers. The increases in discrete and hand-to-hand discrete movements shown by the high EFT scorers, however, can be observed throughout the 30 seconds following the interruption.

Table 5 shows that not only is there no increase in body-focused activity for the above subject groups during the non-interrupt condition, but that the high Stroop scorers show a decrease in discrete movements during the second 30-second interval. As will be discussed below, this unanticipated finding may be due to the decreased memory load during the second half of the monologue.

Tables 3 through 5 group subjects' performance not only on the basis of inherent subject differences, but also on the basis of how they responded during stories given opposite subjective ratings.

Stories given a rating of 6 or 7, or 1, 2, or 3, on Actual Effort Expended (see Appendix 2, Story Rating Scales) are designated High Difficulty and Low Difficulty, respectively. High Emotion and Low Emotion stories rated 5, 6, or 7, or 1, 2, or 3, respectively, on Emotional Involvement. High Complexity stories rated 5, 6, or 7 and Low Complexity stories rated 1, 2, or 3.[1]

Tables 3 and 4 reveal that when subjects testify to stories rated Low Complexity, they show an increase in hand-to-hand discrete movements during the 15-second pre- and post-interruption intervals, but that this effect cannot be demonstrated over the longer interval comparisons. This result is contrary to predictions, and, as will be discussed in detail below, may be due to inadequacies in the construction of the Complexity rating scale.

The only other interruption effect found for story groupings is in the AB vs. CD comparisons of High Difficulty stories. These longer interval comparisons indicate that when subjects testify to stories rated High Difficulty they show a post-interruption increase in both continuous and hand-to-hand continuous movements.

Control data, presented in Table 5, show that in non-interrupted stories rated High Difficulty and High Complexity, there is an increase in continuous movements during the 30-second CD interval. This result prevents interpreting the post-interruption

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[1] It will be recalled that stories were rated on 7-point scales, a rating of 4, therefore, being the mid-point value. While comparisons between the most extreme values (1 and 2 vs. 6 and 7) would have been theoretically desirable, only in the category High Difficulty were these extreme values sufficiently represented to allow for adequate statistical analysis.

increase in continuous movements as being the result of interruption.

Speech data produced one significant finding: Speech productivity, as reflected in number of syllables per word in AB/CD comparisons, increases across all subjects as a result of the experimental interruption (Wilcoxon T. = -148.5, p. = $< .05$, 2-tailed test). None of the subgroupings based on subject characteristics or story ratings used in the body movement comparisons show significant results when applied to the speech variables studied (average fundamental frequency, number of words, mean word duration, number of syllables per word, and mean syllable duration). No significant change in any speech parameter is found in the control condition. The mean, range, and standard deviation of each speech variable are presented by time block and interrupt status in Appendix 7.

Correlations between Story Ratings in interrupt and non-interrupt conditions are shown in Tables 6 and 7. Positive relationships are found between Difficulty and Complexity in both conditions, and, in the non-interrupt condition, between Complexity, Difficulty, and Expectations. In both conditions, negative relationships are found between Expectations and Confidence, and between Confidence and Complexity. In the interrupt condition, Confidence is also negatively correlated with Difficulty. Emotion fails to correlate with any of the other Story Ratings (and is a non-significant category in regard to voice and body movement as well). The mean, range, and standard deviation of each story rating in interrupt and non-interrupt conditions is presented in Appendix 8.

TABLE 6

Spearman Rank-Order Correlations

of Ratings of Interrupted Stories

	Emotion	Difficulty	Complexity	Expectations	Confidence
Emotion	1.00	-	-	-	-
Difficulty	-	1.00	.47*	.76****	-.60***
Complexity	-	.47*	1.00	.82****	-.50**
Expectations	-	.76****	.82****	1.00	-.70****
Confidence	-	-.60***	-.50**	-.70****	1.00

*p = < .05.
**p = < .025.
***p = < .01.
****p = .001.

TABLE 7

Spearman Rank-Order Correlations

of Ratings of Non-Interrupted Stories

	Emotion	Difficulty	Complexity	Expectations	Confidence
Emotion	1.00	-	-	-	-
Difficulty	-	1.00	.81****	-	-
Complexity	-	.81****	1.00	-	-.47*
Expectations	-	-	-	1.00	-.58***
Confidence	-	-	-.47*	-.58***	1.00

*p = < .05.
**p = < .025.
***p = < .01.
****p = .001.

Table 8 shows the mean, range, and standard deviation of subjects' scores on the Embedded Figures and Stroop tests. It should be noted that subjects' mean EFT score is considerably higher than the norms for college women of 66.9 (S. D. 33.6) and 69.4 (S. D. 41.0) published in the test manual (Witkin, et. al., 1971). Normative comparisons cannot be made for Stroop test results as there is no standard form of this instrument.

A Spearman rank-order correlation coefficient of .53 ($p. = < .02$) is found between subjects' scores on the Embedded Figures and Stroop Color-Word tests.

The preceding results address the effects of interruption over post-interruption time intervals of 15 and 30 seconds. During these intervals, changes in hand-to-hand self-touching and overall self-touching was assessed, each category being subdivided into discrete and continuous movements. Post-interruption changes in speech parameters were also evaluated. Factors which influenced these gestural and speech effects were subject differences, reflected in EFT and Stroop scores, and story differences, reflected in the story ratings.

