ALLOCATION OF ATTENTION: EFFECTS ON CLASSICAL CONDITIONING

Dissertation

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

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Denton, Texas
December, 1984
According to Deikman (1966), meditation (defined as a training to sustain attention) has a deautomatizing effect. This assertion was utilized in the present study as a departure point and explored within an information processing framework for classical conditioning.

A sample of 48 college students was selected and randomly assigned to four conditions with different instructional sets involving allocation of attention during a classical conditioning background situation. The basic hypothesis of the study was that provided arousal factors were controlled, focusing of attention upon internal stimulation (i.e. breathing) could delay or attenuate the effect of conditioning, habituation and extinction as compared with instructions to externally allocate attention (on the CS and US). A secondary hypothesis predicted that for subjects under switching conditions changing from internal to external allocation and vice versa would produce a more pronounced extinction pattern as compared with subjects under non-switching conditions.

The data provided support for the basic assumption but not for the secondary hypothesis. Subjects under the condition of external allocation developed
more conditioning and more habituation to the US. No differences were found on extinction rates attributable to one of the 4 main conditions (switching, non-switching, internal allocation and external allocation). However, post-hoc analysis revealed a significant difference on extinction only for the group of subjects under conditions of non-switching and external allocation of attention.

Findings were interpreted in terms of information processing differences due to voluntary allocation of attention. Implications of these results were further explored for their potential value as an instrument to reduce or enhance the effects of experience in general and conditioning in particular. Limitations of the study and future research directions were also discussed.
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Allocation of Attention: Effects on Classical Conditioning

Attention, consciousness, and awareness are terms that, stimulated by the resurgence of cognitive psychology, have become prominent in the repertoire of mainstream psychology. Within the field of learning, attention and awareness have gradually, albeit not unanimously, been acknowledged to constitute a necessary condition for learning to occur, as suggested by studies on classical conditioning (Maltzman, 1977; Pendery & Maltzman, 1977), operant conditioning (George, 1980; Roberts, 1984), habituation (Ohman, 1979; Wagner, 1976) and memory (Norman, 1976; Watanabe, 1980). Some authors, however, have defended the idea of "learning" without awareness (Black, Colt & Pavlowsky, 1977) or detection without awareness as in the study by Mc Cauley, Parmelee, Sperber, and Carr (1980). Along the same line Hasher and Zacks (1979), and Zacks, Hasher and Sanft (1982) have proposed that learning regarding frequency of occurrence does not involve attentional resources.

Overlapping definitions of concepts such as awareness, consciousness, and attention have been a contributing factor to the apparent inconsistency of research results. Studies purportedly addressing the same construct may have been dealing with different underlying variables.

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Several authors have begun considering the decomposition of attention. Moray (1970), for example, has proposed at least six distinct meanings of attention. Posner and Boies (1971) subsequently subsumed Moray's meanings into three main components, alertness, selectivity, and processing capacity. Similarly, Bourne, Dominouski and Loftus (1979) have pointed out that whatever attention is, it involves several discriminable aspects, selectivity, distribution, and alertness or vigilance.

For purposes of this study, the review of the literature on attention was limited to the following areas: (a) conditioning and mediation (instructional control, awareness of contingencies and attentional manipulation), (b) meditation and the training of attention, and (c) information processing-oriented research on conditioning. These three areas were considered adequate to provide a theoretical background for the research hypotheses dealing with the effects of differentially allocated attention during the process of classical conditioning.

Mediation and Conditioning.

S-R (stimulus-response) and S-O-R (stimulus-organism-response) models of learning have represented two extreme interpretations. S-R theories following Thorndike's lead have endorsed several versions of the automatic effect of reinforcement on behavior by contiguity. S-O-R theories, on the other hand, have emphasized the role of internal
mediating processes in learning. Some aspects of this controversy have more recently been recreated in terms of alternative positions supporting or challenging the possibility of learning without awareness. In an early study, Greenspoon (1955) reported a significant effect of verbal reinforcement on increasing certain classes of verbal behavior without the subjects being aware of the contingency between response and reinforcement. This finding, suggesting the dispensability of awareness on learning, has received further support from studies focusing on responses to be conditioned that were unobservable to the subjects (Hefferline & Keenar, 1963; Sasmor, 1966; Roberts, 1984). Kanfer (1968) concluded that although performance can be co-enhanced by awareness, awareness is not necessary for learning to occur and, furthermore, response rates and awareness are two distinct, dependent variables that are not causally related. Also operating within the operant verbal conditioning paradigm, however, De Nike and Spielberger (1963) found that subjects unaware of reinforcement contingencies were not significantly different from control subjects (with no reinforcement) in terms of response increments. More recently, Dawson and Shell (1982) reported the presence of electrodermal responding via semantic conditioning on words presented to the non-attended channel during shadowing. At first glance these results suggested the existence of an automatic semantic processing mechanism. A finer analysis of the
process of conditioning revealed, however, that electrodermal responses were differentially elicited only on trials where subjects momentarily shifted attention to the non-attended stimulus. This uncovering of the disguised automatic and attentional-free quality of conditioning has challenged previous findings based on studies of less sophisticated design.

Alternatives to The S-R Perspective. Cognitive alternatives to the S-R views of learning have had a dominating impact on mainstream psychology. Piaget (1971), for instance, emphasized the role of cognitive activity and development in studying human behavior. He used the concept "action schemata" as the basic unit underlying learning, "from elementary sensory motor behavior right up to the higher logico-mathematical operations" (Piaget, 1971, p.8). Hebb (1961) and later Neisser (1967) also utilized the idea of schemata (though from different perspectives) in their theorizing concerning storage of information and cognitive processing within a framework emphasizing the mediating role of the organism. Similarly, Miller (1960) following a cybernetic model has used the term "logogen" to refer to what Shallice (1972) has called "action systems" to define a finite number of internal (program-like) mediational units controlling for an infinite number of potential actions. Other conceptions where learning has been identified in various degrees with cognitive activity are hypothesis
theory (Levine, 1970), expectancy theory (Bolles, 1972), volitional hypothesis (Dulany, 1968), and signal detection theory (as applied to item recognition) (Bower, 1972).

Brewer (1974), from an extreme position, has challenged the applicability of the principles of conditioning to humans. Similarly, but limited to semantic classical conditioning, Maltzman (1977) has questioned the legitimacy of extrapolating to human adults the principles of conditioning as understood by the S-R tradition. He has contended that classical conditioning in normal adults, as ordinarily studied in the laboratory, is a consequence of thinking rather than vice versa....

The GSR-OR (orienting reflex) is generated by the participants' covert problem-solving activities. It is not a response elicited by the CS signal as the result of the establishment of an association; it is a consequence of the discovered significance of the CS as a signal for the UCS (p. 113).

Within this context, conditioning of the GSR was seen as a function of the subject's attention or awareness of the contingencies, a view that has disputed the associationist interpretation of learning by contiguity.

