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THE EFFECT OF SUBLIMINAL AUDITORY VERBAL STIMULATION ON A SIMPLE MOTOR PERFORMANCE TASK

by Brian J. MacLean

Thesis presented to the School of Graduate Studies of the University of Ottawa as partial fulfillment of the requirements for the degree of Master of Arts (Psychology).

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CURRICULUM STUDIORUM

Brian J. MacLean was born January 8, 1948 in Glasgow, Scotland. He received a Bachelor of Arts degree from the University of Miami in 1969.

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CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

The notion of the perception of stimuli which are not within conscious awareness departs from traditional views of stimulus-response relationships. It is generally assumed that in order to respond to a stimulus, particularly when the response is of a complex nature, a subjective, phenomenal experience of the stimulus is necesary. However, an alternative scheme of how external information is received, classified, and utilized is presented in both historical anecdotal accounts, and more recently within the experimental tradition. The latter evidence embraces a broad spectrum of psychological research ranging from para-psychological phenomena, where the stimulus-response relationship appears inexplicable within the Newtonian Weltanshauung, to the realm of psychophysiology where measurement of stimulus-response interaction has reached a sophisticated level of representation. In the present work, the concern is with that category of phenomena commonly found under the rubric of "subliminal perception."

In Western cultural history, references to phenomena of a subliminal nature are sparse but noteworthy. Perhaps the first statement regarding the influence of stimuli outside the field of awareness, was made by the Thracian, Democritus. One translation of a dictum by this philosopher which states that "much is perceptible which is not perceived by us,"

is interpreted by Beare (1906) to hold the "germ" of Leibnitz's later theory of perceptions insensibles (p. 206).

Plato, in the Timaeus (Cornford, 1937), speaks of a distinction between experience which reaches awareness and that which remains imperceptible. In the Parva Naturalia (Hett, 1964) Aristotle discusses what, in modern terms, would be the relationship of "signal" to "noise": "The stronger always overrides the weaker stimulus; which is why we do not see things presented to our eyes, if we happen to be engrossed in thought, or in a state of fear, or listening to a loud noise" (p. 269).

The next mention of perception of below awareness stimuli appears in the work of the 17th century thinker, Pardis. He speculated that "there are sometimes perceptions so fine and delicate that. . . they escape our knowledge, so that we are unaware of them" (Diamond, 1974, p. 405). During the years 1672 and 1673, Pardis developed an intimate friendship with Leibnitz, in whom we see the inchoate explication of the phenomenon of subliminal perception as it is presently understood. In Leibnitz's New Essays Concerning Human Understanding, a statement appears regarding the relationship between perception in awareness and the relative intensity and configuration of stimuli: "There are a thousand indications which make us think that there are at every moment an infinite number of perceptions in us, but without apperception and reflection, that is changes in the soul itself of which we are not

conscious because the impressions are either too slight and too great in number or too even so that they have nothing sufficiently distinguishing them from each other; but joined to others, they do not fail to produce their effect and make themselves felt" (Leibnitz, 1698, p. 47).

In the late 19th century, one finds the atomization of experience brought to the extreme point in Taine's D' l'Intelligence (Leclerc, 1973). Taine systematically expatiated upon Leibnitz's ideas in his further analysis of sensory qualities into more basic homogeneous subsensations of which we are ordinarily unaware. In so doing, he attempted to define qualitative difference in sensory experiences in terms of quantitative variables such as duration or intensity. In an excerpt directly related to Leibnitz's formulations, he states that "elementary sensations directly making up our ordinary sensations are themselves compounded of sensations of less intensity and duration, and so on. Thus there is going on within us a subterranean process of infinite extent, its products alone are known to us, and are only known to us in mass. As to the elements and their elements, consciousness does not attend to them" (Leclerc, 1973, p. 107). In another statement relating his atomistic scheme to motivational factors, Taine writes that "at the foundation of all bodily events we find an infinitesimal event, imperceptible to the senses, movement, whose degrees and complications constitute

the rest, whether the phenomena be physical, chemical or psychological. At the foundation of all moral events, we guess the presence of an infinitesimal event, imperceptible to consciousness, whose degrees and complications make up all the rest, sensations, images and ideas" (Leclerc, 1973, p. 108).

William James, in a tone redolent of Freud's model of mind, discusses some of the early experimental work on subliminal perception (e.g. Binet, 1896) as "the most important step forward in psychology since I have been a student of that science" (James, 1902, p. 225). James considered subconscious phenomena, or what he referred to as "transmarginal or subliminal" events, to include "everything that passes unrecorded or unobserved" (James, 1902b, p. 366).

Prior to a perusal of experimental investigations of subliminal perception, several definitional issues and methodological considerations deserve attention. The extant literature on the subject seems to classify subliminal perception under two main categorization schemes. The first scheme classifies subliminal perception as an early developmental stage of what may become an event in consciousness, that is a supraliminal perception. As already discussed, Leibnitz's perceptions insensibles fall into this morphogenetic conception of subliminal perception. More recently, we find this part-process developmental view in Werner's theory of

"microgenesis," where perception, as well as other human activities, are seen as an "unfolding process" occurring in a particular programmed sequence (Werner, 1956). This sequential notion of perception is also one of the underlying assumptions of perceptual defense, discussed in a later section.

A second view presents subliminal perception in terms of "an analytical and not a developmental distinction" (Rees, 1971, p. 501) from supraliminal perception. Here, both subliminal and supraliminal perception are seen as separate processes, rather than as stages of a single process. This latter view gives rise however, to some difficulties in use of terminology. If supraliminal perception is conceptualized as a process unto itself, then one would expect that on a developmental continuum, it would include subliminal perceptions; thus, subliminal perception, if we use the term consistently, assumes a non perceptual status (Rees, 1971). It is often unclear in the literature which scheme is being employed when discussing the topic.

Another issue of definition arises from the consociation of the terms "subliminal" and "perception," which appears to be a contradiction. One investigator, recognizing the apparent inconsonance here, suggested replacing this misnomer, imbued as it is with "anthropomorphic overtones" (Dixon, 1971), with "subliminal reception." However, for convenience and consistency with most of the research literature, the present work

will continue to use the epithet "subliminal perception."

Moving away from terminological considerations and on to the question of what types of empirical events are to be classified as instances of subliminal perception, it may be noted that a diversity of phenomena may be found under this rubric. Dixon (1971) appears to most comprehensively embrace the panoply of events which may appear in the category of subliminal perception:

(1) The subject responds to stimulation the energy or duration of which falls below that at which he ever reported awareness of the stimulus in some previous threshold determination.

(2) He responds to a stimulus of which he pleads total unawareness.

(3) He reports that he is being stimulated but denies any awareness (i.e. knowledge) of what the stimulus was.

(4) The subject reports awareness of the stimulus, i.e. he could describe it if asked, but denies any awareness of the fact that he responded to it.

(5) He reports awareness of the stimulus, and of making a response, but professes complete ignorance of any contingency between the two.

(6) In this, the final case, the subject is aware of responding to a stimulus, but unaware of that aspect

of the stimulus which governs his response (Dixon, 1971, pp. 12-13).

The area of primary concern in the present literature survey, and in the ongoing series of researches in the area conducted at Ottawa University, is with those investigations falling under the first three categories. The factor delineating them from the latter three is located on the awareness dimension; specifically, the potentiality for stimulus awareness has been minimized within the experimental environment in the first three situations. Thus, although similar mechanisms may be operating in cognitive processes such as concept formation, where the unconscious nature of the activity has frequently been demonstrated (Heidbreder, 1947; Smoke, 1932), such processes will be excluded from our discussion of subliminal perception due to their potentiality for reaching conscious awareness.

Similarly, ESP phenomena, although related to subliminal perception with respect to a lack of conscious awareness of the critical stimuli, and perhaps underlying mechanisms, will be regarded as distinct from and thus not part of the present discussion of subliminal perception. Subliminal stimuli, while out of the individual's present awareness, are still within the surrounding area of the sensory field, and thus could be consciously perceived if presented at a higher energy level. ESP demonstrations, on the other hand, deal with situations where conscious perception would not be possible regardless

of stimulus limen levels. The former process is amenable to explanatory efforts within the present paradigms employed in psychology, while an understanding of the latter perhaps requires the abandonment of Newtonian notions of time and space.

A definitional issue having methodological ramifications is that of psychophysical threshold and its relevancy to subliminal perceptual research. The "limen" or "threshold" may be conceptualized as the theoretical point below which the information value of a particular stimulus is such that a specific perceptual task performance is unsuccessful, and above which, a sufficent level of information is contained by a stimulus to satisfactorily accomplish a task. Perceptual "tasks" range from the simplest operation where the subject is asked to detect the presence of a stimulus, to the most complex of tasks where the subject is required to identify the stimulus being presented. Empirically, thresholds vary within and between individuals. Thus, rather than being represented by a discontinuous step function, we find the relationship between stimulus information and likelihood of detection to be a continuous ogive curve. Although the threshold "moves," Stevens (1951) points out that "there is reason to believe that at any instant the position of the threshold is fixed, definite, and precise and that adequate procedures would reveal the sharpness of the threshold 'cut'" (p. 33).

In Signal Detection Theory (Tanner and Swets, 1954), we find the concept of a static fixed threshold rejected on the basis that the decision criterion regarding presence or absence of a signal varies with experimental conditions, potential consequences of decisions, and the signal's effect relative to "noise."

In the determination of stimulus intensity values in subliminal perceptual research, whether one ascribes to one of the two aforementioned theories, or some other theory dealing with threshold phenomena, the primary focus need not be on psychophysical thresholds, but rather on the dimension of phenomenal representation. In the present study the concern, with regard to stimulus energy levels, is with the presentation of a population of stimulus energy values below which the awareness threshold may vary, rather than with threshold values or decision criteria.

In psychophysical terminology, subliminal perception may be defined as a discrepancy between a yes/no indicator "wherin the subject who is forced to make a response shows determination by a stimulus of which he reports no awareness" (Dixon, 1971, p. 3). In other words, we find an incongruency between stimulus information value and response level, or more specifically, the occurrence of a perceptual response at a stimulus information level where even the most simple perceptual task, "detection," is impossible. For example, an individual may

be required to make an "identification" response while unable to even detect the signal in question; that is, the subject's task is to identify a stimulus which is not perceived in awareness out of an infinite set of stimulus possibilities (Dember, 1960).

The question of establishing criteria for the demonstration of subliminal perception is thus not in the realm of threshold determination and conscious content involved in perceptual reporting; rather, subliminal perceptual events can be said to have occurred when a contingency exists between an undetectable stimulus and an observable response. Therefore, comments regarding psychophysical threshold methodology will be few, and primarily concerned with the first areas of investigation where discrimination is the task and judgements are made continguous to threshold values. Dixon (1971) cites three criteria which if satisfied "justify" subliminal perception as a construst:

(1) The eliciting of contingent responses by stimulation below the absolute awareness threshold, where this threshold is itself defined as the lowest level of stimulus energy at which the subject ever reports hearing (or seeing) anything of the stimulus.