TABLE 8

Mean, Range, and Standard Deviation of Scores

Embedded Figures Test and Stroop Color-Word Test

	Scores		
Group	Mean	Range	S. D.
	Embedded Figures Test		
All subjects	77.50	24.90-148.80	35.77
8 highest scorers	105.34	76.60-148.80	50.46
8 lowest scorers	49.76	24.90- 69.60	13.93
	Stroop Color-Word Test		
All subjects	43.80	16.00-138.00	27.85
5 highest scorers	70.30	48.00-138.00	51.75
5 lowest scorers	24.40	16.00- 30.00	5.08

Note. Values represent time scores, in seconds.

Confirmation of Main Hypotheses

(1) Results support the central hypothesis that the interruption of verbal monologue produces an increase in autonomic arousal and consequent body-focused activity. Subjects showed a significant increase in hand-to-hand discrete movements and a significant increase in speech productivity following monologue interruption. No increase in speech productivity was found in the non-interrupt, control condition. These results support the view that the double kinesthetic feedback provided by hand-to-hand contact facilitates the modulation of arousal by directing attention toward the skin surface and body boundary, as has been hypothesized by Freedman, et. al.

The data collected on body-focused movement in the present study differ significantly from the findings previously reported by Freedman and his colleagues. In their investigations they reported that body-focused movements, when they occurred, were primarily continuous, rather than discrete. The interruption-related, body-focused activity uncovered in the present study is exclusively in the form of discrete gestures. One explanation of this result flows from Freedman and Steingart's (1975) finding that higher levels of language complexity were associated with discrete body touching. Present data, showing an increase in such movements corresponding to an increase in syllables per word, are in line with this observation.

(2) The hypothesis that subjects of relatively low psychological differentiation (high EFT scorers) show greater interruption effects

than more highly differentiated subjects (low EFT scorers) is also supported. Less differentiated subjects, in addition to reflecting the increase in hand-to-hand discrete movements shown for all subjects, showed a general increase in discrete body-focused movements during the interrupt condition only.

(3) It was hypothesized that subjects most susceptible to interference (high Stroop scorers) would be most disrupted by the interuption of their verbal monologues. This is supported by the finding that in the interrupt condition such subjects also showed, in addition to the general increase in hand-to-hand discrete movements, an increase in discrete movements of all types. Again, no such effect was evidenced in the control condition.

Strength of Experimental Effects

A consideration of B/C and AB/CD comparisons allows for inferences to be drawn about the magnitude and persistence of the experimental effects. The increase in hand-to-hand discrete movements found for all subjects appeared only in B/C comparisons. This suggests that this main experimental effect is short-lived, but strong enough to be shown with statistical significance in the comparison of the relatively few gestures counted in the 15-second B and C time blocks. On the other hand, the increase in speech productivity could be observed only when the AB/CD comparison was made. The effect of interruption on speech may, therefore, be presumed to be weaker, but longer-lasting. Such interpretations suggest that while the hypothesized arousal effects produced by an

interruption are relatively long-lasting, in most subjects they activate a relatively short-lasting gestural response.

For subjects more susceptible to interruption-produced arousal, i.e., those less psychologically differentiated and less resistant to external interference, the above interpretation does not hold true. The body movement effects produced by interruption of these subjects' monologues are evident in both B/C and AB/CD comparisons. It can be inferred, therefore, that such subjects' response to internal "arousal" is both strong and persistent.

The fact that a differential effect between subject groups was found only for body movement and not for speech productivity, suggests that subjects vary not in the degree of arousal presumably produced by an interruption, but in the extent to which they require the arousal regulation of self-touching behavior. The need to distinguish between arousal and its regulation was noted by Freedman (1977).

It is worth noting that the experimental effects, which have been hypothesized to reflect increases in subjects' level of arousal, were obtained despite the likelihood that their baseline arousal level was fairly high. The Posttest Questionnaire and discussion indicated that subjects were totally unaware that the experimental interruptions were important or pre-planned. Indeed, most subjects did not remember being interrupted. Nevertheless, they frequently commented on feeling self-conscious about being before the video camera and being asked to recall the stories in great detail. That interruptions

presumably resulted in a further increase in arousal speaks to the power of the experimental manipulation.

Significance of Story Ratings

It was presumed that the complexity or emotionality of the material upon which subjects' monologues were based would influence the manner in which they were structured in memory. Mandler has suggested that the degree of interruption-produced ANS arousal varies with the degree of organization of the disrupted structures (see Chapter One). Testifying to stories subjectively rated as highly complex, emotional, or difficult was expected to require a more extended use of such cognitive operations as memory retrieval and information selection and organization. The interruption of such stories was expected to result in a differential arousal effect.

Table 4 shows that during stories rated High Difficulty there was an increase in continuous, and in continuous hand-to-hand movements in the 30-second post-interruption intervals. Table 3 shows, contrary to expectations, an increase in hand-to-hand discrete movements during the 15-second post-interruption intervals of stories rated Low Complexity. Lastly, during the 30-second control intervals shown in Table 5, there is an increase in continuous gestures during stories rated High Difficulty and High Complexity.