The debate is, however, far from settled. In a recent study, Bahrick (1984) expressed doubts about the validity of extreme cognitivism that has considered learning basically
in terms of mediation and organization "Cognitive Psychology has not wiped out the contributions of Ebbinghaus, Pavlov, Thorndike, Skinner, and others. Their empirical findings regarding the strength of associative processes remains as valid as ever" (p.37).

Manipulation of Attention. In addition to the attention-related research focusing on operant and classical conditioning as the learning paradigms, there have been several studies utilizing habituation for the study of attention. The use of habituation as a dependent measure for conditioning offers the advantage of being a relatively unobtrusive indicator of processing capacity (Siddle, Remington, Kuiac & Haines, 1983; Stanfert & Siddle, 1983). Working within this paradigm, while controlling for order effects of two stimuli presented with the instructions to attend according to order, Gliner, Preston and Badia (1971) found that autonomic responding was superior to the attended stimuli only when response was given to the first element of the compound.

In a related study, Iacono and Lyken (1983) instructed subjects to either attend or ignore the stimulus presentation on a habituation task investigating electrodermal response. The Gliner et al. (1971) findings were basically confirmed: the ignore group was less responsive and habituated faster than the attend group. If habituation is considered an instance of learning in its simple non-associative form
(Campbell & Slehower, 1980), these findings question the hypothesis that attention-awareness facilitates learning as measured by faster rates of habituation. Though most authors have regarded habituation as an instance of learning (i.e., Ohman, 1979; Wagner, 1973), others have argued against such conception and have interpreted it as an instance of fatigue (see Wickelgreen, 1967). Whatever the underlying process of habituation, the evidence concerning the effects of instructions is far from clear. Becker and Shapiro (1981), for example, found no differences in habituation measures (i.e., skin conductance and alpha suppression) between groups instructed to attend and non-attend groups. These authors, however, did report a significant difference between groups in terms of a larger p 300 component (activity changes in potentials after about 300 msec of stimuli presentation) of the averaged evoked potential in the "attend" group. Along this line Picton and Campbell (1976) had already suggested that whereas early components of the evoked potential were unaffected by changes in attention, the late components (those with a peak latency near 350 msec) probably reflected a response set selection process.

As in any other science, psychological research depends on technological growth to advance. In the case of computer aided brain technology, increasing sophistication may help elucidate the mechanism of attention. At the present time it is clear only that some still unknown components of
attention or their combination have a role in the performance fluctuations related to habituation and conditioning.

**Meditation and the Training of Attention**

Meditation, defined as a strategy for the training of attention, has been considered within the Buddhist tradition to develop higher states of consciousness, capable of a more direct perception of reality (Walsh, 1980). Traditional approaches to meditation in general have emphasized the "focusing of attention" per se—regardless of the content or even the method—as a means to enhance the unbiased perception of reality. According to Goleman (1977) "Structure and process of consciousness can be endurably altered by the systematic retraining of the attentional habits" (p. 41).

More recently, meditation has been studied for its purported stress-reducing effects (see Holmes, 1984 for a review). The conceptualization of meditation merely as a relaxing tool has, however, not gone without critics. According to Boals (1978) such a notion has outlived its usefulness, and meditation—the strategy for the deploying of attention—is now in need of a cognitive reconceptualization.

From an applied psychology perspective, Walsh (1980) has viewed meditation as one of the innovative psychotherapies, aimed at the training of attention in order to heighten awareness and bring mental processes under voluntary control (including stress-related conditioned responses). Kornfield (1977) and Wallace and Fisher (1982)
have referred to the process of meditation as having a deconditioning effect capable of freeing practitioners from conditioned reactions. In a similar fashion, Deikman (1966) has hinted at the deautomatizing or deconditioning effect of mystic states—the product of meditation and other contemplation practices. Deautomatization—whose counterpart automatization was suggested to Ego Psychology by Hartman (1958)—can supposedly be attained by the manipulation of attention (the reinvesting of actions and percepts with attention). According to Gil and Brenman (in Deikman, 1966) "the techniques of both, meditation and hypnotic induction, seem to constitute just such a manipulation of attention as is required to produce deautomatization" (p. 329).

An analysis of the existing literature suggests that the notion of a deautomatizing effect of meditation, albeit intuitively appealing, has not been empirically endorsed. Most authors supporting this view have failed to provide solid evidence to substantiate it.

Selected Research Findings on Meditation Practices. There have been two identifiable trends of research related to meditation. The first, beginning with the studies of Das and Gestaut (1955), and Anand, China and Singh (1961), has focused on the neurophysiological correlates of meditation, specifically brain wave fluctuations. Originally, Wallace (1970), Wallace and Benson (1972), Orme and Johnson (1973) proposed the existence of a response pattern which though
sharing some features with relaxation (in terms of oxygen consumption, carbon dioxide elimination, cardiac output, heart rate, etc.), purportedly produced a state physiological and biochemically unique (Boals, 1978). The state was first described and labeled by Wallace and Benson (1972), as a "wakeful hypo-metabolic state". The uniqueness of the meditation effect has been partially endorsed by Throll (1982). Others (Barte & Baslien, 1980; Fenwick, Donaldson, Gillies & Beshman, 1977; Holmes, 1984) have concluded that this effect is not significantly different from the one associated with relaxation.

The second trend of research, related to the development of cognitive psychology, has focussed on the perceptual effects of meditation. Pelletier (1974), for instance, reported changes due to meditation in terms of a decrease in perceptual bias on measures of field dependency/independency. Dillbeck (1982) found that Transcendental Meditation (TM) produced shifts in visual perception toward more flexibility and interpreted the results in terms of a reduction in conceptually driven process attributable to TM.

Apart from the tangential mention of informational processing mechanisms in the Dillbeck study, there has been no research focusing on the information processing aspects of meditation. There are, however, scattered data, mostly originating from the aforementioned first trend of research.
that are consistent with the hypothesis that information processing changes occur during meditation. Accordingly, several studies have explored the phenomena of resistance to habituation in terms of alpha wave blocking, as recorded in subjects during meditation.

Banquet (1973) and Anand et al. (1961), for instance, reported the absence of the alpha wave blocking phenomena to afferent stimulation (normally capable of producing the orienting response) in subjects practicing meditation. Hirai (1966) and Wallace and Benson (1972), on the other hand, found that Zen Meditation produced a sustaining of the alpha wave blocking (which is interpretable as lack of habituation). This suggested that meditation (at least within the Zen Tradition) was responsible for producing a state of sustained alertness, where in spite of the repetitiveness of the stimuli, subjects did not show the normally observed decrease in responsivity.

In the studies mentioned above, the practices that yielded a lack of habituation (such as Zen Meditation) had as a focus of training the maintenance of attention on external stimuli. Conversely, practices that produced the blocking of afferent stimulation were those where training emphasized the concentration on internal processes (Yogi Meditation).