(2) The retrospective reporting by the subject that he neither saw nor heard anything of the stimulus.

(3) The occurrence of contingent responses, without

> reported awareness of the stimulus, that differ qualitatively from those elicited by the same stimulus when presented above the awareness threshold (Dixon, 1971, p. 18).

Dixon considers the third criterion to have the greatest importance of the three, since it includes both the unawareness factor and demonstrates the uniqueness of subliminal perception as a phenomenon distinct from supraliminal perception. Although this last criterion does lend support to the notion that subliminal perception is not just a weak form of supraliminal perception, there is no logical compulsion to reject subliminal perception if this last criterion is not upheld. This last criterion would only be a necessary condition if subliminal perception is defined as a process operating by a significantly different set of rules from supraliminal perception; at the present time, there is insufficient evidence to suggest that such a conclusion is warranted.

The first area of discussion includes that group of investigations where subjects are required to make discriminations between stimuli presented at suprathreshold levels. One of the first experimental studies of subliminal perception is that of Pierce and Jastrow (1884), where it was demonstrated that subjects were capable of judging weight differences between stimuli at levels finer than one JND. What is of interest here is that accuracy scores were significant even when sub-

jects reported zero confidence in their judgements. That is, discriminations were made when subjects indicated no awareness of distinctions on the stimulus dimension in question. Fullerton and Cattel (1882) also found evidence of accurate discrimination between weights at subjects' minimal confidence level reports.

Urban in 1908 conducted another study on weight judgements. Two weights were varied till subjects judged them to be of equal magnitude. When asked to guess which weight was heavier, subjects were able to do so at a better than chance expectancy. Sidis (1898) demonstrated that numbers could be discriminated from letters at a distance where subjects reported that their judgements were mere guesswork. Pillai (1939) presented letters auditorily in the form of "whispers" and found that subjects were able to make discriminations at better than chance accuracy.

In each of the preceding studies, while task stimuli are within the suprathreshold range, and subjects are aware of the particular type of cue necessary for discrimination, the specific stimulus value differences upon which determination is contingent are putatively not within the individual's conscious awareness. One of the first questions arising from these studies is whether stimulus distinctions were in fact subliminal, or to put it another way, if in fact there was no conscious percept mediating responses. Related to these

threshold considerations is the difficulty in comparing different studies of this type, due to variations in stimulus presentation methods. Different patterms of presentation have been found to yield different thresholds. For example, Collier and Verplanck (1958) point out that the response to a near threshold stimulus will differ depending on whether it was preceded by a number of suprathreshold stimuli, or by a number of subthreshold stimuli. Methodological issues such as these were generally not psychophysical considerations at the time of these early studies.

Another procedural question arises with regard to the types of verbal indicators of lack of awareness in studies of this type; they are often ambiguous and open to various interpretations. For example, does "guessing" imply a complete lack of relevant information, or does it also include situations where appropriate information is available but falls below that level necessary for the subject to feel "confident" in making judgements?

In a different type of study, Perky (1910) asked subjects to imagine particular forms while viewing a translucent glass screen, and then to pictorially represent these putatively internal images. Unknown to the subjects, specific images were actually projected on the screen at faint intensity levels. Subjects' responses indicated that they were not distinguishing between the images projected and those

endogenously generated. Williams (1938) displayed a visual array of geometrical symbols at subliminal intensities and found that the "pure guess" category of discrimination yielded significant accuracy scores. In a related study, subjects were led to believe that they were to guess the configuration of ESP symbols which were being transmitted, while they gazed into a mirror (Miller, 1939). In reality, no symbols were being "sent" by telepathic communication, but subliminal images of the symbols were projected onto the mirror. Subjects made correct guesses at better than chance level.

Apart from the awareness indicator methodological questions already mentioned, the last three studies were possibly influenced by target shape considerations. For example, it is unclear if every symbol used has an identical threshold level. Some research indicates different detection thresholds for different geometrical shapes, even when area is held constant (Kristofferson, 1954, 1957). Furthermore, in studies where subliminal perceptual evidence is based upon subjects displaying a discrepancy between a verbal report of unawareness and an accuracy indicator, motivational factors may prove to be an extraneous source of variance. For example threshold values derived from subjects' ratings are dependent on the subjects' honesty, as well as the amount of effort subjects were willing to expend "in applying the ratings at the lowest levels in accordance with E's instructions" (Wilcott, 1957, p. 30).

The next major area involving subliminal perception includes those studies where discrimination of emotionally arousing from neutral stimuli is said to occur without awareness. The discrimination takes the form of the organism "defending" itself against verbal material of a "threatening" nature. The assumption basic to this phenomenon is that the human perceptual system is capable of detecting "the presence of anxiety arousing stimuli at an unconscious (non-verbalizable) level of awareness" (Eriksen and Browne, 1956, p. 175). The spate of investigations concerned with this phenomenon commonly known as "perceptual defense," formed a major part of the "New Look" movement in perceptual research in which the effects of motivational variables became the primary focus. The first ten years of research on perceptual defense was primarily concerned with demonstrating the experimental occurrence of the phenomenon, while later research focused on methodological issues in an attempt to empirically separate sensory from response factors.

The prototype study in perceptual defense is that of Postman, Bruner and McGinnies (1948). Subjects were found to have a higher recognition threshold to tachistoscopically presented "low value" words than to "high value" words. In 1954, Eriksen pointed to word familiarity as an alternative explanation to motivational factors. In another study, GSR measures were taken as duration of exposure time was increased

to identification threshold (McGinnies, 1949). Higher thresholds and greater GSR effects were found for taboo as opposed to neutral words. Critics attributed the results to the lower frequency of taboo words (Solomon and Howes, 1951), as well as a higher degree of confidence required to report taboo words in the experimental setting.

In a study designed to control for alleged contaminating effects, Lazarus and McCleary (1951) using nonsense syllables, paired half with shock and half presented alone during a pretest training period. During a subsequent presentation, the shock paired syllables produced higher emotional responses, thus confirming the theoretical prediction in a situation where both word familiarity and response bias were eliminated. However, following the success of early studies, a number of researchers in the area reported negative results (Zajonc, 1962; Goldstein, 1962; MacIntosh, 1961).

Most of the studies presented so far have methodological problems related to both technological considerations and questionable psychophyiscal prodedures. It is uncertain whether tachistoscopic presentation does not in fact provide more information than presumed (i.e. the issue of partial cues, which has been a criticism of much of the subliminal perceptual research efforts). Furthermore, psychophysical procedures have generally depended on the ascending Method of Limits till identification is possible, thus preserving the

stimulus "surprise" value at the cost of the reliability obtainable by a concomitant descending stimulus presentation (See Goldiamond 1958, for a complete discussion of psychophysical methodology).

Rather than reporting further on the voluminous body of literature in the New Look perceptual defense research, a look at two of the later studies in the area show examples of more recent methodological improvements.

Bootzin and Natsoulas (1965), once again using tachistoscopic stimulus presentation, eliminated response bias against reporting taboo words by requiring subjects to choose between two taboo words or between two neutral words. They found that accuracy scores for neutral words were higher than those for taboo words, and that both word sets were identified at greater than chance level. Rather than relying on the usual negative indicator of an unseen stimulus, two positive indicators are found in this study. In the last study of perceptual defense, subliminal perception is treated as an independent variable, as opposed to previously mentioned researches, where it is seen in the role of a dependent variable. Dixon (1958a) in an ingenious design, separated input and output measures by presenting neutral and emotional words to one eye, while measuring detection threshold in the other eye. The detection threshold to a spot of light in one eye was found to be higher when taboo rather than neutral words were presented to

the other eye. This finding was supported by a number of studies employing both verbal measures and physiological correlates (Dixon and Lear, 1963; Emrich and Heinemann, 1966; Dixon, 1966; Emrich, 1967).

The perceptual defense studies reviewed thus far, as well as other areas of subliminal perceptual investigation, have employed different techniques to insure nonawareness of stimuli. The variety of methods to create "subliminality," include manipulations of exposure duration, magnitude, size, and optical ambiguity. Due to a lack of demonstrated equivalence of these different procedures, the comparability of results employing these different methodologies remain equivocal. However, the perceptual defense area seems to hold a special position of importance within the subliminal research literature. It was the first topic dealing with subliminal phenomena which attracted a great deal of well considered criticism (Eriksen, 1960; Goldiamond, 1958), and thus paved the way for methodological improvements in subliminal perceptual studies in general. Furthermore, the perceptual defense studies are most directly responsible for the experimental investigation of the relationship between events not entering conscious awareness and motivational factors.

Up to this point, the concept of subliminal perception has been evoked as an explanation of differential responding to stimuli, where the "subliminality" dimension is found in

differences among the stimuli; the general nature of these stimuli is known to the subject. That is, the indicator responses of awareness and accuracy of discrimination are by design tied together, and thus not independent. The next series of studies involves the construct of subliminal perception as an independent variable. In this case, subliminal stimulation is accessory to the task at hand, and can be manipulated independently of output (dependent) measures.

A number of studies have used accessory stimulation as an independent variable in the study of illusions. Dunlap (1900) and Hollingworth (1913) presented the feathers/arrows components of the Müller-Lyer illusion at intensity levels presumably too faint to be consciously perceived. Although the expected effect was demonstrated, the extent of perceptual distortion was minimal. Tichner and Pyle (1907) and Manro and Washburn (1908) replicated Dunlap's study with negative results while Bressler (1931) in a more well controlled study, once more demonstrated the illusion. In a more recent study the effect again failed to be shown with subliminal stimulus components (Trimble and Eriksen, 1966). Due to differences and vagueness in threshold determination procedures in these studies, the issue remains unclear.

In another type of illusion study, a supraliminal image of a square was superimposed onto a subliminal pattern of diverging lines. Subjects were found to perceive such stimulus arrays as trapezoidal in shape (Smith and

Henricksson, 1955). A more recent study by Zenhausern, Ciaiola and Pompo (1973), used supraliminal and subliminal white noise stimulation ranging from -30 db beneath detection threshold to +60 db above detection threshold. They found that subliminal stimulation at the -30 db level produced the highest quantity of illusory effects.