The finding that continuous movements increased during both control and interrupt conditions for High Difficulty and High Complexity stories suggests that this effect is independent of experimental

interruptions. It appears to be a consequence of the inherently high memory demands required by such stories, and the arousal presumed to be engendered by such a difficult task. The increase in continuous hand-to-hand movements, however, was limited to High Difficulty stories in the interrupt condition only, and may be considered a valid experimental effect.

Unanticipated Results

Two body movement findings were unanticipated: The increase in discrete hand-to-hand movements shown in Low Complexity stories in the interrupt condition, and the decrease in discrete movements shown by high Stroop scorers in the non-interrupt condition.

High Stroop scorers are individuals who are relatively less psychologically differentiated; they were found to be particularly susceptible to the effect of the experimental interruption. Under non-interrupt conditions, however, these subjects showed a decrease in discrete movements during the second 30-second monologue interval. This suggests that the arousal level of such less differentiated subjects was naturally higher during the early portions of their monologues, possibly because more of the story had then to be retained in working memory. As their testimony progressed, memory retention demands were reduced, resulting in a decrease in hypothesized arousal and related discrete movements. If such subjects were interrupted, however, they showed a strong interruption response.

Most difficult to interpret is the finding that during Low

Complexity stories, subjects showed an increase in hand-to-hand movements following an interruption. Complexity ratings, due to scale construction and procedural difficulties which will be discussed below, are, in and of themselves, somewhat ambiguous. Such a situation makes understanding the relationship between interruption, gesture, and Low Complexity even more problematic. That the interruption of High Complexity stories failed to produce an interruption response may have been due to the ambiguity and lack of consistency shown by subjects when making High Complexity ratings. It may be speculated that stories rated Low Complexity were, in fact, stories which subjects found uniquely uninteresting or even boring. Given this not unreasonable assumption, subjects' overall arousal level during testimony to these stories may have been lower than for any of the others, prior to interruption. The decrease in discrete hand-to-hand movements following the interruption of Low Complexity stories may, therefore, represent the same general type of arousal-related response as has been suggested previously.

Correlations between Story Ratings

Tables 6 and 7 present the intercorrelations of subjects' Story Ratings in the interrupt and non-interrupt conditions. While ratings of interrupted stories show numerous positive relationships, it is significant that there were far fewer such correlations for the non-interrupted stories. These differences between interrupt and non-interrupt conditions will be discussed below. Negative correlations were found between Confidence and Expectation, indicating

that subjects more easily and accurately recalled their expectations of stories which appeared obviously simple and easy to remember. Correlations between Confidence and Difficulty, and Confidence and Complexity were similarly negative.

In the interrupt condition, there is a large and highly significant correlation between Difficulty and Expectation ratings; this relationship does not appear for the non-interrupted stories. Further, the large and highly significant relationship between Expectation and Complexity is also true only in the interrupt condition.

That Expectation should be strongly correlated with Difficulty only in the interrupt condition suggests that subjects' evaluation of the difficulty they anticipated they would have in remembering a story prior to testifying to it was influenced by whether or not the story was subsequently interrupted. Considering that subjects were first asked to rate the actual difficulty they had in testifying, and immediately thereafter to try to recall their expectations of difficulty, one might anticipate that Difficulty and Expectation ratings would tend to agree, and that subjects would be unlikely to report that their expectations were frequently in error. If such agreement were found in both interrupt and non-interrupt conditions, this simple explanation would probably suffice. However, the fact that differences were found between conditions requires a more substantial explanation.

In considering this issue, it becomes necessary to carefully

evaluate the nature of the tasks presented to the subject when she was first asked to rate the difficulty actually experienced in testifying and, immediately thereafter, to recall her expectations as to how difficult to remember she thought the story she had just studied would be. The first task asked for a very narrowly-limited rating of objective performance - how accurately the subject recalled the main facts and small details of the story, and how much effort was required to do so. After having made this very specific estimate, the subject was then asked to recall an expectation. Although the Difficulty and Expectation rating scales parallel each other and appear to require similarly delimited evaluations, the latter rating is qualitatively different from the former.

When the subject tried to recall her expectation, she was really trying to recall a feeling-state, perhaps not even consciously noted at the time. Such an anticipatory feeling could be expected to be relatively diffuse, and its recollection likely to be difficult to separate from subsequent feeling-states engendered during the interrupted testimony.

The results of the present study support the contention that subjects are more aroused during interrupted monologues. During monologues which were rated highly difficult there was, in particular, a specific increase in continuous, hand-to-hand movements. In the interrupt condition, when subjects attempted to recall their expectations of the stories subsequently rated highly difficult, the anticipatory feeling which they used as data may thus have included the

within-testimony awareness of increased general arousal, as well as the specific feeling-state which gives rise to, or results from, continuous hand-to-hand movement. The inclusion of such internal states in the subjects' Expectation ratings would have served to differentiate the ratings of interrupted from non-interrupted stories and, further, would have provided a distinctive basis for feeling that the stories that proved to be difficult had been anticipated to be difficult as well. Presumably, following non-interrupted testimonies, subjects had little basis for recollecting their expectations of difficulty. The fact that Confidence is strongly related to Expectation in the non-interrupt condition supports this interpretation.