How could meditation be held accountable for effects in both directions? On one hand, some studies reported
that meditation was able to produce sustained response to
steady stimuli, on the other hand, meditation practices led
to lack of response. There are reasons to suspect that
the effects of manipulating attention by such means were
not limited to a single dimension. The differences in
instructions and meditation methods could be responsible for
the failure in producing a systematic effect. Even when the
practice of meditation studied was standardized, as in the
case of Transcendental Meditation, studies have failed to
ensure that the processing attentional mode remained constant.

Within a different context, Iacono and Lyken (1983),
working on instructional manipulation of attention, have
criticized the ambiguity of instructions on habituation
studies. They have also suggested that the relative lack
of consistent findings might be due to the subjects' variability
in tuning their attention when instructions are poorly
controlled.

Most studies, manipulating attention by means of
instructions, have used habituation as an indicator of
conditioning. Thus far, no classical conditioning study
has been reported addressing the interaction between
meditation and the process of conditioning.

Given that the concept of attention (though somewhat
different connotations), has played a major role in both meditation
and dual processing studies, the next section provides a
framework for the reconceptualization of meditation and its purported effects on human information processing.

**An Information Processing Perspective**

James, as early as 1890, had suggested a distinction between habitual (automatic) and conscious behavior, which depended on the degree of attention involved. Within the information processing framework, attention has been a key concept. Kahneman (1973), for instance, initially identified it with effort. Accordingly, attention could be differentially deployed according to either enduring or momentary dispositions, thus relating the processing of information to the allocation of effort.

Recently, some authors, (Schneider & Schiffrin, 1977; Schneider & Fisk, 1982) have proposed a dual processing attention model (DPAT), that considered human performance along a continuum having automatic processing on one extreme and control (or effortful) processing on the other.

Working within a visual search paradigm, Schneider and Shiffrin (1977) have elaborated on the automatic-control notion. They have distinguished two modes of visual information processing, called automatic detection and controlled search. According to such model, control processing requiring attention occurs serially and does not improve with practice. Furthermore performances under this mode are sensitive to attentional demands and can be voluntarily modified by the subject. Automatic detection
on the other hand, occurs in parallel and only develops under conditions of at least relative consistency (i.e., when targets remain as targets, and distractors as distractors during a detection task. Consequently, it does not necessarily requires attention, is not capacity limited, (for an opposite view, see Fisher, 1982; and Navon & Gopher, 1979) and cannot be modified by the subject.

According to Logan (1979) and Schneider and Fisk (1982), whether a subject engages in control processing, or develops automaticity, is a function of two conditions: the amount of training and the consistency of practice. These two conditions, leading to the development of automatic detection in visual search tasks, also have been found to be necessary within an auditory target detection task (Pollstrock, 1982). Similarly, Fisk and Schneider (1983) have extended the scope of the dual processing notion from the original visual search paradigm to the study of processing semantic information.

Hagen and Hale (1973) and Torgesen (1977), within the area of child development and educational psychology, have proposed a version of the dual processing notion. They have distinguished between incidental, and voluntary or central learning. The former (relatively independent of intention and effort) is considered to occur more or less automatically as a product of exposure to the environment. The latter, on the other hand, is seen as conscious and involves the active use of effort and cognitive strategies.
Sternberg and Wagner (1982) have indicated that the poor learning performance of some children is specifically related to limitations in developing automatization of skills (acquired automatic processing). In addition, Ackerman and Dickman (1982) have suggested that due to this deficit on automatic processing, some children with learning problems may need to overlearn, more than normal students do, in order to retain information.

In a broader sense, human malfunctioning, has been related to deficits in control or effortful-attentional processing along several dimensions (see Salzinger, 1972 for schizophrenics; Meichembaum, 1971, 1977, for impulse control, and Hasher & Zacks, 1979 for depression and aging). Bauer (1982) and Ceci (1982) specifically, have contended that it is a purposive (control) processing deficit or an inadequate elaborative encoding skill--and not an automatic deficiency, as Sternberg and Wagner (1982) have suggested--that underlies the poor performance of some children.

Another important feature of automatic functioning is its resistance to change. Shiffrin and Schneider (1977) have concluded that "The learning of an automatic-attention response is a long term phenomenon greatly resistant to change....Eventually automatic responses can be 'unlearned' and new sets of automatic responses learned, but only after considerable amounts of retraining" (p. 185). Similarly, Pylyshyn (1980) has addressed the
phenomenon of resistance to change automatic responses in terms of impermeability of information, as opposed to permeability as a feature of voluntary (control) responding.

From the perspective of the use of feedback, the dichotomy of automaticity versus control, has been approached by Keele and Summers (1976) who have adopted two concepts from cybernetics to deal with automatic-like and control-like performances. The terms used are "Open Loop Control" (OLC) and "Closed Loop Control" (CLC). CLC refers to the functioning that is dependent upon "motor programs" with no mechanisms responsible for error detection or correction. OLC, on the other hand, involves the use of correcting mechanisms sensitive to internal or environmental feedback.

Within the notion of feedback sensitivity, Staddon and Simelhag (1971) have hinted at a reclassification of learning types, replacing the traditional view distinguishing between operant and classical conditioning or type I and II conditioning. They have challenged the operant nature of superstitious conditioning as understood by Skinner (1938), by uncovering two procedurally distinguishable types of responding, independent of whether the muscles involved in the action were striped or smooth. In one case, responses were considered reinforcement independent; in the other, responses were seen as reinforcement dependent, or feedback sensitive, to use Underwood's (1982) concepts.

The role of feedback on performance has offered a relatively straightforward criterion for the study of
behaviors in terms of the automaticity-control distinction. Not surprisingly, feedback has often been related to both awareness and automaticity as illustrated by Underwood (1982). When we use feedback about the current state of the environment and of ourselves, in order to select between alternative courses of future action, then we have an awareness of performance...in actions highly skilled, however, we lose awareness of the components of actions and they appear to become automatized (p. 112). Within the context of the S-R/S-O-R dichotomy, responses that are insensitive to feedback are considered to be minimally mediated and relatively predictable (i.e., its elicitation is under stimulus control). According to Eaglen and Mackenzie (1982), automatic responding develops as cognitive control over responses decreases with repetition.

Within the cognitive tradition where the principle of conditioning by contiguity and the notion of automatic performance have been challenged in favor of an exclusive mediational view (Brewer, 1974; Maltzman, 1977; Pendery & Maltzman, 1977), there have been authors (Bolles, 1972) that have explicitly acknowledged a qualitatively different kind of performances (i.e., automatic responses) that do not fit within an all-encompassing cognitive model of mediated behavior.
The scope of studies dealing with the development of automaticity through practice and consistency has not been limited to motor acts (Keele & Summers, 1976) or visual search tasks (Shiffrin & Schneider, 1977). La BERGE and Samuels (1974) have proposed a model for reading wherein automatic encoding of words enabled the subject to allocate attention to more demanding integrative functions. Such integrative functions involving higher level processes, have, however, not escaped being considered as subject to automatization. Hartman (1958) and Norman (1976), for example, each from a different theoretical perspective, have suggested that cognition could also become routinized through practice and experience, thus implying awareness is not a necessary condition even for higher processing. Along this line, Underwood (1982) has written

The development of motor performance from an unskilled act which involves feedback, to a skilled act which gives the appearance of being performed without attention or awareness, is a process which has similarities with the development of mental skills (p. 182).