A related area where subliminal stimulation has been employed to influence traditional perceptual phenomena is in studies using accuracy of perceived stimulus intensity differences as the primary dependent variable. Using inter and intra-modality stimulus combinations, several authors have investigated Helson's (1959) Adaptation Level Theory. Black and Bevan (1960) found that subliminal shock presented within a series of supraliminal shocks acted as an anchor stimulus. Goldstone, Goldfarb, Strong and Russell (1962) failed to replicate this study, but found positive results "by moving the anchor back in time so that it preceeded the next series stimulus by a shorter interval" (Bevan, 1964, p. 95). Bevan and Pritchard (1963) showed a less impressive though significant anchoring effect with both stimuli to be judged and accessory subliminal stimulation presented in the form of sound energy. A study of similar design showing positive results in the visual modality involved presentations of disks for size judgement, while subliminal anchor stimuli were presented tachistoscopically (Boardman and Goldstone, 1957).

The series of studies just presented, investigated whether a stimulus not in awareness may affect behavior by restructuring the setting in which the responses they affect take place. Like other areas of subliminal perceptual research, conclusions here are less than definitive. Trimble and Eriksen pointed out that most of these studies have not used modern psychophysical methodology and thus prove highly questionable. Dixon (1971) on the other hand, appeals to the number of studies showing positive results, and contends that "parsimony and a priori likelihood" (p. 37) lends support to the credibility of studies demonstrating subliminal perceptual phenomena.

The next area of researches, having a distinctly Freudian flavor, consists of evoking free associative type responses from a subject who is unaware of concurrent subliminal verbal stimulation. A representative study of this type involved subjects giving written reports of the first word appearing in conscious awareness each time a supraliminal visual cue was presented (Dixon, 1956). It was found that responses were related to concomitantly presented subliminal verbal material in an associative, symbolic manner. Furthermore, response latency was directly related to the emotional value of the stimulus word; thus highly emotional words were associated with greater response latency. In a study by the same author, subjects were given identical instructions and again received a supraliminal visual stimulus and concomitant auditory

subliminal verbal stimulation. Once again symbolic associates were reported rather than the test stimuli, while GSR recordings were found to be higher for arousing as opposed to neutral words (Dixon, 1958a). In a variation of the aforementioned studies, Spence and Bressler (1962) tachistoscopically presented words followed by an optically ambiguous array of nonsense words. Subjects were next given a list of infrequent and frequent semantic associates to "House," and a group of control words, and then instructed to report if any of these were in the previously shown ambiguous array. Of three conditions, where subjects either received the critical word at supraliminal, close to threshold, or at subliminal levels, only the last yielded a negative correlation between reaction time and associative strength, while no relationship was shown for the other two conditions.

Although a number of studies lend support to the previously mentioned researches (Spence, 1961; Spence and Gordon, 1967; Spence and Ehrenberg, 1964), other efforts showed negative findings (Fuhrer and Eriksen, 1960; Banreti-Fuchs, 1967). Once again it may be noted that methodological differences blur the issue and preclude the possibility of meaningful comparisons between results of studies demonstrating the effect and those failing to do so.

However, the aforementioned studies lend a particular import to subliminal perceptual research beyond what has been

presented thus far. In finding responses with semantic rather than structural relationships to the critical stimuli, it appears that the likelihood of conscious awareness of the independent variable has been reduced. Had the subjects been aware of the stimulus, or had they received partial cues as suggested by some authors (Wiener & Schiller, 1960), responses would more likely have been identical to the stimulus word, or structurally similar. In yielding qualitatively different types of responses at subliminal and supraliminal levels, Dixon's third criterion for subliminal perception, as already mentioned, is satisfied.

An area deserving mention in the context of a discussion of subliminal perception, is that of Sleep-Assisted-Instruction (SAI). Although the reception of external stimuli during sleep is similar to subliminal perception in that both are processes differing from what is generally considered conscious activities, it is still unclear whether they depend on identical underlying mechanisms. However, since in some studies they share an unreported awareness of presented stimuli, several representative SAI studies are relevant to the present topic. Oswald, Taylor and Treisman (1960) reported that during sleep, an auditorily presented meaningful stimulus can elicit a cortical response. In a survey of extant SAI investigations, Aarons (1976) reported a number of sleep learning studies where "phenomenal awareness was not deemed necessary

for learning" (p. 23). Evans, Gustafson, O'Connell, Orne and Shor (1970) report that motor responses may be evoked by verbal cues during sleep and forgotten when awake, but again occurring during subsequent sleep with no instructions. In leaving this area, a full development of which is beyond the scope of this paper, it may be pointed out that like subliminal perception, "the equivocal data of SAI research could hardly be used to formulate a well developed theory" (Aarons, 1976, p. 24).

Another major instance where subliminal verbal material is used to influence ongoing activity is that area in which subthreshold words are presented concurrently with pictorial representation. In the classic study of this type, subjects were tachistoscopically shown "Angry" and "Happy" at undetectable exposure durations while viewing suprathreshold pictures of an expressionless face (Smith, Spence, & Klein, 1959): The authors found a signficant relationship between judged pleasantness and the particular concurrently-presented adjective. A replication of this study was conducted using a dichoptic viewing situation where the critical stimulus presented to one eye was above the detection threshold level, but masked by an image of higher intensity (brighter) presented to the other eye. This binocular rivalry methodology thus decreases the possibility of the critical words reaching recognition threshold. As found in the last study, the judgements of facial expression were affected in the expected direction by

semantic value of the subliminal words. This disambiguating quality of subthreshold information is once again shown in a third successful replication of the Smith et al. (1959) study. Henley (1975) presented the words "Happy" and "Sad" in one ear, and masked these stimuli by tones presented to the other ear, while subjects viewed an "indifferent" face. Here we see the extension of this type of study to a cross-modal paradigm. Furthermore, subliminal stimuli were found to affect the pictorial representations on later trials where the subliminal words were no longer presented.

In a group study, subjects viewed slides of paintings and rated them on six bipolar adjectives scales (e.g. good-bad, strong-weak). During the presentation of each slide (30 sec.), a subliminal auditory message was presented by a female voice. Messages consisted of either the six "positive" or six "negative" adjectives, or six neutral words. During the 30 sec. rating period, white noise at comparable levels was presented. Results showed a significant difference between both positive and neutral conditions and between positive and negative conditions when sound levels were ascertained to be subliminal (Swingle, 1977).

The next topic of consideration has engendered more incredulity within the academic research community as well as more attention (often negative in nature) from the general public than any other area within the body of subliminal perceptual literature. In 1956, it was reported that sub-

liminal advertisements were being presented at a New Jersey drive-in theatre; this event soon instigated a United States Congressional Investigation. The developers of the subliminal technology claimed a sales increase of 50% (McConnell, Cutler, and McNeil, 1958), but no explicit details of the study are available.

In a study of motivation and choice behavior, Byrne (1959) tachistoscopically flashed "Beef" at regular intervals during a supraliminal film, while a control group just observed the film. Subsequent to the film, subjects rated how hungry they felt, and were invited to select from a number of food items. It was found that subjects in the experimental group showed no increase of verbal references to the critical stimulus, nor were they more likely to choose the critical stimulus object in a multiple choice situation; however, they did rate themselves as significantly hungrier than control subjects. Food deprivation duration had no effect on any of these relationships.

Goldstein and Davis (1961), in a study involving choices between pictures of faces of individuals running for political offices, point out that although "stimulus registration without awareness serves to modify or increase S's level of motivation or arousal," (p. 254) overt choice responses may be related to learning history rather than stimulus semantic value.

In a study by Champion and Turner (1959), a subliminal

message , "Wonder Rice," and a drawing of a spoon were shown during a film. Following the film, subjects were shown a visible image of a spoon, and asked if they had ever seen it used in advertisements. Although the results were negative, it is questionable if non perception is an adequate refutation of an effect which is designed to by-pass conscious awareness.

Spence and Ehrenberg (1964) presented the word "cheese" tachistoscopically at either subliminal or supraliminal levels. They found that words associated with "cheese" were differentially recalled over neutral words at a higher rate in subjects with a longer period of food deprivation. The authors contend that deprivation produces a drive which is necessary for a sub-threshold food associated word to be effective. However, some researchers have invoked the well known criticism that the threshold used in this study was of stimulus recognition, rather than detection, and thus the subliminality of the stimulus is in question.

In a study more directly related to consumer behavior, George and Jennings (1975) presented the words "Hershey's Chocolate" (below the detection threshold) superimposed onto a film. A control group saw only the film. Purchasing behavior was measured by monitoring sales at the only store in the vicinity. Results showed no existing contingency between the subliminally presented stimulus and consumer behavior. It is to be noted that a baseline measure of purchasing the item in question was not obtained. Thus what may be demonstrated

here is only the failure of a subliminal stimulus to initiate purchasing of an item, which would perhaps have a low purchase rate under any circumstances. The study does not directly address the question of whether subliminal stimulation may affect sales increases or decreases of an item already known to be sold at a particular rate.

While well documented evidence is lacking for an influence on complex overt behavior such as consumer tendencies, by subliminal stimulation, a recent study by Swingle, Renaud and Lawson (1977) suggests that a simple dichotomous choice situation may be influenced by semantic aspects of subliminal stimuli. In a dyadic two choice "power" game (Swingle, 1970), subjects received subliminal messages, or white noise at sound energy levels ranging from -2.5 db to -30 db. Messages were either of an altruistic or exploitative nature regarding the "other player." The number of exploitative responses in the altruistic message condition were found to be significantly less than in the exploitative message condition. A further point of interest is that subjects played against an 80% co-operative preprogrammed opponent, which according to previous research (Swingle, 1970) invites an exploitative strategy. Thus we find evidence of the prepotency of a subthreshold auditory message over a highly competitive set.

Our last area, dealing with motor behavior and subliminal stimulation, brings us to the subject of the present study.

In a study by Zuckerman (1960), graphomotor behavior was investigated. Subjects were asked to give written descriptions of TAT cards presented tachistoscopically at a sequentially increasing exposure duration. While viewing the cards, the message "write more," "don't write," or no message, were presented to subjects at subthreshold exposure times. While the expected direction of effect was found at subliminal levels, a second study found that the same messages presented supraliminally produced inconsistent results. Some subjects significantly increased or decreased their response output while others were unaffected by the messages.

Zenhausern, Pompo and Ciaiolo (1974) used white noise stimulation over a range of subliminal and supraliminal values (-30 db to +10 db) during a reaction time motor performance task. The results indicated that only accessory stimulation at +70 db above threshold improved reaction time. A study by Zenhausern and Hansen (1974) investigated a perceptual motor task (Stencil Design Test) over a range of white noise stimulus intensities ranging from -30 db below threshold to +60 db above threshold. They found that -10 db below threshold and +60 db above threshold facilitated performance, while -30 db below threshold and +35 db above threshold produced a decrement in performance.

The last study concerning motor performance and subliminal perception to appear in the literature, involved an attempt to teach a psychomotor task and problem solving skills by

means of subliminal stimulation (De Chenne, 1976). Subjects were stimulated tachistoscopically during a film unrelated to the task at hand. The results showed no evidence to support the hypothesis. However, no definitive conclusion may be drawn regarding the efficacy of subliminal stimulation in this type of situation due to the diminutive total exposure time (.5 secs) of the subliminal stimuli.