A further explanation for the above correlation finding is also possible. Given that the interruption appeared to be due to the investigator's losing his place in the text, subjects may have taken this as an indication that the ongoing material was inherently difficult.

As already noted, strong relationships exist between the ratings of Complexity, Difficulty, Expectation, and Confidence. In order to understand these correlations, it is necessary to consider the specific nature of the Complexity Rating Scale. It should be recalled that, unlike the other Story Ratings, Complexity judgments were made after all four monologues and their individual ratings had been completed, and required that subjects provide their own criteria for judging degrees of Complexity. The reason for these

differences in procedure and scale construction stemmed from the fact that pretesting had established that subjects could vary greatly in terms of the manner in which they made subjective evaluations of Complexity. One preliminary subject felt that Subway, for example, was particularly complex because it involved many different people; another felt that Mountain was highly complex because it involved decision-making during a crisis; a third found the details of Watch highly complicated. It appeared impossible to anticipate the factors which subjects would feel made a given story complex, or to establish a scale which would provide any kind of absolute rating. For these reasons it was decided to obtain relative, rather than absolute, Complexity ratings by asking subjects to rate all four stories together at the end of the study, leaving the criteria up to the subject, in order to allow for individual differences. Some general suggestions, intended to indicate the variety of possible criteria which might be used, were, however, provided.

Unfortunately, subjects did not show the kind of individualistic responses which had been anticipated, and in most cases, restricted the basis of their judgments to the few slight indications of possible criteria which had been given only as examples. Moreover, because of the physical construction of the scale, the criteria which the subjects did specify were referred to in general terms and were applied to all four stories. It is thus impossible to draw any clear conclusions about the subjects' bases for making Complexity ratings, nor can the information be sorted and analyzed separately for interrupted

and non-interrupted stories.

The fact that the full meaning of the Complexity ratings is obscured makes their observed correlations with the other variables in Tables 6 and 7 difficult to interpret. The simplest explanation is that the same factors which influenced Difficulty ratings (memory demands and effort expended) were significant influences in the Complexity ratings as well, and that the limited criteria mentioned by the subjects accounts for the remaining variance. This is a particularly reasonable interpretation of the Complexity ratings in the non-interrupt condition, where $r_s = .81$ ($p. = .001$).

Suggestions for Future Research

During the analysis of the results of the present study, an important question arose which could not be answered from the data collected: Were there, indeed, significant differences in memory performance as a result of subject and/or story differences, or the occurrence of an interruption? Although the study purported to test the memory ability of courtroom "witnesses", no evaluation of memory performance was actually conducted. This issue is of importance because the effects of interruption, as presented here, have been presumed to be related to the degree of organization of the cognitive structures interrupted. Clearly, such organization would vary with the extent to which story material was adequately represented in memory.

Although subjects were all given five minutes to study each story, there was neither control nor measurement of the effort or

adequacy of their attempts at memorization. Some subjects may have read the material many more times, or employed more efficient learning strategies than others. Greater experimental control over such variables would prove valuable for future research.

It would also be most germane to determine whether there was a decrement in memory performance following an interruption. The theoretical rationale presented for the present study would predict such effects. One could assess pre- and post-interruption differences in memory performance through a comparison of number of items correctly recalled during each interval. Such a comparison would be useful to include in further studies in this area.

Concluding Comments

The research here presented, as well as previous investigations reviewed in Chapter Two, points to an intimate relationship between an individual's self-touching behavior and various "aspects" of cognitive functioning. The evidence seems strongly to support a relationship between self-touching and arousal, attention, psychological differentiation, attentional interference, and the processes whereby mental structures become "focused" and subsequently represented. Neither past nor present research, however, clarifies the seemingly obvious question of whether this relationship is, indeed, a functional one.

The difficulty in answering this question suggests the possibility that it is not, in the first instance, a proper one to ask. In brain research, early questions about specific hemispheric functions

have been replaced by an interactional perspective which asks about the integrated functioning of the whole brain. Similarly, a more appropriate cognitive perspective would not try to separate "body" movement from "mental" activity, but would recognize both as manifestations of the same process.

The question of who we are is, or should be, the most important question asked by cognitive psychologists, and by members of the human community generally. The theory and research considered here suggest, at a minimum, the logical inseparability of "mind" and "body". When the question of human identity is ultimately understood, it may be found that it cannot be answered except by recognizing the logical inseparability of "self" from every aspect of existence.

APPENDIX 1

Research Description for Subject Recruitment

Dear City College Student:

In the United States, every person charged with a crime is presumed innocent until proven guilty. Such proof often rests on the testimony of witnesses who may vary considerably in their ability to accurately communicate information concerning events about which they have knowledge. My doctoral research, as a PhD candidate in the Experimental Cognition Program at CCNY, is investigating various factors which affect how accurately persons are able to give courtroom testimony.

I am seeking female volunteers to serve as subjects for my study. Each will be paid $6.00 for approximately 1-1/2 to 2 hours' participation, which will consist of testifying before a video camera to previously studied stories, the taking of two perceptual psychological tests, and the completion of some brief questionnaires.