In current psychological literature, different authors have emphasized distinct aspects of the dual processing notion.
With varying degrees of explicitness, versions have dealt with automaticity and control on a variety of ways, as shown by the following dimensions: (a) automatic/effortful (purposeful), (Hasher & Zacks, 1979; Sternberg, 1969) (b) consciousness/unconsciousness (Dixon, 1981, Norman, 1976; Shevrin & Dickman, 1980); (c) preconscious/attentive processing (Neisser, 1967, 1976); (d) parallel/serial processing, (La Berge & Samuels, 1974; Schneider & Shiffrin, 1977); (e) feedback dependence/feedback independence, (Keele & Summers, 1976; Staddon & Simelhag, 1971; Underwood, 1982); (f) neurological mechanisms for the control of voluntary/involuntary movements (Vanderwolf, 1971); (g) mechanisms for the processing of expected/unexpected --or surprising-- events (Gray, 1980; Grossberg, 1982; Pearce & Hall, 1980; Sokolov, 1963; Vinogradova, 1975); (h) incidental/voluntary or central learning (Hagen & Hale 1973; Torgesen, 1977); (i) permeability/impermeability (Pylyshyn, 1980); (j) performance versus expectancy based behavior (Bolles, 1972).

The dual processing notion, however, has not gone unchallenged as a general theory of performance. Though the idea has been accepted within some areas, (i.e., motor skill development, visual search tasks, etc.), there are domains where the validity of its application is more controversial. Ryan (1983) has questioned the automaticity-control distinction proposed by Schneider and Shiffrin
as an independent theory of human performance. Although such a distinction might be useful within the contexts of reading and motor skill development, Ryan contended this was not the case when item recognition was used as a paradigm case. Ryans' challenge was not limited to one aspect of the automaticity/control distinction. "It is argued that virtually every defining attribute of the two operations (automatic and controlled) as specified is violated by extant item recognition data" (Ryan, 1983, p. 171). Specifically, he suggested that within the Sternberg paradigm, supposed automatic processing occurred serially, and that on the other hand, "automatic" encoding was not entirely load independent. This last claim has been recently supported by Kahneman and Chajezik (1983) in a study involving speeded choice responses.

Processing of Expected and Unexpected Events. Kamin (1969) studies on the so called "blocking phenomenon" have suggested that on compound trials only unexpected reinforcers have a reinforcing effect, that is, that mere contiguity does not suffice to produce conditioning. In addition to being contiguous, reinforcement needs to be informative.

The increasing rapprochement between the two notions (the automaticity/control distinction, and the idea of a differential processing of expected an unexpected events) is illustrated by the Pearce and Hall (1980) model of classical conditioning, where the processing of, or
attending to events that have unexpected consequences is considered as the main factor accountable for conditioning. From a different perspective, Mackintosh (1975) suggested that the organism is capable of processing only events having expected consequences (in other words the organism is to perceive what it already expected). These two views presented internal paradoxes as pointed out by Grossberg (1982), who, in turn, proposed a model allowing for two complementary subsystems: orienting and attentional. These two processes were considered to be responsible for corresponding processing of unexpected and expected events. Vinogradova (1975), Sokolov (1963) and more recently, Gray (1980) have all referred (in their own versions) to the existence of two mechanisms accounting for the processing of familiar or expected, and surprising or unexpected events. In terms of dual processing theories, the processing of expected events can be considered automatic, and the processing of unexpected events, controlled or effortful.

Voluntary Control and The Dual Processing Notion.

Automatic processing has generally been considered not to be under voluntary control (see Hasher and Zacks, 1979; Shiffrin and Schneider, 1977). Early in the 70's, however, Kahneman (1973) proposed a theory where the allocation of attention was seen as a function of decision rules under subject control. This claim, according to Schneider and Shiffrin (1977) was correct only within the limits of
control processing. Accordingly, in automatic processing—theoretically regarded as demand-free—the allocation of attention made little difference on performance. Recent studies, however, have challenged again the notion of an attention "independent" automatic processing. Within the area of dichotic listening (involving different stimuli being presented simultaneously to both ears) Dawson and Schell (1982) have questioned the existence of an automatic semantic processing mechanism capable of operating independently of attention, as Shiffrin and Schneider (1977) contended. They found instead that conditioned electrodermal responses (EDR) to the unattended channel were correlated with involuntary attentional shifts, thus suggesting that at least some degree of attention was necessary for the performance of supposedly automatic tasks. Along the same line, Reiner and Morrison (1983) have reported that the presumed automatic interference appearing in the stroop task, might be due to attentional rather than to automatic processing. Similarly, Ogden, Martin and Paap (1980) found that letter encoding affected reaction time on secondary tasks, thus suggesting that early perceptual components of encoding were automatic (or pre-attentive in terms of Neisser, 1967) in that they were obligatory or out of voluntary control but not so in that they were still resource demanding. These authors and others (see Kanheman & Chajezik, 1983; Prinzmetal & Banks, 1983) have
pointed out the limitations of the definition of automaticity in terms of two criteria. One of them, involving processing capacity, seems no longer tenable; the other, involving voluntary control, remains as a more stable feature of automatic processing.

Within the context of classical conditioning, Eaglen and Mackenzie (1982) have found that instructional or voluntary control of extinction of vasomotor responding was possible, provided that the number of conditioning trials was not too large. In their study, instructional control occurred after 25 trials, but not after 100 trials. This suggested that the effect of instructional control over extinction was limited to an early stage and that automatic responding developed as cognitive higher order control over responses gradually decreased through trials, as a function of repetition.

Consistent with this view, Pearce and Hall (1980) have offered an information processing model for conditioning where the presentations of CS-US pairings are considered to make the CS an increasingly better predictor of the US. According to Pearce and Hall, once the US is fully predicted, the CS is no longer centrally processed (attended) although it is still capable of producing an internal representation of the US, thus eliciting the automatic conditioned response. Within this and other information processing models (see Ohman, 1979; Wagner, 1973) the rehearsal or central processing of events
is considered to be necessary for conditioning to occur. Accordingly attending to an event leads to its processing in some kind of short-term working memory mechanism. This rehearsal or processing eventually allows for the transfer of information to a longer term storage where such information is relatively available, provided the appropriate retrieval cue is present.