The present study was designed to investigate the effects of subliminally presented messages on a simple repetitive motor action with a minimal incentive reward. For this purpose, a standard lever-pressing situation, requiring only a modicum of energy expenditure and minimal concomitant perceptual or cognitive activity, was chosen. The messages were imperatives to accelerate or decelerate in conjunction with an affective description of the task.

Considering the paucity of previous research in the area of motor behaviour as influenced by subliminal stimulation, few guidleines were available. However, several considerations influenced the choice of a motor task and subliminal stimulation. As previously mentioned, the only available study on the effects of subliminal accessory stimulation on a pure motor task, is that of Zenhausern et al. (1974), where reaction time was the only dependent variable. Although supraliminal white noise did affect reaction time in a facilitory direction, it is questionable whether this one measure of motor performance

is an adequate test of accessory stimulation effects. The study by Zuckerman (1960) shows that the semantic value of a subliminal stimulus can influence overt behavior. However, the output measure in this study is a task having both psychomotor and elaborative cognitive process components.

In the Zenhausern and Hansen (1974) study, the task combined both psychomotor and problem solving cognitive components. DeChenne's study too was a compounding of motor and cognitive elements.

In the Swingle et al. (1977) investigation, it was shown that although a message with semantic value influenced responses, subliminal white noise had no effect.

In the present study, a germane consideration was the inclusion or absence of a feedback or incentive factor in the lever pressing situation. The primary objective was to provide a situation where the individual would perform at his own personal tempo, while at the same time to construct a reinforcement contingency which would parallel real life situations in the sense of rewards for performance effort. The attempt to establish a response rate apposite to the individual subject was based on the assumption that an increase in inter-subject variability in response rate would be most conducive to the detection of subliminal stimulation effects on response parameters. However, the investigation of a simulated real life situation by the introduction of an incentive condition would, as may be expected, affect the response rate.

Swingle, Coady and Moors (1966) found greater inter-subject variability in a lever-press situation when only points were presented rather than with added monetary incentive. In another lever-press study by Swingle and Moors (1967), the introduction of monetary incentive increased the response rate of slow responders, and retarded the rate of fast responders. In the present study, a cumulative point system with no monetary feedback was used in conjunction with an instructional set which avoids suggestions of response rate direction. By employing a relatively neutral pre-task instructional set in conjunction with an absence of monetary incentive, it was surmised that although the point system was present, this minimal reinforcement condition would not preclude the effects of subliminal stimulation in the present situation.

Considering the above findings, and the exploratory nature of this study, the motor task chosen was used to porvide several response measures:

(1) Response latency after the onset of an supraliminal visual cue;

(2) Response rate over a thirty trial period, each trial consisting of 10 seconds;

(3) Maximum response rate per second within a trial;

(4) The second within a trial where the maximum response rate occurs;

(5) The response rate during the first second of a trial.

The selection of sound levels presented in a random order, as well as a failure to include a white noise condition was guided by the following considerations:

(1) Swingle et al. (1977) found positive results with verbal messages, which were presented in a varied sound level sequence.

(2) Zenhausern et al. (1974) as well as Swingle et al. (1977) found no effect of subliminal white noise on response patterns.

(3) Random sound levels were used due to the dearth of information regarding stimulus intensity parameters in both subliminal perceptual studies and SAI research (Aarons, 1976).

The hypotheses in the present study are concerned with the effect of subliminal stimulation on lever-press response parameters. It was expected that if the semantic values of the messages were effective, each dependent variable would be effected in a particular direction. A number of studies have shown that subliminal effects are maximized when subjects are in a relaxed, passive state (Fisher and Paul, 1959; Murch, 1969). It may follow from this that subliminal reception is more likely to occur in this study during the rest periods intercalated between lever-pressing trials, than during the active lever-press periods. Latency measures, may thus be expected to yield lower values in the message condition

urging acceleration, while the reverse would be expected in the deceleration condition. The second and third dependent measures, number of responses per trial, and maximum number of responses within a second of a ten second trial are respectively expected to show higher values in the acceleration message condition. The second during which the maximum number of responses occurs is, following the same line of reasoning, expected to occur earlier in the acceleration condition than during the deceleration condition. The last dependent measure, the number of responses during the first second of a trial, is expected to yield lower values in the deceleration condition than the acceleration condition.

CHAPTER II

METHOD

The present study was concerned with the investigation of the effects of subliminal auditorilly presented communications in a simple repetitive motor task situation under minimal incentive conditions. One group of subjects received a subliminal message urging acceleration of response rate, while a second group received a message with deceleration instructions. A noise control condition with comparable sound parameters to the experimental groups, and a no noise control condition formed the remaining subject groups. The study is defined as a two factor repeated measures design. As may be recalled, the dependent measures in the lever pressing task were:

(1) Latency of first response for each trial;

(2) Frequency of response for each trial;

(3) Maximum number of responses per second for each trial;

(4) The second during which the maximum number of response occurs;

(5) Number of responses per second for the first second of each trial.

Subjects

The subject population consisted of male students enrolled at the University of Ottawa. All subjects were fluent in the English language. Subjects ranged in age from 18 to 38 (mean age, 23.9; standard deviation, 5.29). Participation was on a voluntary basis, and was solicited by telephone.

Apparatus and Instruments

Lever-Pressing Apparatus

The instrumentation consisted of a 19 x 21 inch table model relay rack upon which was mounted: (1) an electric impulse counter displaying accumulated points, (2) a white "Go" light and a red "Rest" light, and (3) a Stromberg Carlson cam key (No. 171 D). The white "Go" light was activated for 10 second periods after the first lever press per trial. At the end of these 10 second periods, the red "Rest" light was activated for 15 second durations. During the time period when the "Go" light was on, subjects could accumulate points (displayed on the counter) at the rate of 1 point for every 5 lever presses (FR 5). When the red "Rest" light was on, no points could be accumulated. Stimulus presentations and point accumulation were controlled by standard relay circuitry programming equipment. The PDP - 11/10 computer was used to monitor the number of lever pressing responses and latency of response for each trial at an accuracy level

of ± .01 seconds.

Subliminal Auditory Stimulation Characteristics

Stimulus Intensity. Considering the paucity of studies using auditory subliminal stimulation, it is not surprising that little is known about this variable; one also finds a dearth of information regarding subliminal stimulus delivery methodology in the auditory modality. Little guidance is found in the Sleep-Assisted Instruction literature regarding this factor. In both western and Soviet SAI research, little attention has been given to stimulus intensity parameters (Aarons, 1976).

Of the few studies on subliminal auditory stimulation, Fisher (1975, 1976) provides an example of air-conducted transmission methodology (loudspeakers). This author set his sound source at a distance of one meter from the subject, while the stimulus (verbal message) energy level was recorded at the speaker as 42.5 db. The ambient noise level in the experimental room was recorded at 40.0 db without the taped message playing. Three independent judges who were acquainted with the message contents were unable to detect the presence of a message.

In the study by Swingle (1977) on aesthetic ratings, the accessory auditory messages were presented via a ceiling mounted loudspeaker. The recorded maximum average sound level at ear height directly beneath the speaker was 73 db

with peaks to 92 db; the ambient noise level in the room was 66 db. Swingle et al. (1977) in a psychological gaming study, varied sound levels of a compound message from -2.5 db to -30 db (-2.5 db, -5.0 db, -7.5 db, -15.0 db, -30.0 db) as measured next to the speaker; ambient noise in the experimental room was recorded at 70 db. Subjects were seated at a distance of slightly over one meter away from the speaker, and during a post-experimental probe indicated no awareness of the subliminal messages when asked to describe the nature of the experiment. Independent judges were unable to detect the presence or absence of the message at a one meter distance from the speaker.

In the present study, subjects were seated at a two meter distance from a 7" midrange enclosed speaker. Sound levels used were identical to those in Swingle, Renaud and Lawson (1977) as measured on a VTVM: -2.5 db, -5 db, -7.5 db, -15 db, -30 db. Using a recorded 0 db reference tone, the volume control on the tape recorder was adjusted so that the tone was first audible with an ear placed against the speaker, but inaudible at a distance of 1 meter from the speaker. Using a gain control circuit, the sound intensity levels of the messages were attenuated in a random sequence of the aforementioned values, and recorded on magnetic tape.

Sound level measurements of the reference tone were taken using a Brüel & Kjaer (Type 1613) Impulse Sound Level Meter. Under no noise conditions with the recorder off, the

ambient noise levels in the room were measured at an average of 65 db, and at a peak of 68 db (linear scale at the slow meter setting), and at an average and peak of 34 db and 39 db respectively (Scale A at the slow meter setting). Sound level measurements at the speaker with the recorder on were 23 db without the tone on, and 36 db with the tone on (fast scale at the weighted 1000 Hz external filter). Three independent judges were able to hear the highest sound intensity message (-2.5 db) with an ear against the speaker, but unable to detect the presence of this message one meter from the speaker.

Stimulus Quality. Content characteristics of subliminal auditory verbal messages have received only a modicum of consideration. In the Sleep-Assisted-Instruction studies, Aarons (1976) points out that more research is necessary to delineate the effect of speech qualities on SAI. However, a number of studies suggested direction for the present research. Issacson (1969) reported that "normal" voice quality in the waking state, is more conducive to information recall than nasal, denasal, or "weak" qualities. Tani and Yashi (1970) found that a minimum of eight repetitions of material is necessary in SAI to show learning effects. Bliznichenko (1966) pointed out that transmission of verbal information in SAI is analogous to the relationship between a promptor and an actor and that the basic condition necessary for improvement of learning is

the repetition of verbal material in the same sequence.

Oswald, Taylor and Treisman (1960), reported that both male and female subjects awakened more frequently to their own name when presented by a female as opposed to a male voice. Fisher (1975, 1976) delivered verbal messages with a voice of the same sex as subjects. Swingle (1977) transmitted messages with a female voice to a mixed sex group, while Swingle et al. (1977) delivered messages to female subjects using a male voice.

The present study used a female voice for presentation of verbal messages to a male subject population. Three compound messages were constructed. In each experimental condition, one of the three compound messages was presented at a random sequence of sound levels (-2.5 db, -5.0 db, -7.5 db, -15.0 db, -30.0 db). For the first condition, the message was "Go faster; this is enjoyable; do better; this is fun; press quickly; speed up." For the second condition, the message was "Go slower; this is tiresome; do worse; this is boring; press slowly; slow down." In the third condition, each message was recorded backwards and randomly presented, thus providing almost identical auditory stimuli to the first two messages. The last condition was a no noise control.