Subjects may expect to gain interesting information about their cognitive/perceptual style, and will be making a valuable contribution to the advancement of our understanding of the factors which influence the nature of courtroom testimony.

If you are interested in participating, please leave your name and telephone number on the sign-up sheet which is being circulated.

You may also sign up on the list on the door of Room H111A, diagonally across from the Psychology Office on the first floor, or you may call either me, Roger Gradess, or my research assistant, Silvana Pizzuti. My telephone number is 685-1665, and Ms. Pizzuti's number is 478-8298.

Thank you. I look forward to your participation.

APPENDIX 2

Story Ratings and Posttest Questionnaire

I. ACTUAL EFFORT EXPENDED

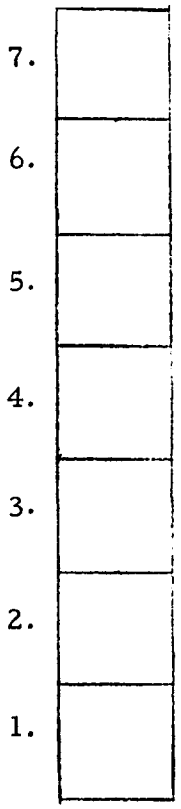
We would now like you to rate the story you have just testified to in terms of how hard it was for you to remember. Please place a check in the box which best describes how much effort this story took to recall.

7. Extreme effort: I tried very hard to remember all of it, but forgot many important facts and details.
6. Very strong effort: I tried very hard to remember all of it, but forgot many of the smaller details.
5. Strong effort: I tried hard to remember all of it, and remembered most of the main facts and smaller details.
4. Moderate effort: I was able to remember almost all the facts and details, but needed to tell the story in my own way.
3. Slight effort: I was able to remember nearly the entire story, but it was somewhat difficult.
2. Very slight effort: I was able to remember nearly the entire story rather easily.
1. Almost no effort: I was able to remember nearly the entire story with almost no difficulty.

II. EXPECTATIONS PRIOR TO TESTIFYING

Thinking back now to the time just after you had finished studying this story, we would like to know how hard you thought it would be to remember. That is, what were your expectations about the testimony you were about to give? Please place a check in the box which best describes how hard you thought this story would be to remember.

7. Extremely hard: I expected to forget many important facts and details.
6. Very hard: I expected to forget many of the smaller details.
5. Hard: I expected to remember most of the main facts and smaller details.
4. Moderate: I expected to remember nearly the entire story, even if I had to somewhat rearrange the order of events.
3. Easy: I expected to remember nearly the entire story if I concentrated on it.
2. Very easy: I expected to remember nearly the entire story rather easily.
1. Extremely easy: I expected to remember nearly the entire story with almost no difficulty.



III. CONFIDENCE

In regard to the previous question, how confident are you in your ability to recall your expectations? That is, how clear and specific or vague and indistinct is your recollection of your reaction to this story immediately after studying it? Please check the appropriate box.

7. Extremely confident: I remember my reaction to this story and my expectations of testifying to it extremely accurately and with great clarity.
6. Very confident: I remember my reaction to this story and my expectations of testifying to it with unusual accuracy and clarity.
5. Confident: I remember my reaction to this story and my expectations of testifying quite clearly.
4. Moderately confident: I remember my reaction to this story and my expectations of testifying fairly clearly.
3. Somewhat confident: I have a general, but vague, recollection of my expectations of my ability to testify.
2. Slightly confident: I have some slight recollection of my expectations of my ability to testify.
1. Almost no confidence: I really recall very little of my reaction to this story immediately after studying it.

IV. EMOTIONAL INVOLVEMENT

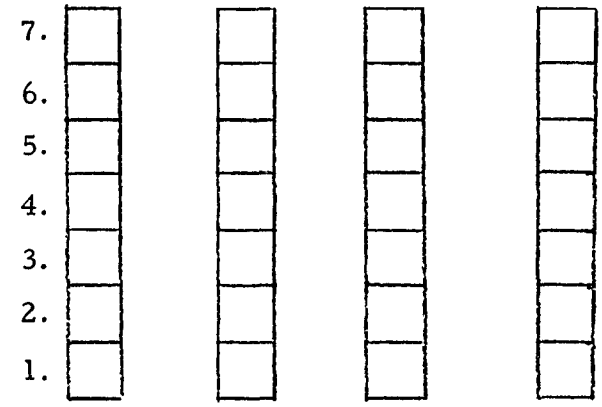
How emotionally involving was the story you just testified to? Please place a check in the box which best describes the emotions you felt while studying and testifying to it.

7. Extremely strong response: This story had an exceptionally powerful emotional impact on me.
6. Very strong response: This story had a powerful emotional impact on me.
5. Strong response: Many things in this story produced definite, strong, emotional reactions in me.
4. Moderate response: The entire story was quite interesting and held my attention.
3. Slight response: There were a number of interesting aspects to the story.
2. Little response: There were only a few aspects of this story which I found interesting.
1. Minimal response: I had practically no emotional response to this story.