**The Problem**

Studies done within the context of information processing and meditation suggest that focusing of attention on either internal or external stimuli has an effect on conditioning and/or habituation. Whereas a general information processing model identifies attention with processing capacity and considers its involvement necessary in learning new behaviors (see Wagner, 1973 for classical conditioning, and Ohman, 1979 for habituation). A meditation model (Wallace & Fisher, 1983) suggests that the focusing of attention has a deautomatizing or deconditioning effect. Accordingly, Wallace and Fisher (1983) have referred to the so called Deikman-Ornstein model of meditation as follows:

The principal mode for learning deautomatization, is meditation. When we achieve this process successfully, our awareness opens up in a way that is similar to escaping the bounds that determine
our behavior. Instead of being selective about what we attend to, we permit ourselves in a way, to start from the beginning in the processing of information. Rather than react to situations in a learned automatic fashion we allow learning to start anew (p. 92).

Studies on meditation and attention manipulation, however, have failed to observe consistent effects when attention is manipulated during habituation or classical conditioning. This lack of consistency may be due to a failure to account for the multidimensionality of attention. An illustration of this is a study done by Becker and Shapiro (1981) where instructions such as attend to the stimuli in whatever way your meditation calls for" (p. 696), were given on the unwarranted assumption that the practice of meditation produced a systematic effect over the way a stimulus, alien to the practice, was processed or attended to. Similarly, the use of standard ways to manipulate attention by asking the subjects to count the stimuli, presupposes that attention can be controlled by an operation which in terms of Posner and Boies' (1971) classification represents only one component, i.e. processing capacity, or in terms of the Bourne et al. (1979) continuum represents the extreme of the dimension called "distribution."
A general analysis of procedures has revealed thus that not only have different instruction sets been implemented (thus implicating the use of unidentified components of attention), but also that targets utilized for the allocation of attention have varied across studies. The present work represents an attempt to avoid such ambiguities by: (a) confining the target of attention to either internal (breathing) or external (CSs and USs "sounds") stimuli, and (b) limiting the use of attention to a passive form (which is procedurally equivalent to meditation, and for the purpose of this study was adapted from Deikman's 1966 experimental meditation method and from Woollams, 1975, subjective perception).

Given these constrains, and operating within a classical conditioning paradigm, a meditational model would suggest that "passive attention" regardless of the locus of attention would reduce the CS capability of evoking CR's. An information oriented model on the other hand, would predict that practicing passive attention during classical conditioning with an internal locus, would divert processing capacity from the relevant information (CS-US contingency in this case) occupying part of the rehearsing time required for the CS-US to become associated. An external locus toward the CS and US, however, even if attention is passive, would allow for more rehearsing time in the central processor thus resulting in more conditioning or automatization.
The Hypotheses

The following specific hypothesis (three primary and one secondary) involving two dependent measures; electromiographic activity and skin temperature, were tested:

(a) Subjects instructed at the beginning of the experiment to externally focus their attention on the CS and US sounds would produce larger response amplitudes (increase for the EMG and decrease for temperature) to the CS over the conditioning trials, than subjects under instructions to focus their attention internally—on their breathing. This would mean a higher conditioning rate for the "sounds" condition.

(b) Subjects instructed at the beginning of the experiment to focus their attention on sounds would display increasingly less active response amplitudes (smaller for the EMG and larger for temperature) to the US over the conditioning trials than subjects under instructions to focus on their breathing. This would indicate a higher habituation rate for the sounds condition.

(c) Subjects instructed at the onset of the extinction trials to focus their attention on "sounds" would produce a steeper change in the response amplitude (decrement for the EMG and increment for temperature) to the CS over the extinction trials, than subjects under instructions to focus on their breathing.
(d) Subjects instructed at the beginning of the experiment to either focus their attention internally or externally and then remain under the same condition during both, conditioning and extinction trials, would display less active responses (decimals for EMG, increments for temperature) to the CS over the extinction trials than subjects asked to switch method at the onset of the extinction trials.

Method

Subjects

Subjects (22 males and 26 females) were selected from a pool of 76 undergraduates volunteering, in exchange for extra credit points, from introductory level education and psychology classes at North Texas State University. Ages ranked from 19 to 43 ($\bar{x} = 24.3$, $SD = 4.5$). Of the participants, 24 percent reported having had at least some experience with meditation or yoga practices. Subjects were stratified as to sex and the order of subject presentation was randomly assigned to one of four treatment conditions prior to beginning the study. When originally invited to participate, students were not told that they would take part in a study involving attention or meditation, they were informed instead that the experiment was about some relaxation techniques and that physiological measures would be taken.

Apparatus

The skin temperature on the middle finger of the non-dominant hand was measured by a Med Associates temperature
monitor. This measure is considered a reliable correlate of peripheral blood flow, and therefore reflects relaxation/tension.

The electromyographic (EMG) activity of the subjects was measured by an Autogenic Training HT-1 monitor with the active electrodes (9 mm HgCl/Hg) placed on the outer surface of the subjects' wrists and the ground electrode placed on the back of the neck. The EMG signal was filtered by this apparatus to admit only potentials within the 100 to 200 Hz range; this was to limit environmental and electrocardiac signals. According to Brazier (1970), the wrist to wrist placement concentrates upon the upper body and neck muscles yielding a measure of general body muscle activity and tonus.

The analogue measurements of these parameters were digitalized using Med Associates modular equipment and recorded on printing counters. These measures were averaged by this equipment over 1 sec intervals throughout the study trials. The EMG signal was rectified prior to averaging so that it represented the total EMG activity rather than the sum of alternating potentials.

The timing of the data intervals was accomplished with a LVB Corp. Logic Box 1 discrete logic programming apparatus which was also programmed to control the presentation of the various stimuli to the subjects and to signal the experimenter when to change the instructions given to the subjects.
The unconditioned stimulus (US) consisted of a 78 db noise with an average duration of 500 msec. The conditioned stimulus (CS) consisted of a 10 sec constant purr sound of 30 db. Both (CS and US) were presented via headphones (SH-803 A by Rystl Corp.). The frequencies of the CS and US were the nominal values of the Med Associates signal generator used. The loudness was set with the use of a 1551-C sound level meter by General Radio Corp. The experiment took place in a 4 X 4 m room at 25° C. Each subject was seated on a movable cushioned chair in front of a table of 5 X 1 m (75cm high) over which a 25 X 10 cm sign reading "breathing" or "sounds" was placed according to treatment condition.

Study Variables. The primary variables studied as a function of instructional set were as follows: (a) degree of habituation to the US autonomic response (orienting reflex) as a product of repeated exposure (trials), and (b) the degree of conditioning to the CS as a consequence of its pairing with the US and of extinction. According to the classical forward conditioning paradigm, when conditioning occurs, subjects' responses begin to anticipate the presentation of the US in the CS-US interval.