Each compound message, taking approximately 7 seconds to complete, was first presented at the termination of the fifth baseline trial, and continued throughout the remaining

25 - ten second lever pressing trials and 25 - fifteen second rest trials. Thus each subject received one of the aforementioned compound messages approximately 89 times.

Personality Measures

ANSIE. The Nowicki-Strickland Internal-External Control Scale (ANSIE) was used to measure locus of control. The most widely used measure of locus of control was developed by Rotter (1966). The concept of locus of control differs from traditional learning theory notions of behavior by excluding the constructs of drive and drive reduction, and replacing them with the construct of expectancy. Rotter defines this type of expectancy as:

> When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in internal control. (p.1).

The results of over 300 investigations (MacDonald, 1972) support the predictive utility of this factor (expectancy)

in a wide variety of behaviors (Rotter, 1966; Lefcourt, 1971). This prototype instrument proves to have considerable experimental support for its reliability and construct validity (Rotter, 1966). However, critics have pointed out that this scale suffers several limitations: (1) a response bias related to social desirability, (2) a confounding of different types of locus of control, and (3) its relationship to reading level complexity (Nowicki and Duke, 1974).

The ANSIE scale was developed from the Nowicki-Strickland Internal-External Control Scale for children (Nowicki-Strickland, 1973). The ANSIE appears in the form of a paper-and-pencil test containing 40 items to be answered either yes or no. Psychometric data were collected in 12 separate studies from 766 subjects. Split-half reliability coefficients ranged from .74 to .86 ($N = 158$). Test-retest reliability over a 6 week interval was reported at $r = .83$ ($N = 48$). Discriminant validity of the ANSIE was supported by demonstrating no relationship between test scores, social desirablity, and intelligence. Two college population samples completed both the ANSIE and the Marlowe-Crowne Social Desirability Scale with the resulting coefficients: $r = .10$, $df = 47$; and $r = .06$, $df = 67$. Another college population sample was administered the ANSIE and the Scholastic Aptitude Test (SAT) with a resulting non-significant correlation coefficient ($r = .11$).

Convergent validity evidence was found in significant correlations between Rotter's scale and the ANSIE in separate

samples: $r = .68$, $df = 47$, $p < .01$; $r = .48$, $df = 37$, $p < .01$.

Rotter, in discussing the qualities of those who may be classified as falling at the internal end of the Internal-External dimension, states that they may follow suggestions or conform when presented with conscious choice. However, if suggestions or attempts to influence are perceived as inimical or appear designed to be subtly manipulative, he responds resistively (Rotter, 1966). In the present study, the ANSIE is employed in an exploratory manner to investigate whether a relationship exists between the internal-external dimension and possible suspicion on the part of the subject regarding subtle attempts at manipulation; this subject attribution may be indicated via video-monitoring of the experimental session, and/or during the post-experimental probe. See Appendix A for a copy of the ANSIE.

EPI. The Eysenck Personality Inventory (EPI) is a self-report questionnaire consisting of 57 "yes" or "no" items. The EPI was designed to measure two presumably distinct orthogonal dimensions of personality. The dimensions of neuroticism-stability (N) and extraversion-introversion (E) are each represented by 24 questions. A Lie Scale consisting of 9 questions is included to detect a response bias in the direction of social desirability. A full presentation of validity, reliability and normative data are reported in the EPI Manual (Eysenck and Eysenck, 1968). Briefly, norms were established

on a non-clinical English population. Test-retest reliability was established over a one year interval with a group of 92 subjects. The reliability coefficients for extraversion (E) and neuroticism (N) were reported as $\underline{r}$ = .82 and $\underline{r}$ = .84 respectively. Over a nine month test-retest period, another group of subjects yielded test results having reliability coefficients of $\underline{r}$ = .97 and $\underline{r}$ = .88 for extraversion and neuroticism respectively.

Investigations have demonstrated correlational relationships between Extraversion-Introversion and sensory thresholds. In a study of electrical vestibular stimulation, Dunstone, Dzendolet, and Henckerath (1964) found that introverts have a significantly lower threshold than extraverts. Eysenck (1967), in a review of several studies on critical flicker fusion, argued that introverts are more capable of resolving flickering stimuli than extraverts. Fisher, Griffin and Rockey (1966) demonstrated a lower gustatory chemoreceptor threshold in introverts than extraverts. Smith (1968) showed that auditory thresholds in introverts are significantly lower than those found in extraverts.

Eysenck has related the extraversion measure to "cortical inhibition" and introversion to "cortical excitation" (Eysenck, 1957). In a later work, he argues that higher arousal levels are the neurological basis for "excitation" (Eysenck, 1963). Smith (1968) contends that "inhibition" is not likely to be associated with the determination of auditory thresholds, and

thus the finding of lower auditory thresholds in introverts lends support to the notion of higher arousal levels in introverts. Thus we may expect that introverts would experience particular stimuli in their sensory field as more intense than extraverts exposed to the same stimuli. With regard to the present study, the EPI is utilized to investigate the relationship between the effects of subliminal auditory stimulation and the introversion-extraversion personality dimension. More specifically, the EPI was used in the present study to see if a relationship exists between the introversion-extraversion dimension and auditory detection of message transmission, which may be indicated by video-monitoring during the experimental task and/or in the post-experimental probe.

During a number of pilot runs in the present study, the experimenter questioned subjects about their understanding of item number 25. This particular probe was motivated by two considerations. The use of the word "gay" has recently assumed homosexual connotations, and thus the item in question may take on an additional possible meaning for some individuals. Furthermore, the popular press gave front page coverage to homosexual homicides at the time of data collection. On discovering that several pilot subjects did in fact find the meaning of the word "gay" open to alternate interpretations, the adjective in question was changed to "lively". A copy

of the EPI questionnaire can be found in Appendix B.

Procedure

The experimental design consisted of 4 groups of 20 subjects each; subjects were assigned to groups in a random fashion. Each group received one of the three aforementioned subliminal auditory stimulus presentations or no sound presentation for the last 25 ten second trials, and the 25 fifteen second rest periods interpolated between the lever pressing trials. The first 5 trials of a total of 30 trials served as a practice period during which no accessory auditory stimulation was presented. Subjects were run "blind" to control for possible ESP effects; that is, the experimenter was unaware of the specific condition of each subject. This consideration was evoked by one study in particular within the parapsychological literature. Kreitler and Kreitler (1972) found that subliminal visual stimuli (Latin Letters) were identified correctly more often when a "sender" concentrates on transmitting the same letters to the subject, than when no sender's transmission is present. Furthermore, a blind experimenter minimizes the experimenter-expectancy effect.

The experimental setting consisted of two floors of a social psychology laboratory. The first floor was utilized for a subject waiting room, stimulus presentation equipment, and data collection instrumentation. The second floor included an 8 x 10 ft. experimental cubicle, and an 8 x 10 ft. cubicle

employed for test administration and post-experimental probe. The experimental cubicle included the lever pressing apparatus and a loudspeaker located at ear level 2 meters from the subject (to the right and behind at 45° from his midline). The second room consisted of a desk, chair, and a supply of pencils. To minimize extraneous noise, subjects were not run during heavy traffic hours, and the second floor was solely devoted to the present study.

Subsequent to seating subjects in the experimental cubicle, they were asked to fill out a self-addressed envelope for the purpose of receiving a copy of the experimental results at the end of the study. They were next given a set of instructions to read (See Appendix C). After a five minute period, the experimenter returned to the room and asked if there were any questions regarding the instructions. The experimenter next reviewed the written instructions with the subject to insure understanding of the task. Briefly, the subject was told that the study was concerned with "motor activity" and that points could be accumulated by depressing the lever on the panel in front of him when the white "Go" light comes on, but could not be accumulated when the red "Rest" light comes on. The experimenter then reiterated that points could be accumulated at a rate of 1 point for every 5 lever presses, and that the session would take between 10 and 15 minutes. After once again asking the subject if he had any questions, the experimenter

left the room, and the session began. The lever pressing sessions lasted between 12 and 13 minutes.

Subjects were visually monitored by means of a hidden camera during the experimental session for the purpose of observing any possible attentional responses which may have suggested awareness of the subliminal message.

At the end of the experimental session, the experimenter reentered the room and showed the subject to the second cubicle. Subjects were first probed regarding their understanding of the purpose of the study, with questions proceeding from a general nature to the specifics of the auditory qualities of the experimental environment (See Appendix D for Probe questions). Subjects were next administered the EPI and ANSIE, with standard instructions.

CHAPTER III

RESULTS

The effects of subliminal stimulation on the motor task were tested by a two factor analysis of covariance with repeated measure on one factor. The thirty trials of the experimental session were collapsed to form six five trial blocks. The first five trial block, treated as a practice period during which no treatment manipulations were applied, was used as the covariate. One analysis of covariance was performed for each dependent measure. The means and standards deviations of the dependent measures are presented in Tables 1 to 6. The means and standard deviations for each dependent measure per group over the 30 trial experimental session is shown in Table 1. Tables 2 to 6 show means for each of the last five 5 trial blocks for each group. Table 7 to 11 display summaries of analyses of covariance for each of the dependent measures.

Latency. As shown in Table 7, no significant group, trial, or group X trial interaction differences were found in the latency for each five trial average measure.

Number of Responses per Trial. Table 8 reveals a tendency towards group differences, F (3, 75) = 2.71, P = .051. However, post hoc procedures were unable to isolate differences between means. Figure 1 illustrates the graphic representation of means over the five 5 trial blocks for the four groups.