Subject Name _____

Looking back at all the stories and remembering your experience of studying them and testifying to them, please rate each one in terms of its complexity or simplicity. In making these judgments, you should use whatever characteristics seem relevant - the plot, the characters, the number and type of facts involved, the situation, etc.

	SUBWAY	FLOOD	WATCH	MOUNTAIN
7. Extremely complex				
6. Very complex				
5. Moderately complex				
4. Neither especially complex nor especially simple				
3. Moderately simple				
2. Very simple				
1. Extremely simple				



On what did you base these ratings? _____

_____

Is English your native language? Yes _____ No _____

If NO, when did you begin speaking English? Age _____

Do you have any form of rash or skin condition? Yes _____ No _____

Please check the appropriate boxes:		Left-handed	Right-handed
	Yourself	_____	_____
	Your father	_____	_____
	Your mother	_____	_____
	Your siblings	_____	_____

Your mailing address: _____

Your telephone number: _____

Subject Name _____

Please answer the following questions in any way you like:

At any point during this (these) session(s) did you get any idea about what, specifically, we might be looking for? If so, what gave you that idea?

How did you feel being a subject in this experiment? What was it like to be before the camera, in this room, etc.?

Why did you decide to participate?

What did you expect your tasks to be like? Were your expectations fulfilled?

How well paid do you feel you were for what you did?

How would you describe your own personality or style? Are you sociable? Do you like public speaking? Etc.

APPENDIX 3

Stories

FLOOD

You are out for a walk on / a Sunday / morning / and you pass by the closed / AAA / Furniture / Showroom. / As you glance inside you discover that there is water / all over / the left side / of the main floor, / perhaps several inches deep. / It has already soaked the carpet / and the bottoms / of several pieces / of upholstered furniture. / You can see that the water is still gushing / out of one section of flooring, / and you realize that you have arrived just after / a serious plumbing leak has occurred. / Wondering what you should do, / you see a sign / on the door. / It states that, in case of an emergency, / one should call / the owner, / Mr. / A. / Levin, / and it gives his telephone number. / You go to the pay phone / on the corner / and call Mr. Levin / who, you learn, lives only a block away. / You wait / until he arrives and enters the store. / He wades through the water / and goes to the basement / where he turns off / the main water supply valve. / You see that the water damage has been extensive. Several pieces of upholstered furniture are sitting in the pool of water, / and the carpet has been completely ruined as well. / Mr. Levin tells you that he believes that the plumbing contractor who has just completed / installing a new sink / in the rear of the store / is at fault, / and that he intends to sue him for recovery of damages. / He asks if you will testify to what you have observed.

WATCH

You purchase / an Owasha / electronic / digital display / watch / on December / 18th / from Midtown Jewelry, / an established retail / store / at 315 / West / 48th Street / in Manhattan. / You wear the watch / for two months, / at which point it suddenly / ceases to function. / You put in a fresh battery / and it begins to run again, / and you assume / that it had been supplied with a battery / which was already nearly exhausted. / Two months later / your second battery / also goes dead. / Before it does, however, instead of your watch just stopping suddenly as it did before, a variety of idiosyncratic problems develop. / The digital display / becomes erratic, / sometimes flickering through several random numbers / before showing the time. / Not only that, but it ceases to keep accurate time. / Sometimes it runs about eight minutes / fast. / sometimes about eight minutes / slow. / You take the watch to Midtown Jewelry / and explain all the problems / to the manager, / Ms. Goldofsky. / She sympathizes / and tells you to take the watch to Owasha, / Inc. / She gives you the name and address of Mr. / O. / Naaki, / their American / sales representative, / and you return the watch to him. / He accepts it, / stating that it must be sent to their factory / in Garden Park, / New Jersey, / and that he will have it back to you in a month. / After five months / you still have not received it. / You complain / numerous times / to both Mr. / Naaki / and Ms. / Goldofsky / without success, / and decide to take the matter to Small Claims Court to be resolved.

SUBWAY

You are riding the Lexington Avenue Subway. / It is about three in the morning / and you are on your way home / from a late night party. / You are sitting alone. / As you glance around the subway car you see, riding with you, about a dozen other people, / one of whom is a lone, / middle-aged / man. / Suddenly the man leaps to his feet, / his eyes bulging. / He begins to scream / in what sounds to you like intense agony. / He starts to pound his head with his fists / as his body twists and jerks spasmodically. / You look with anxiety at the other people in the car, / but they all seem riveted to their seats, / unable to respond. / As the train slowly pulls into the station / a number of people wait on the platform / in front of the subway car doors. / The doors open and the man rushes out, / his arms flailing. / As he runs from the car he unknowingly / strikes / a young / Puerto Rican / woman / directly in the face. / She falls at once to the ground. / Blood covers her fingers / as she clutches desperately / at her left / eye. Two / policemen / run from the adjacent platform / and wrestle the man / to the ground. / He is still screaming wildly / and you watch as he attempts / to beat his head against the concrete platform. / An ambulance team arrives / and the struggling man / and the injured woman / are swiftly carried from the station on stretchers. / You are asked to appear as a witness to what happened.