Study variables were effected by the experimental manipulation showing deflections on the averaged finger temperature and averaged EMG potentials. Decrements in temperature and increments in EMG represent an automatic
pattern associated with stress reactions. Up to the limits set by autonomic response latency and the attenuation of the amplitude of the CS compared to the associated US, the greater the deflection of these two measures (decrease) for EMG and (increase for temperature) during the averaged post US interval (computed each trial for both EMG and temperature) the greater the presumed degree of habituation. The degree of conditioning was assumed to be a function of the observed differences in temperature and EMG levels between the after CS (CS-US interval) and after US intervals. This difference score was computed by taking the value of the after US interval and subtracting the after CS interval scores, (one for EMG and one for temperature were computed this way for each trial.

Meditation Techniques. The theoretical position with respect to automatic as opposed to effortful processing of stimuli suggested that when subjects externally focused their attention when in a relaxed state (focused their meditation) upon the CS and US sounds, then the processing of these stimuli remained "effortful" or became effortful as compared to when the attention was allocated to some internal object (in this case toward their breathing). For the sake of convenience, these techniques/instruction manipulations were labeled "Breathing" and "Sounds". As described below, subjects received a brief training in each of these attentional-meditational techniques before the beginning of the conditioning trials. Scripts of the training instructions are in Appendix A.
Procedure

Upon being informed of the relaxation nature of the study; potential candidates were asked to make an appointment for a two hour individual session. Once in the experimental room, subjects were asked to sign an advised consent form (Appendix C) and to fill out a questionnaire for the collection of demographic information (see Appendix B). The subjects then had the sensors attached for temperature and EMG and were exposed to a set of three US noises at 5 sec intervals. After the US's were presented, the subjects were asked to rate the unpleasantness of the noises by marking with an "X" on the following scale:

1- Not at all unpleasant
2- Somewhat unpleasant
3- About half way between "not unpleasant and most unpleasant"
4- Definitely unpleasant
5- About the most unpleasant I could stand.

Four volunteers marked the "X" on choices one or two and were eliminated from the study. Also six subjects who did not show the required EMG response (a positive change in at least two of the three post US readings with a minimum increase in the EMG of 5 microvolts) were excused from participating. These 10 places were filled by subsequent volunteers, according to the aforementioned prerandomization procedure.
After the check of the unpleasantness of the US, the subjects were given instructions via written cards and orally (see Appendix A for the sequence and scripts of oral and written instructions). Order of instructions concerning "breathing" (card # 2) and "sounds" (card # 3) method was randomly determined for each subject. During the last of the five instruction cards, the visual sign containing either the word "breathing" or "sounds" appropriate to the instructions was displayed before the subjects. At this point, subjects were asked to close their eyes and to practice for 15 sec and then to practice another 15 sec. Each method was practiced twice in this manner before the actual experiment. During the last two 15 sec. practice trials, subjects were checked on their EMG level and were discarded from the experiment under either of two circumstances: (a) if their average EMG had not decreased at least 5 microvolts from the base line previously taken for the US reaction, or (b) if averaged EMG fluctuated more than 3 microvolts between methods implying underlying arousal differences.

Conditioning Trials

The subjects who passed all of the qualifying pre-treatment conditions continued with the second part of the study. After having been asked to stretch and having the sensors checked again for proper attachment, they were asked to settle into the chair and practice the procedure named on
the displayed sign. They were told that they would hear during this practice a series of loud and softer noises. Depending on the instructions displayed on the card they were to attend to their breathing or to sounds. They were also informed that the exercise would take about half an hour and that they might or might not later in the exercise be requested to switch from one method to another by means of a change in the sign. At this point if no questions were asked subjects were to put on a set of headphones and instructed to begin.

Subjects entering this phase of the study were sequentially assigned to a pre-randomized treatment condition such that the first qualifying subject received the treatment assigned by recourse to a table of random digits. In cases where subjects did not complete the study, these positions were filled by subjects later recruited. The make-up subject assignments were held until the end of the pre-randomized conditions had been reached and then were filled in their original order until the design was complete.

When these conditions called for the change in instructions the experimenter changed the sign bearing the name of the instructions. When necessary the experimenter lightly touched the arm of the subjects, who had their eyes closed.

Conditions

The following conditions were superimposed on a series of 25 paired CS-US presentations, immediately followed by
20 extinction trials (Trials 26-46) with the presentation of the CS alone. The times between the onsets of the CS were randomly varied from 14 to 25 sec. with a mean of 19 sec. The CS-US interval was held constant to 10 sec. The instructional conditions that were superimposed upon these trials follow:

**Treatment S-B.** Attend to SOUNDS instructions for Trials 1-25, Attend to BREATHING for Trials 26-46 (Instructional set switched when extinction began)

**Treatment S-S.** Attend to SOUNDS for Trials 1-46

**Treatment B-S.** Attend to BREATHING for Trials 1-25, Attend to SOUNDS for trials 26-46 (Instructional set switched when extinction began)

**Treatment B-B.** Attend to BREATHING for trials 1-46.

Figure 1 diagrams the four treatments with the conditioning and extinction trials. After the completion of Trial 46 the subjects were disconnected from the apparatus.

On two occasions when the equipment had not functioned properly, the subjects were excluded from analysis. These conditions in the study design were then scheduled to be filled after the rest of the pre-randomized conditions had been presented as though the subjects had not qualified.

After the experiment was completed the subjects were given two questionnaires, one to check the way instructions were followed (see Appendix D) and the other to collect
<table>
<thead>
<tr>
<th>Group</th>
<th>Training to Allocate Attention</th>
<th>Conditioning (US-CS)</th>
<th>Extinction (CS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-S</td>
<td></td>
<td>1-25</td>
<td>26-46</td>
</tr>
<tr>
<td>B-B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-S</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- - - - Breathing Method

- - - - Sounds Method

Figure 1. Conditions of Attention Allocation during conditioning and extinction trials for the four experimental groups.
information concerning past experience in meditation and counseling (Appendix E). Subjects were then informally debriefed and thanked for their participation.

**Results**

Automated data processing equipment was used for numerical analysis on the EMG and temperature fluctuations of the 48 subjects. Data analysis was performed using the SAS package (Ray, 1982).

The two electrophysiological activity scores (finger temperature and EMG) were computed for each subject's trials (25 for conditioning and 15 for extinction) for the 10 sec. after the CS and after the US. These scores were then standardized to T-scores (mean = 50, S.D. = 10) based upon individual means and S.D.'s. This standardization corrected for differences in individual subjects' baseline levels and response lability. In addition to the after CS and after US scores, the US-CS differences (an index of conditioning) were computed by subtracting the after CS score from the after US score and standardized across trials into T-scores.