Table 1

Means and Standard Deviations of Dependent Measures for Experimental and Control Groups per Trial

		Latency of Response	Number of Responses	Maximum Number of Responses	Second of Maximum Responses	Number of Responses in First Second
Backward Noise Control	Mean	.39	66.02	7.56	4.47	7.09
	SD	.09	8.69	1.17	1.82	1.34
Slow	Mean	.34	64.05	7.28	4.59	6.91
	SD	.06	7.47	1.08	2.19	1.21
Fast	Mean	.34	68.42	7.89	4.23	7.37
	SD	.07	7.48	.82	1.59	1.00
No Noise Control	Mean	.37	61.69	7.01	5.07	6.53
	SD	.18	9.84	1.31	1.87	1.23

Table 2

Adjusted Means for Latency Measures for Experimental and Control Groups over Five Trial Blocks

Trial Block	Groups			
	Backward Noise	Deceleration	Acceleration	No-Noise
1	.38	.36	.35	.36
2	.35	.36	.36	.37
3	.37	.35	.35	.34
4	.41	.37	.35	.36
5	.38	.37	.36	.34

Table 3

Adjusted Means for Number of Responses per Trial for Experimental and Control Groups over Five Trial Blocks

Trial Block	Groups			
	Backward Noise	Deceleration	Acceleration	No-Noise
1	63.00	61.10	64.61	60.84
2	65.48	64.43	65.26	61.30
3	65.69	65.39	67.68	62.60
4	66.20	66.62	69.01	63.12
5	67.32	65.99	70.04	64.20

Table 4

Adjusted Means for Maximum Number of Responses per Second for Experimental and Control Groups over Five Trial Blocks

Trial Block	Groups			
	Backward Noise	Deceleration	Acceleration	No-Noise
1	7.18	6.95	7.31	7.00
2	7.46	7.35	7.46	6.97
3	7.47	7.45	7.77	7.13
4	7.57	7.64	7.88	7.23
5	7.77	7.67	8.06	7.38

Table 5

Adjusted Means for Second of Maximum Number of Responses per Trial for Experimental and Control Groups over Five Trial Blocks

Trial Block	Groups			
	Backward Noise	Deceleration	Acceleration	No-Noise
1	4.70	4.92	4.91	4.89
2	4.91	4.58	4.15	5.52
3	4.80	5.05	4.38	5.23
4	4.39	4.04	4.13	4.69
5	3.89	4.17	3.62	4.83

Table 6

Adjusted Means for Number of Responses During First Second per Trial for Experimental and Control Groups over Five Trial Blocks

Trial Block	Groups			
	Backward Noise	Deceleration	Acceleration	No-Noise
1	6.68	6.44	6.75	6.52
2	6.96	6.80	7.23	6.57
3	7.23	6.90	7.18	6.66
4	7.20	7.17	7.37	6.80
5	7.27	7.21	7.73	6.91

Table 7

Summary of Analysis of Covariance
for Latency of Response

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Tail Probability
Message					
Between Groups	0.04	3	0.01	0.49	0.69
Covariate	2.61	1	2.61	88.26	0.00
Within Groups	2.22	75	0.03	-	-
Trials					
Between Trials	0.01	4	0.00	0.43	0.79
Trials X Message	0.04	12	0.00	0.60	0.84
Trials X Message Within Groups	1.83	304	0.01	-	-

It may be seen that the acceleration group has a uniformally higher score over the last 25 trials for the experimental session than the other three groups. The backward noise control group has a response rate close to that of the acceleration group during the early trial blocks, but fails to accelerate as sharply across trials. The deceleration condition shows an early response rate slower than the two previous groups; however, the acceleration pattern brings response rate in the later trials to a level similar to backward-noise group. The no-noise control condition begins with a slower response rate than the other groups, and maintains this pattern throughout the remaining trials.

The trial-factor analysis yielded highly significant results which were further examined by the Newman-Keuls trest. All non-adjacent trial block X trial block comparisons proved to be statistically significant, $P < .05$. The four adjacent trial block comparisons, with the exception of trial blocks one and two were significantly different, $P < .05$. The trial X group interaction proved non-significant.

Maximum Number of Responses per Second per Trial. Table 9 shows no group differences for this variable. Once again a highly significant trials effect is seen. The Newman-Keuls test revealed significant differences between all non-adjacent trial block comparisons, $P < .01$. All adjacent trial block comparisons were non-significant, with the exception of trial

Table 8

Summary of Analysis of Covariance
for Number of Responses per Trial

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Tail Probability
Message Condition	21938.23	1	21938.23	141.95	0.00
Between Groups	1258.45	3	419.48	2.71	0.05
Covariate	15379.07	1	15370.07	99.51	0.00
Within Groups	11591.51	75	154.55	-	
Trials					
Between Trials	924.82	4	231.20	16.54	0.00
Trials X Message	156.75	12	13.06	0.93	0.51
Trials X Message Within Groups	4248.65	304	13.98	-	-

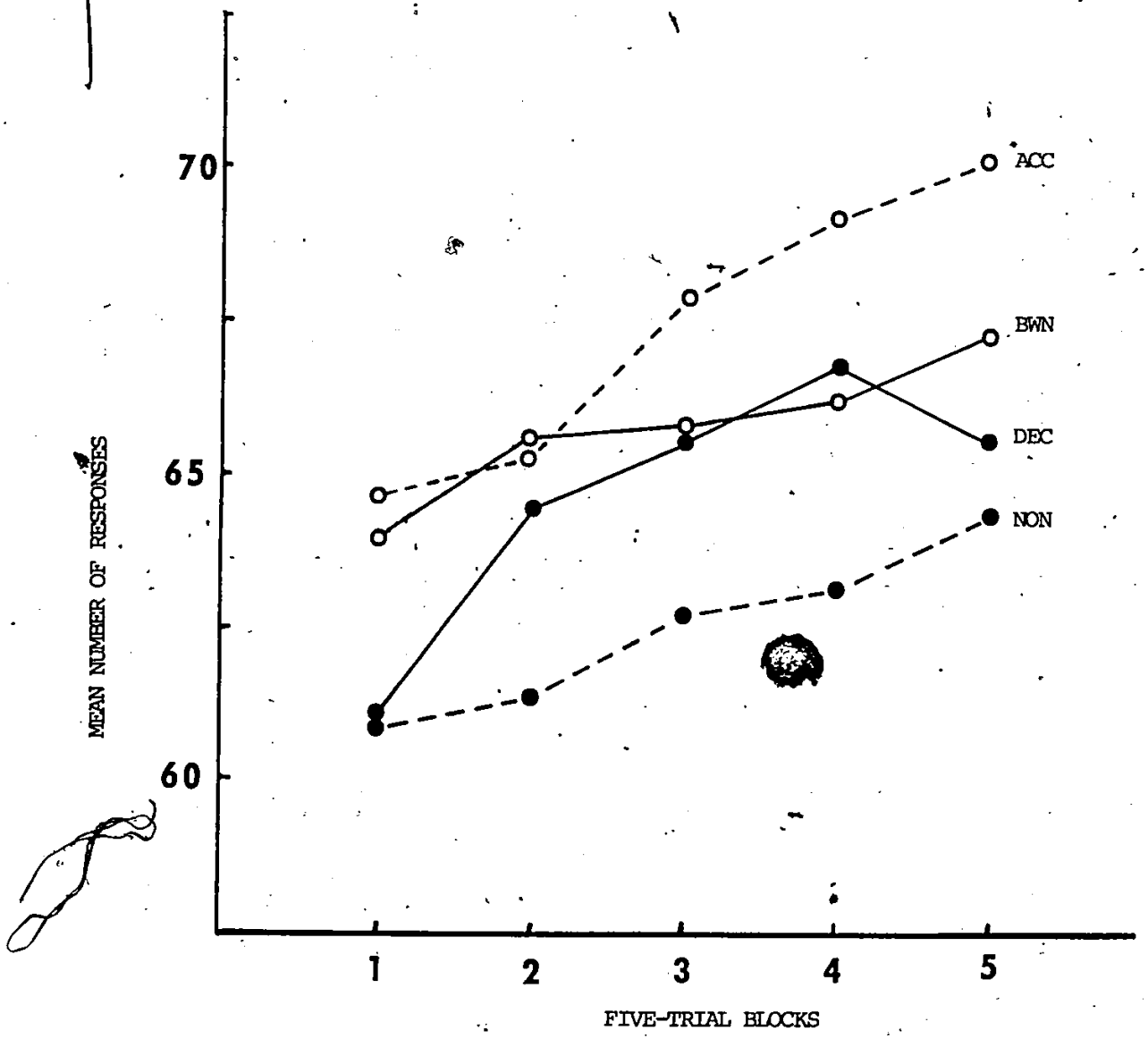

Figure 1. Mean values of lever-pressing responses per trial averaged over five-trial blocks for subjects in the four groups: Acceleration (ACC), Backward Noise (BWN), Decceleration (DEC), and No-Noise (NON).

Table 9

Summary of Analysis of Covariance for Maximum Number of Responses per Second per Trial

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Tail Probability
Message Condition	241.30	1	241.30	118.98	0.00
Between Groups	15.30	3	5.10	2.51	0.06
Covariate	315.77	1	315.77	155.70	0.00
Within Groups	152.11	75	2.03	-	-
Trials					
Between Trials	17.91	4	4.48	22.48	0.00
Trials X Message	2.29	12	0.19	0.96	0.49
Trials X Message Within Groups	60.56	304	0.20	-	-

blocks one and two, $P < .01$. Once again no trial X group interaction reached significance.

Second of Maximum Number of Responses per Second per Trial. Table 10 depicts no significant group differences, nor a group X trial interaction. The highly significant trial effect was tested by the Newman-Keuls procedure. All non-adjacent trial blocks were significantly different, $P < .05$, with the exception of trial block one and three. All adjacent trial blocks were not significantly different, with the exception of trial blocks three and four, which reached significance, $P < .05$.

Number of Responses for First Second of a Trial. As may be seen in Table 11, no significant group differences nor group X trial differences were found. The highly significant trial differences were subjected to the Newman-Keuls test. All non-adjacent trial blocks were found to be significantly different, $P < .05$. All adjacent trial blocks were not found to be significantly different, with the exception of trial blocks one and two, which reached significance, $P < .05$.

Post Experimental Probe and Personality Measures. Careful questioning at the end of the experimental session revealed that none of the subjects suspected the purpose of the experiment, nor were any subjects found to report any indications of detection of message transmission. The multiple regression using the extraversion-introversion and locus of control measures as predictor variables, and lever-press parameters

Table 10

Summary of Analysis of Covariance for Occurrence of Maximum Number of Responses per Second per Trial

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Tail Probability
Message Condition	37.16	1	37.16	3.38	0.07
Between Groups	32.38	3	10.79	0.98	0.41
Covariate	519.68	1	519.68	47.25	0.00
Within Groups	824.92	75	11.00	-	-
Trials					
Between Trials	38.14	4	9.54	5.23	0.00
Trials X Message	17.77	12	1.48	0.81	0.64
Trials X Message Within Groups	554.58	304	1.82	-	-

Table 11

Summary of Analysis of Covariance for Number of Responses During the First Second per Trial

Source	Sum of Squares	Degrees of Freedom	Mean Square	F	Tail Probability
Message					
Between Groups	16.52	3	5.51	1.66	0.18
Covariate	302.82	1	302.82	91.49	0.00
Within Groups	248.25	75	3.31	-	-
Trials					
Between Trials	21.49	4	5.37	17.33	0.00
Trials X Message	3.35	12	0.28	0.90	0.55
Trials X Message Within Groups	94.25	304	0.31	-	-

as criterion variables showed no significant multiple R's. The simple correlation matrices of personality and lever press measures are presented in the Appendices E to H.

CHAPTER IV

DISCUSSION

As may be recalled, the results of the present study showed that only the second dependent measure, that is the total number of responses per trial, approached a marginal significance level between groups. However, it may be conjectured that if the trend illustrated in Figure 1 represents a true picture of separation between groups, it is conceivable that subliminally presented noise rather than semantic value per se is the effective stimulus in altering the response pattern. However, later trials showed an increasing separation between the acceleration group and both deceleration and backward-noise control groups. Thus, it may be that while an acceleration message can increase responding beyond a general activation effect of the backward-noise situation, the deceleration message is ineffective in decreasing response rate below this level. However, further investigation is necessary before the probity of such speculations can be fairly evaluated.