MOUNTAIN

You are driving / alone / through Bear Mountain / State Park, / and notice how the road curves / sharply / as you drive steeply / downhill. / It is necessary / to brake / often, / for the car tends to accelerate / to an unsafe speed as you make your descent. / Rounding / a particularly sharp curve / you see, directly in front of you / in the middle of the road, / the sprawled, / bleeding body / of a young motorcyclist. / His motorcycle, / one wheel still spinning, / lies wrecked / on the embankment. / You veer / onto the shoulder / to avoid striking the boy, / a maneuver that leaves you breathless. / You rush from your car / to try to help / and find that the rider is unconscious / and pale. / Blood is welling up / inside his right / ear. / You feel yourself growing faint / and lower your head / to keep from losing consciousness. / You are afraid to touch / or move him, / for you see his crumpled position / and are terrified that his back is broken. / You think that you should block the road / from below / with your own car, / emergency lights flashing, / then run uphill / and around the curve / to wave down cars / speeding downhill. / As you move toward your car / an old / Volkswagen / Microbus, / traveling much too fast / downhill, / rounds the curve / and runs directly over the fallen boy. / The driver, braking / and swerving / too late, / loses control of the Microbus, / which overturns. / He escapes unhurt, / and you are asked to testify to what you witnessed.

APPENDIX 4

Order of Stimuli, Stroop Color-Word Test

Card W	Card CW*	Card C
	r b g b r b r g	
B G B G R B G R	G R B R B G B R	G R B R B G B R
	r b g r g b g r	
B G R G B R B R	B R B G R G B G	B R B G R G B G
	b r g r g b r b	
G B R B R G R G	R G R G R G B R	R G R G R G B R
	r g b g b g b g	
B G R G B R B G	G R G B R B R B	G R G B R B R B
	b r b r g r b r	
B G R G R B R G	G B G B R G R B	G B G B R G R B
	g r b r g r g b	
R B R G R B R B	R B G B R B R G	R B G B R B R G
	g b r b g r g b	
G B G B G B G R	R G B R B G B R	R G B R B G B R
	g r g r b r b g	
B R B G R G R B	B G B G R B R B	B G B G R B R B
	r b r b g r g b	
R G B G R G B R	G R G R B G B G	G R G R B G B G
	r g b r g b g b	
G R B R B G B R	B R G B R G R G	B R G B R G R G

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* lower case = color name
upper case = color ink

Note: Stimulus colors were: Red (R), Green (G), and Blue (B)

APPENDIX 5

Scoring Rules for Continuous Movements

If a continuous, body-focused movement is interrupted by a momentary break (less than one second) in contact between hand and touched surface, such interruptions are to be disregarded.

If a continuous, body-focused movement is interrupted by a pause in motion which resumes, without a break in contact, in less than 3 seconds, such interruptions are to be disregarded.

If a continuous,body-focused movement is interrupted by a pause in motion of 3 seconds or more, two separate movements shall be scored.

If a continuous, body-focused movement starts in one time block and ends in another, it shall be scored as a separate movement for each block in which it occurs.

If a continuous, body-focused movement begins prior to Block A, but extends into it, its Start Time shall coincide with the Start Time of Block A. The duration scored shall be its actual duration in Block A, even if this is less than 3 seconds.

If a continuous, body-focused movement begins in Block D and continues beyond it, its End Time shall coincide with the End Time of Block D. The duration scored shall be its actual duration in Block D, even if this is less than 3 seconds.

APPENDIX 6

Gestural Data

TABLE A

Mean, Range, and Standard Deviation of Gestures

Type x Time Block, Interrupted Stories, All Subjects

	Time block			
	AB	B	C	CD
Discrete gestures[a]				
N[b]	20	15	21	23
Mean	3.00	2.27	2.52	3.48
Range	1-7	1-7	1-7	1-11
S. D.	1.26	1.60	1.76	2.60
Continuous gestures[c]				
N[b]	15	11	14	16
Mean	13.6	8.09	7.78	12.44
Range	2-30	2-15	3-15	2-30
S. D.	9.52	5.07	4.65	8.09
Discrete hand-to-hand gestures[a]				
N[b]	13	8	15	17
Mean	2.38	1.75	1.93	2.59
Range	1-7	1-3	1-5	1-8
S. D.	1.86	0.89	1.23	2.09
Continuous hand-to-hand gestures[c]				
N[b]	12	10	12	14
Mean	13.25	7.60	6.58	12.43
Range	2-30	2-15	1-15	1-30
S. D.	10.28	5.38	4.65	9.51

[a]Data for discrete gestures reflect frequency counts.
[b]N represents total number of time blocks in which a given type of gesture appears.
[c]Data for continuous gestures reflect non-transformed raw scores, in seconds.