A 4 X 2 MANOVA was performed with attending instruction conditions ("Breathing," "Breathing-Sounds," "Sounds" and "Sounds-Breathing") and trials for independent variables. Demographic and background information was included for ancillary analysis as independent measures. A correlation matrix was computed in order to determine the strength of relationship between each possible pair of variables.
The MANOVA analysis yielded significance for two main effects (trials and condition) and the interaction between these (Hotelling-Lawley's trace = 2.86, \( \text{df} = 2, 741 \), \( p < .05 \); Hotelling-Lawley's trace's trace = 4.79, \( \text{df} = 6, 1580 \), \( p < .0001 \); respectively). In spite of the fact that the EMG measure only contributed to 1.3 percent to the canonical variability, it was not dropped from the general analysis because it had been part of the initial hypotheses. Further univariate analysis considered temperature (in either form: average or US-CS difference per trial) as the only dependent measure. Results related specifically to the hypothesis of conditioning, habituation and extinction are presented in the following sections.

**Habituation.** The first hypothesis predicted differential patterns of habituation according to the two conditions. The US T-scores from groups B-S and B-B versus S-B and S-S were collapsed and contrasted within the conditioning stage (Trials 1 - 25) resulting in two main groups whose data were analyzed across five intervals representing the 25 trials. Both, interval main effect and condition by trial interaction were significant (see Table 1). The two treatment conditions (B and S) in this analysis are plotted against the conditioning trials (1 - 25) in Figure 2.

**Conditioning.** The second Hypothesis predicted differences between the two main conditions (S and B) in the level of conditioning achieved. The US-CS Difference score should
Figure 2. Habituation patterns based on average US temperature for conditions B and S during conditioning trials. Interval A is Trials 1-5; B is Trials 6-10; etc.
Table 1

Analysis of variance on US temperature data for B and S conditions during conditioning trial

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>1</td>
<td>14</td>
<td>14</td>
<td>0.14</td>
<td>0.7</td>
</tr>
<tr>
<td>Trial</td>
<td>4</td>
<td>3581</td>
<td>895</td>
<td>8.86</td>
<td>0.001</td>
</tr>
<tr>
<td>Condition by Trial</td>
<td>4</td>
<td>1059</td>
<td>264</td>
<td>2.62</td>
<td>0.03</td>
</tr>
<tr>
<td>Error</td>
<td>990</td>
<td>104684</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

have become high (above 50 T-score) for Temperature and low (below 50 T-score) for EMG when conditioning occurred. Since the after US responses showed the expected habituation over trials by indicating decreasing ANS activity, the after CS responses should have shown more ANS activity if the subjects had acquired a conditioned response to the CS. The relative increase of after CS ANS activity in the context of general decrease in ANS activity due to habituation yielded larger after US scores for Temperature and smaller ones for EMG as compared to the after CS scores. With this difference taken and then standardized to T scores, conditioning was reflected in scores greater than 50 T for Temperature and less than 50 T for EMG.

The US-CS Difference scores were pooled from group S-B and S-S versus B-S and B-B, and examined for statistical reliable differences on their quadratic trend within the conditioning Trials 1 - 25. Although the MANOVA analysis
of the US-CS Difference scores showed a significant main effect for trials (Hotelling-Lawley's trace = 2.82, df = 8, 1976, p < .04). The interaction of trials by condition did not produce a sufficiently small significance level for temperature. The univariate interaction showed only a marginal trend for the 25 conditioning trials (F = 2.18, df = 4, p < .06). Further post-hoc, exploratory, univariate analysis for the first 10 trials of conditioning with Temperature resulted in a significant condition by trial interaction (F = 2.5, df = 9, p < .008).

**Extinction.** The third and fourth hypothesis predicted different rates of extinction between treatments. Three modalities of the dependent variable were utilized in the data analysis, the standardized response amplitude scores of both the US and CS-related changes and the differences per trial of the US-CS-related changes. Given that no main effect nor interaction was found to be significant in the MANOVA when analyzing all the extinction trials (26 - 46) on either the standardized Temperature and EMG, or in a separate analysis of the US-CS Difference score for Temperature and EMG; further post-hoc univariate analysis was performed for the US-CS differences in Temperature only during the first 10 extinction trials. Results presented in Table 2 show significant condition by trial interaction effect in Trials 26 - 35.

Pairwise comparison on the US-CS Difference scores yielded condition S-S (X = -.98) significantly higher (t = 2.27;
Table 2
Analysis of Variance Summary on the US-CS scores during the Ten First Extinction Trials

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition</td>
<td>1</td>
<td>27</td>
<td>27</td>
<td>0.66</td>
<td>0.4</td>
</tr>
<tr>
<td>Trial</td>
<td>9</td>
<td>540</td>
<td>60</td>
<td>1.45</td>
<td>0.1</td>
</tr>
<tr>
<td>Condition by Trial</td>
<td>9</td>
<td>937</td>
<td>104</td>
<td>2.50</td>
<td>0.008</td>
</tr>
<tr>
<td>Error</td>
<td>420</td>
<td>17462</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$df = 38, p < .02$ when orthogonally contrasted with t-test for simple effects against groups S-B ($\bar{X} = .123$), B-S ($\bar{X} = .124$) and B-B ($\bar{X} = -.170$). Additional analysis was done with the first 10 extinction Trials 26 - 35, in order to determine if differences existed on the conditioning-extinction rate between treatment conditions. A MANOVA analysis showed that both main effects (condition and trial) and the interaction between these were statistically significant (Hotelling-Lawley's traces = 4.04, $df = 6, 3124, p < .0005$ for Conditions; 5.90, $df = 6, 3124, p < .0001$ for Trials; and 6.21, $df = 6, 3124, p < .001$ for Interactions).

For the demographic and debriefing variables, there were four pairs with a correlation coefficient of .3 or larger: meditation experience and age, .39 ($p < .0001$); meditation experience and perceived pleasant-unpleasantness of the experience, .33 ($p < .0001$); US rating and perception of the experience, .37 ($p < .001$); and change method and age, .44 ($p < .001$). No correlation was found to be
significant between the demographic and debriefing variables, and the primary study variables.

**Discussion**

The first hypothesis predicted that the instructions to focus attention on the sounds would enhance the rate of conditioning as compared with the group of subjects attending to their breathing (internal focus of attention). The breathing method, as can be seen in Figure 3, produced a flatter pattern on the US-CS difference in Temperature which indicated that the US was not losing its strength at the expenses of the CS becoming conditioned. Such a pattern was theoretically expected according to the forward classical conditioning paradigm, where two simultaneous processes presumably occur, a gradual decrease in responsivity to the US by virtue of habituation or accommodation, and a gradual increase in reactivity to the CS. The sounds method, however, produced a steeper pattern of US-CS Difference score in Temperature than the breathing method; this was considered to be indicative of conditioning.

Generally, one would have expected an overall main effect due to the US-CS pairing over the trials of this procedure. However, the necessity to standardize the Temperature and EMG measures within each subject masked any over trials effect for the US-CS Difference, and thus masked this check on the manipulation. The within subjects standardization controlled for individual differences in base line measurement level and in ANS responsivity. Since the Trials by Condition
interaction effect was in the predicted direction, it was assumed that conditioning had in fact been evoked, at least in the Sounds group of subjects.