The trials effect, to reiterate, proved statistically significant in all but the first dependent measure (i.e. latency for the first response of each trial), and showed a continuous, relatively consistent picture of positive acceleration over the experimental session. The last three dependent measures, that is maximum number of responses per second per trial, the second where this maximum response occurs, and the

number of responses during the first second of a trial, showed a similar group separation pattern to the number of responses per trial measure already discussed.

The acceleration pattern over trials was most likely due to a combination of practice effects and the self-competitive set induced by the point system. The practice effect is unlikely to be the only variable responsible for the consistent "improvement" in performance, since little learning is associated with the lever-pressing task, and thus a subject can reach an asymptotic level with little experience.

The latency measure however, indicates no continuous pattern over trials. This may mean that subjects did not attempt to devise a strategy, such as timing the rest periods, to increase their first response rate after the "Go" light was activated. However, one generally finds the greatest decreases in latency scores over the first few trials, and thus once again it may be that subjects reached an asymptotic level early in the experimental session.

The post-experimental probe, since it suggested that none of the subjects detected the broadcasted messages nor suspected attempts to manipulate their behavior, could not be employed in the investigation of possible relationships between personality variables and detection of low intensity level sound stimulation. The conclusion that no subject did in fact detect the transmitted messages is primarily based on self-report

methodology, which we are assuming is valid in this case. That is, the ad hoc assumption has been made that the converse of Polanyi's (1964) notion that "we can know more than we can tell" was not a critically limiting factor. In other words, it was presumed that the subject was neither withholding nor offering false information regarding his non-detection of the stimuli in question for reasons related to articulation difficulties (Nisbett and Wilson, 1977), or demand characteristics (Orne, 1969). Furthermore, video-monitoring of the experimental sessions corroborated the non-detection of subliminal messages.

Limitation of the Present Research and Directions for Future Research

One of the problems faced during the design and implementation of the present study was the paucity of research efforts regarding the sound stimulus parameters in question. Message characteristics such as sound level intensity, content, and voice quality, as well as their relationship to the experimental task, were chosen with little documented evidence to act as guidelines, and thus were selected largely on a conjectural basis. A related difficulty in the present study involved the programming of sound levels. A possibility exists of non-detection of an effect due to the compounding of sound levels, thus perhaps masking a particular effective sound intensity. Ideally, to delineate sound level effectiveness within a specific behavioral situation, a number of studies would have

to be performed using different levels of sound intensity. Another point of interest related to repeated measures designs using subliminal stimulation is the possibility that information transmitted during one trial may affect performance on subsequent trials (Henley, 1975; Swingle, 1977). This "carryover" effect may be investigated by the use of an A-B-A-B design in which information is transmitted only during the trial period; the trial period and intertrial interval may be varied along the temporal dimension for the purpose of mapping the subliminal message's influence over time. It is conceivable that such a carry-over effect may vary with stimulus qualities such as intensity, frequency, message information content, and affective tone.

Regarding message characteristics such as semantic value and voice quality, the instrumentation used in the present study did not allow adequate programming and monitoring flexibility to manipulate or record critical parameters, such as voice frequency and intensity fluctuations. A methodological improvement would move in the direction of employing broadcasting equipment which would maintain such sound stimulus parameters within a small range relative to ambient noise levels in the experimental environment. Furthermore, message content was static, that is, constant over subjects. Instrumentation allowing the programming of transmitted subliminal information during the experimental session would make possible

the manipulation of content and other message variables contingent upon subject characteristics and behavioral output. For example, on site programming would allow the experimenter to include the subject's name or appropriate sex of the communicator within the body of the messages. As already mentioned, evidence from the SAI (Sleep-Assisted-Instruction) area suggests that such personal identity parameters in the communication content as well as communicator characteristics may be of some importance (Oswald, Taylor, and Treisman, 1960).

The other side of the stimulus characteristics issue is the background upon which the stimulus is imposed. Although still a moot point, Dixon (1971) points out that due to its low energy level, a subliminal stimulus is unable to compete with signals of supraliminal intensity (p.85). In the present study, attempts were made to attenuate extraneous noise sources as much as possible; however, the protection necessary in such research is most likely of the nature of an experimental situation utilizing sound-proof cubicles with sound sensitive monitoring equipment to record. both broadcast signals and ambient noise levels.

In addition to extraneous environmental noise, another possible source of reception interference may involve the nature of the experimental task itself. In addition to the mechanical noise of the lever-pressing apparatus when depressed, internal biological noise may have precluded signal reception. Although

the experimental task required minimal muscular effort, it is possible that the physical effort involved may have increased internal systems activity such as cardiac and respiratory acceleration to the extent of adding another source of environmental noise. A study by Saxon and Dahle (1971), in line with Lacy, Kagen, Lacey and Moss (1963), found that increased heart rate induced by activity, reduced auditory sensitivity to a tone.

An issue of importance with regard to the interaction between the subliminal instructional set in the acceleration condition and the experimental task is that of a possible ceiling effect. That is, it may be that the nature of the lever-pressing task as it is used in this study, was such that a subject may reach an upper limit of responding easily and thus be inaccessible to further exhortations to accelerate the response rate. A task requiring greater effort (e.g., the same task but with a spring mechanism requiring more force to depress the lever) and thus presumably greater variability in responding, would perhaps be more appropriate for the detection of differences between groups.

The final and obvious question regarding this study is whether the expectations resulting from the pre-experimental instructions effected a particular direction of responding. It may be that for the achievement oriented subject population (Rosenthal and Rosnow, 1969, 1975) used in this study, the experimental task evoked a response strategy which proved pre-

potent over attempts at subliminal influence. In other words, it is conceivable that the demand characteristics of the experimental task interacted with subject qualities in such a way as to preclude subliminal message effects.

The present study was the third in an as yet undetermined number concerned with certain aspects of subliminal perception. The auditory modality was the subject of investigation in the three completed studies, and those planned for future research. This decision was guided by two considerations, the first being the dearth of studies conducted with sound, as opposed to the plethora of research with subliminal visual stimuli. The second directing influence is the range of potentialities regarding applicability of a subliminal broadcasting technology in a natural environment.

The first stage of the research is intended to focus on the range of behaviors susceptible to subliminal influence. The behaviors include simple motor performance, perceptual, decision-making and problem solving tasks. The second stage will be devoted primarily to the specification of particular effective stimulus characteristics such as intensity and frequency levels and communicator qualities. This will be accomplished by testing the effects of a series of sound energy parameters on behaviors known to be accessible to influence by subliminal auditory stimulation. The third stage, as originally planned, would involve the use of physiological

measures such as heart rate as additional behavioral indices of subliminal effects. The fourth stage includes the intercalation of programmable messages contingent upon subjects' behavioral output.

However, at this point in time it seems that certain aspects of the overall design of the project require modification. Considering the lack of cogent statistical results in the present study, and the a priori likelihood that gross behaviors present an intractable disposition regarding vulnerability to influence by subliminal stimulation, the first stage of the project in particular, may call for reformulation. In the investigation of a phenomenon, the behavioral effects of which are presumably subtle, it is perhaps judicious to begin by researching those behaviors not requiring such complexities as entailed by initiation or alteration of overt acts. Specifically, the physiological measures planned for the third stage would seem more appropriate at the beginning phases of this research.

Dixon and Lear (1964) found that for subjects with a high awareness threshold for visually presented emotional words, a heart rate deceleration occurred prior to awareness, while a heart rate acceleration was found with subjects having lower thresholds for the same word. Similarly, a study by Emrich and Heineman (1966) found E.C.G. measures to yield different patterns for emotional and neutral words presented subliminally. According to a number of researchers (Raskin, Kostes, and

Bever, 1969; Steele and Koons, 1968; Steele and Lewis, 1968), a situational task requiring exclusion of some aspects of the environment to concentrate on internal factors, as in certain types of problem solving activities, is associated with cardiac acceleration. Likewise, in a situation demanding attention to all external environmental aspects, cardiac deceleration occurs. An interesting point arises here in relation to subliminal perceptual research. Dixon (1971) points out that the "common denominator of subliminal perception and endogenously generated perceptual experience is that both involve unawareness of external stimulation, [and] both predispose towards endopsychically determined primary process cognitions" (p. 317). It may prove fruitful to examine how subliminal stimuli as opposed to supraliminal stimuli are treated by the subject in terms of cardiac patterning. It would be of interest to know if certain types of subliminal stimuli are received and processed as problem solving activites requiring internal attention, or are treated by the subject with cardiac patterns suggesting an externally directed attentional mode.

Socio-Ethical Issues and Concluding Statements

Socio-ethical implications of subliminal research involve a number of issues which deserve consideration and further investigation. The status of subliminal perceptual research in many academic circles has, like paranormal research, been regarded as nonacceptable as a respectable object of scientific

interest. One of the unfortunate consequences of this bias has been the growth of blatant examples of technological opportunism bolstered by forms of psychological obscurantism-notably, a most liberal use of the construct of unconscious processes. Some contemporary promulgators and employers of subliminal technology claim that the efficacy of the methodology is related to the effect of subliminal stimulation on the subconscious mind.

Becker, the developer of the first subliminal technology to reach public attention by presumably increasing food sales at a drive-in theater (McConnell, Cutler and McNeil, 1958), is presently utilizing subliminal messages in the auditory and visual modalities for therapeutic purposes. However, the specifications, in terms of equipment, stimulus intensity levels, and frequencies used, are not included in a report by Becker and Jewell (1977) on the use of subliminal technology in a behavior modification weight control program. Supraliminal signals were used in a videotape presentation to provide instructions, while subliminal signals were used to provide the desired associated affect. In dealing with the ethical considerations of using subliminal technology without an adequate degree of information regarding its possible effects, the authors appeal to a paper by Knuth (1976), who put forth the scientific strategy of operating with less than complete knowledge of an issue. How one so glibly employs analogical reasoning to

demonstrate similarity between an issue in the realm of philosophy of science and a consideration within the sphere of psychotherapeutic ethics is presented in a less than pellucid manner.

Becker, Corrigan, Elder, Tallant and Goldstein (1965) presented a research paper concerning the feasibility of using subliminal visual symbols for advertising purposes. The authors, aside from presenting an inadequate explanation of data analysis, bring up the ethical question of advertising with subliminal techniques and then quickly point out that this communication methodology will most likely not be used in commercial or political areas, but rather in social service areas such as education and psychodiagnostics. One finds a rather peculiar incongruency in predicting use of subliminal technology in socially beneficial ways in the body of a study with entrepreneurial implications.