TABLE B

Mean, Range, and Standard Deviation of Gestures

Type x Time Block, Non-Interrupted Stories, All Subjects

	Time block			
	AB	B	C	CD
Discrete gestures[a]				
N[b]	21	16	16	20
Mean	4.48	2.75	2.50	3.30
Range	1-15	1-6	1-9	1-11
S. D.	3.45	1.61	2.19	2.50
Continuous gestures[c]				
N	14	13	14	18
Mean	13.86	7.69	10.14	15.56
Range	5-25	4-13	1-23	2-30
S. D.	7.17	3.26	5.90	9.46
Discrete hand-to-hand gestures[a]				
N[b]	12	7	8	12
Mean	2.83	2.00	1.25	2.00
Range	1-10	1-4	1-2	1-4
S. D.	2.52	1.00	0.46	1.13
Continuous hand-to-hand gestures[c]				
N[b]	13	11	10	13
Mean	11.69	7.09	9.10	15.23
Range	4-25	1-13	1-15	2-30
S. D.	7.92	3.93	4.58	9.48

[a]Data for discrete gestures reflect frequency counts.

[b]N represents total number of time blocks in which a given type of gesture appeared.

[c]Data for continuous gestures reflect non-transformed raw scores, in seconds.

APPENDIX 7

Speech Data

TABLE C

Mean, Range, and Standard Deviation of Number of Syllables, Words, and Syllables per Word, by Time Block for All Subjects, Interrupted Stories

	Time block			
	AB	B	C	CD
Number of syllables				
Mean	67.22	34.09	34.38	70.53
Range	42-90	17-46	21-43	52-85
S. D.	11.15	6.73	5.59	14.99
Number of words				
Mean	14.75	7.09	7.38	14.81
Range	10-25	4-11	5-16	10-26
S. D.	3.23	1.71	2.09	3.58
Syllables per word				
Mean	4.81	5.12	4.97	4.87
Range	2.20-8.18	2.45-9.20	1.94-8.40	2.54-8.00
S. D.	1.44	1.74	1.52	1.28

TABLE D

Mean, Range, and Standard Deviation of Word Length, Syllable Length, and Pitch, by Time Block for All Subjects

Interrupted Stories

	Time block			
	AB	B	C	CD
	Word length[a]			
Mean	1.46	1.51	1.42	1.14
Range	0.54-2.42	0.57-3.20	0.48-2.20	0.65-2.21
S. D.	0.41	0.53	0.40	0.36
	Syllable length[b]			
Mean	.299	.295	.284	.291
Range	.243-.375	.230-.383	.223-.379	.238-.364
S. D.	0.03	0.15	0.04	0.04
	Pitch[c]			
Mean	261.19	260.97	262.84	260.93
Range	234-294	234-294	232-294	232-296
S. D.	15.54	15.87	8.10	17.39

[a]Values represent seconds.
[b]Values represent seconds.
[c]Values represent hundredths of octaves above A = 27 Hz.

TABLE E

Mean, Range, and Standard Deviation of Number of Syllables, Words, and Syllables per Word, by Time Block for All Subjects, Non-Interrupted Stories

	Time block			
	AB	B	C	CD
	Syllables			
Mean	66.38	33.44	33.50	66.69
Range	29-84	12-14	12-42	35-83
S. D.	9.23	6.30	6.25	10.66
	Words			
Mean	14.56	7.53	7.84	15.22
Range	11-22	5-11	4-10	8-21
S. D.	2.52	1.47	1.99	2.88
	Syllables per word			
Mean	4.71	4.60	4.40	4.52
Range	2.42-7.09	2.00-7.33	2.00-6.00	2.76-6.63
S. D.	1.01	1.27	0.79	1.08

TABLE F

Mean, Range, and Standard Deviation of Word Length, Syllable Length, and Pitch, by Time Block for All Subjects

Non-Interrupted Stories

	Time block			
	AB	B	C	CD
	Word length[a]			
Mean	1.41	1.34	1.25	1.32
Range	0.67-3.04	0.52-2.09	0.59-1.76	0.73-2.17
S. D.	0.45	0.43	0.31	0.43
	Syllable length[b]			
Mean	.284	.293	.288	.292
Range	.223-.428	.245-.375	.212-.357	.212-.360
S. D.	0.08	0.14	0.04	0.03
	Pitch[c]			
Mean	260.64	260.13	259.66	259.77
Range	234-289	235-287	236-290	236-290
S. D.	14.91	15.41	14.84	17.85

[a]Values represent seconds.
[b]Values represent seconds.
[c]Values represent hundredths of octaves above A = 27 Hz.

APPENDIX 8

Rating Scale Data

TABLE G

Mean, Range, and Standard Deviation of

Story Ratings for All Subjects

	Story			
	Flood	Watch	Subway	Mountain
	Emotion			
Mean	3.50	3.56	4.63	5.13
Range	1-5	1-7	1-7	3-7
S. D.	0.93	1.83	1.65	1.39
	Difficulty			
Mean	4.00	5.31	3.88	4.31
Range	1-6	3-7	1-5	1-7
S. D.	1.59	1.31	1.34	1.46
	Complexity			
Mean	2.75	4.88	3.31	4.25
Range	1-6	3-7	1-7	2-6
S. D.	1.53	1.29	1.59	1.46
	Confidence			
Mean	4.88	4.25	5.13	4.31
Range	3-7	2-7	4-7	1-6
S. D.	0.93	1.34	0.93	0.85
	Expectation			
Mean	3.31	4.88	3.88	5.31
Range	1-6	2-7	1-6	3-7
S. D.	1.67	1.93	1.73	1.36

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