Up to this point the focus has been on two primary ethical issues. First, the question arises whether one is justified in marketing a therapeutic methodology, the efficacy and ramifications of which have received little testing. Secondly, if subliminal technology could be used to manipulate behavior without the individual's awareness, should research be conducted to test and refine such applications as the commercial exploitative use of these techniques.

A relatively widespread contemporary use of subliminal stimulation exemplifies an ethical issue involving the appli-

ation of an untested methodology upon individuals without their awareness or consent. An article in the popular press reported the use of subliminal auditory messages in retail stores in Canada and the United States for the purpose of reducing the incidence of customer and employee theft (Kinsman, 1978). A compound message consisting of three imperatives instructing the listener not to steal is programmed to repeat the message at the rate of 133.3 times per minute. Besides straining even a reader's most parochial moments of credulity by suggesting that the subconscious mind is capable of decoding speech transmitted with a celerity befitting modern computer data processing, the article points out that an increasing number of North American commercial institutions are surreptitiously installing this technology.

The aforementioned examples of research and application of subliminal technology perhaps portends a trend to either misrepresent and misapply an ineffective behavioral control method on an unsuspecting public, or to exploit the behavioral manipulation potentialities of a possibly powerful technology. In conclusion, a statement made a number of years ago once again seems apposite to present conditions:

> Recently, to our dismay, the announcement of a commercial application of long-established psychological principles has assumed nightmarish qualities, and we find ourselves unwillingly cast in the role of invaders of personal

privacy and enemies of society. A kind of guilt by association seems to be occurring, and, as future incidents of this kind will occur, it threatens to undermine the public relations we have built with years of caution and concern for the public welfare. The highly emotional public reaction to the 'discovery' of subliminal perception should serve as an object lesson to our profession, for, in the bright glare of publicity, we can see urgent ethical issues as well as an omen of things to come. When the theoretical notion $E = MC^2$ became the applied reality of an atom bomb, the community of physicists became deeply concerned with social as well as scientific responsibility. Judging from the intensity of the public alarm when confronted with a bare minimum of fact about this subliminal social atom, there exists a clear need for psychologists to examine the ethical problems that are a part of this era of the application of their findings.

The vehemence of the reaction to the proposed use of a device to project subliminal, or from the public's point of view 'hidden', messages to viewers indicates that the proposal touches a sensitive area (McConnell, Cutler, and McNeil, 1958, p. 238).

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APPENDIX A

ADULT NOWICKI-STRICKLAND INTERNAL-EXTERNAL SCALE (ANSIE) - FORM C

Name: _____

Age: _____

Sex: _____

YES NO

___ ___ 1. Do you believe that most problems will solve themselves if you don't fool with them?

___ ___ 2. Do you believe that you can stop yourself from catching a cold?

___ ___ 3. Are some people just born lucky?

___ ___ 4. Most of the time do you feel that getting good grades means a great deal to you?

___ ___ 5. Are you often blamed for things that just aren't your fault?

___ ___ 6. Do you believe that if somebody studies hard enough, he or she can pass any subject?

___ ___ 7. Do you feel that most of the time it doesn't pay to try hard because things never turn out right anyway?

___ ___ 8. Do you feel that if things start out well in the morning that it's going to be a good day no matter what you do?

___ ___ 9. Do you feel that most of the time parents listen to what their children have to say?

___ ___ 10. Do you believe that wishing can make good things happen?

___ ___ 11. When you get criticized, does it usually seem it's for no good reason at all?

YES NO

___ ___ 12. Most of the time do you find it hard to change a friend's (mind) opinion?

___ ___ 13. Do you think that cheering more than luck helps a team to win?

___ ___ 14. Did you feel that it was nearly impossible to change your parent's mind about anything?

___ ___ 15. Do you believe that parents should allow children to make most of their own decisions?

___ ___ 16. Do you feel that when you do something wrong there's very little you can do to make it right?

___ ___ 17. Do you believe that most people are just born good at sports?

___ ___ 18. Are most of the other people your age and sex stronger than you are?

___ ___ 19. Do you feel that one of the best ways to handle most problems is just not to think about them?

___ ___ 20. Do you feel that you have a lot of choice in deciding whom your friends are?

___ ___ 21. If you find a four-leaf clover, do you believe it might bring you good luck?

___ ___ 22. Did you often feel that whether or not you do your homework has much to do with what kind of grades you get?

___ ___ 23. Do you feel that when a person your age is angry at you, there's little you can do to stop him or her?

___ ___ 24. Have you ever had a good luck charm?

___ ___ 25. Do you believe that whether or not people like you depends on how you act?

___ ___ 26. Did your parents usually help you if you asked them to?

___ ___ 27. Have you felt that when people were angry with you, it was usually for no reason at all?

YES	NO		
___	___	28.	Most of the time, do you feel that you can change what might happen tomorrow by what you do today?
___	___	29.	Do you believe that when bad things are going to happen, they just are going to happen no matter what you try to do to stop them?
___	___	30.	Do you think that people can get their own way if they just keep trying?
___	___	31.	Most of the time do you find it useless to try to get your own way at home?
___	___	32.	Do you feel that when good things happen, they happen because of hard work?
___	___	33.	Do you feel that when somebody your age wants to be your enemy, there's little you can do to change matters?
___	___	34.	Do you feel that it's easy to get friends to do what you want them to do?
___	___	35.	Do you usually feel that you have little to say about what you get to eat at home?
___	___	36.	Do you feel that when someone doesn't like you, there's little you can do about it?
___	___	37.	Do you usually feel that it was almost useless to try in school because most other students are just plain smarter than you are?
___	___	38.	Are you the kind of person who believes that planning ahead makes things turn out better?
___	___	39.	Most of the time, do you feel that you have little to say about what your family decides to do?
___	___	40.	Do you think it's better to be smart than to be lucky?

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IN APPENDIX B, LEAVES 91, 92.

NOT MICROFILMED.

Eysenck Personality Inventory

MAY BE OBTAINED FROM:

Published by Educational and Industrial Testing Service
Box 7234, San Diego
California 92107

APPENDIX C

INSTRUCTIONS

THIS RESEARCH PROJECT IS CONCERNED WITH MOTOR ACTIVITY. WHEN THE WHITE "GO" LIGHT COMES ON, YOU CAN ACCUMULATE POINTS BY PRESSING DOWN ON THE BLACK LEVER ON THE LOWER CENTER OF THE PANEL IN FRONT OF YOU. YOU WILL BE ABLE TO ACCUMULATE ONE POINT FOR EVERY FIVE LEVER PRESSES. WHEN THE RED "REST" LIGHT COMES ON YOU WILL NO LONGER BE ABLE TO ACCUMULATE POINTS. THE ENTIRE SESSION WILL LAST BETWEEN TEN AND FIFTEEN MINUTES, DURING THIS TIME EACH LIGHT WILL BE SEEN A NUMBER OF TIMES. AT THE END OF THE SESSION, NEITHER OF THE LIGHTS WILL BE ON.

APPENDIX D

Post-Experimental Questionnaire

What do you think was the purpose of this experiment?

Did you notice anything unusual during the experiment?

Did you hear any unusual noises during the experiment?

APPENDIX E

Intercorrelations between Dependent Variables and Personality Measures for the Backward Noise Group

	Latency of Response	Number of Responses	Maximum Number of Responses	Second of Maximum Responses	Number of Responses in First Second	Extraversion-Introversion	Locus of Control
Latency of Response	-	0.15	0.29	-0.20	0.29	-0.31	0.38
Number of Responses		-	0.95	-0.41	0.93	0.04	0.12
Maximum Number of Responses			-	-0.59	0.98	-0.11	0.25
Second of Maximum Responses				-	-0.69	0.48	-0.20
Number of Responses in First Second					-	-0.19	0.24
Extraversion-Introversion						-	-0.25
Locus of Control							-

APPENDIX F

Intercorrelations between Dependent Variables and Personality Measures for the Deceleration Group

	Latency of Response	Number of Responses	Maximum Number of Responses	Second of Maximum Responses	Number of Responses in First Second	Extraversion-Introversion	Locus of Control
Latency of Response	-	-0.14	-0.09	-0.03	-0.10	-0.22	0.19
Number of Responses		-	0.93	-0.52	0.88	0.19	0.35
Maximum Number of Responses			-	-0.74	0.98	0.32	0.34
Second of Maximum Responses				-	-0.78	-0.44	-0.25
Number of Responses in First Second					-	0.33	0.33
Extraversion-Introversion						-	-0.16
Locus of Control							-

APPENDIX G

Intercorrelations between Dependent Variables and Personality Measures for the Acceleration Group

	Latency of Response	Number of Responses	Maximum Number of Responses	Second of Maximum Responses	Number of Responses in First Second	Extraversion-Introversion	Locus of Control
Latency of Response	-	-0.03	-0.22	0.25	-0.00	-0.10	-0.12
Number of Responses		-	0.89	-0.06	0.83	0.03	-0.28
Maximum Number of Responses			-	-0.43	0.86	0.09	-0.09
Second of Maximum Responses				-	-0.48	-0.07	-0.01
Number of Responses in First Second					-	0.10	-0.39
Extraversion-Introversion						-	0.05
Locus of Control							-

APPENDIX H

Intercorrelations between Dependent Variables and Personality Measures for the No-Noise Group

	Latency of Response	Number of Responses	Maximum Number of Responses	Second of Maximum Responses	Number of Responses in First Second	Extraversion-Introversion	Locus of Control
Latency of Response	-	-0.26	-0.21	-0.22	-0.20	0.29	-0.37
Number of Responses		-	0.93	-0.34	0.91	-0.18	-0.20
Maximum Number of Responses			-	-0.55	0.94	-0.16	-0.18
Second of Maximum Responses				-	-0.64	-0.02	-0.10
Number of Responses in First Second					-	-0.26	-0.09
Extraversion-Introversion						-	-0.06
Locus of Control							-

ABSTRACT

The present study was the third in a series of exploratory researches designed to investigate the effects of subliminal auditory stimulation on a variety of behaviors. This study was concerned with the effect of subliminal messages on a simple motor performance task (lever-pressing). Subjects were 80 male University of Ottawa students randomly selected from university enrollment records. Four groups were formed in a random fashion, each consisting of 20 subjects. Two groups received subliminal messages either urging acceleration or deceleration of response rate; a third group received these messages recorded backwards, while the final group received no message. Messages were presented at a randomly programmed sequence of the following sound intensity levels: -2.5 db, -5.0 db, -7.5 db, -15.0 db, and -30 db. Subjects lever-pressed for 30 ten second trials, with 15 second rest periods between trials. An electronic counter on the lever-press apparatus accumulated points at the rate of one point for every five lever-presses. Messages were transmitted after the first five trials, which were treated as a practice period. The results suggested a marginally significant effect; however, specific group differences could not be isolated.