The EMG parameter did not show systematic variation as did Temperature. The failure of the EMG was most likely due to measurement noise. Inspection of the EMG record from individual subjects showed frequent high amplitude spikes, apparently occurring at random with respect to the study trials. EMG was considerably more affected by voluntary activity than Temperature. While subjects were asked to remain still during the study, they were not restrained and many did make movements of postural adjustment.

Other facets of EMG as opposed to Temperature electrophysiological measurement are the latency of response and response averaging within the subjects. Temperature has a two to five second latency between an orienting stimulus and the measured response. This lag in response time can be further increased by thermodiamic inertia of finger and sensors. EMG, on the other hand, as an electrochemical reaction measured electronically has a response latency within the subject of less than two seconds and trivially small measurement inertia (in milliseconds). Given any distractions to the subjects, whether from outside the experimental situation or due to lapses in the attention task, variability associated
Figure 3. Changes within the 10 first conditioning trials on US-CS for conditions B and S.
with these distractions would tend to be attenuated within the Temperature measurement and recorded by the EMG measurement.

The second hypothesis predicted that subjects under instructions to focus (externally) on the sounds, would display a higher habituation rate in terms of changes across trials in the after US related activity. This hypothesis was supported by the data. Given that the main effect of trials was found to be significant, which indicated that across conditions, the US gradually lost its initial power to elicit the unconditioned response. The interaction between trials and the two main conditions, breathing and sound, was tested and found statistically significant. The external focusing of attention (sounds condition), as predicted, produced a steeper habituation rate. Figure 2 shows that for subjects practicing breathing, while the temperature related to the US gradually increased, the increments were not as steep as the group with the focus on "sounds".

If habituation is to be considered as an instance of conditioning between the US and its context, as suggested by Ohman (1979), the present finding is consistent with the information processing notion that if attention is focused on the relevant information, CS-US, some learning about the relationship between them occurs.
A meditation model would have predicted that for as long as passive attention (void of intellectual activity) were practiced toward any object, the organism would respond in a fresh fashion (developing less conditioning).

The third and fourth hypotheses predicted different rates of extinction between conditions. In its original form neither one was supported when analysis was done having as dependent variable either the US average or the CS average per trial. As in the case of the conditioning hypothesis, visual inspection of the results revealed that variability increased with trials, thus further post hoc analysis was performed for the 10 first extinction trials on the US-CS Difference scores. A significant trial by condition interaction for the US-CS Difference in Temperature resulted with condition S-S being significantly different from the others (see Figure 4). This suggested that such a measure—capitalizing from shifts of both the US and the CS-related changes—was more sensitive to the differences between conditions, at least within the early extinction trials.

In addition to that analysis, the 10 first trials of conditioning were compared to their counterpart, first 10 extinction trials, in order to explore differences in the conditioning-extinction rate between treatment conditions. In this case again significant interaction resulted for the condition S-S that was significantly different from the other three (see Figure 5).
Figure 4. US-CS Mean Differences for the Four Conditions within the 10 First Trials of Extinction
Figure 5. US-CS Mean Differences for the Four Conditions during the First 10 Trials of Conditioning and Extinction
The resulting differences between the S-S condition and the others, not being predicted by the hypothesis can not be unequivocally interpreted, based on a single study. Since this difference was not detected by either US nor CS fluctuations alone, the differences on the S-S pattern may not have been due to a relative increase on US, nor to a relative decrease on the CS related temperature, but rather to a combination of both.

If such were true, the results not only do not support the third and fourth hypotheses, but are in opposition to those predictions. According to the forward classical conditioning paradigm, temperature after both the CS and the expected US should have increased with trials, but this theory offers no explanation for an interaction where some subjects display relatively more activation to the CS at the end of the extinction period. Visual inspection of plots reveals that only for the S-S condition did the average Temperature during the first two extinction trials fall below the end of the conditioning trials (about 2 standard deviations). Previous study had suggested that during classical conditioning, both omissions of expected events and presentations of new events reduced processing capacity on a simultaneous secondary tasks (Dawson, Schell, Beers & Kelly, 1982) The observed drop on such trials may thus represent an enhanced state of alertness, probably a break in automatic processing in favor of an attentional process.
However, the question remains why this sudden change was present only for the S-S and not for the B-B (the other non-switching condition), nor even for the S-B or B-S which in addition to the unexpected omission of the US were almost simultaneously instructed to switch attentional method. Such instruction should have enhanced the processing shift reflected in the temperature drop but these did not.

The simple description of the interaction pattern thus suggests that only subjects having practiced sound attending during conditioning and extinction are detectably sensitive. When the US omission occurs this group displays what Grossber (1983) and Gray (1980) would call an automatic switch to attentive process, which is automatic in terms of purportedly being out of the subject's control (a function of stimulus change), but is attentive in terms of enabling the subject to process a mismatch (notice a change).

One possible explanation is that subjects in the two switching conditions develope an expectation for changing experimental conditions, the later perception of this expected change does not then produce ANS arousal (lower Temperature scores). This argument would roughly follow Neisser's (1976) suggestion that any information congruent with perceptual expectations is easily processed. This leaves the B-B, non-switching condition. The B-B group (as shown in Figure 4) does not show evidence of moving toward conditioning (or
automatic processing), which if considered as a sign of control processing, when the unannounced and thus unexpected omission of the US comes, there is not evidence in the response trend of a processing shift. The B-B subjects presumably already attending due to processing the the US and CS in a different way as compared with the sounds method, do not produce a detectable change. The S-S group, shifting the processing of the CS and US to automatic without receiving instructions, is likely to be less prepared for the unexpected omission of the US thus producing the observed sudden drop in temperature.

Results from the US-CS multivariate analysis as well as those from the conditioning-extinction rate, consistently point at a distinctive S-S pattern whose theoretical significance remains unclear. Whatever the mechanism responsible for such pattern is and especially for the temperature drop (increased activation) on the first two extinction trials, it is only clear that continued external allocation to the US and CS sounds, produce a distinctive extinction pattern. Obviously this finding can be due to some error artifact and be of no theoretical importance. It is also possible that the low variability accounted for by the temperature variable be due to the fact that some subjects were not temperature responders. Similarly, the inability of the EMG variable to account for much (even less than temperature) of the treatment differences should be noted. It is evident that EMG was more noise sensitive when compared with temperature. Further
studies should double check static electricity as well as skin resistance before actual measures are taken.

Although background information does not account in this study for much of the variability, studies done with habituation or classical conditioning should consider the reduction of sampling error by including when selecting the sample, classification variables more related to individual fluctuations in conditioning or habituation, for instance the Vossel and Rossmann (1984) classification of habituation in terms of slow and fast.

Overall, these results suggest that the manipulation of attention—by means of instructions given in a very brief period of training—have an effect along measures of conditioning, habituation and extinction. The implications of these findings are subject to questioning. It was the purpose of the author to explore the effects of manipulating allocation of attention for a very applied reason. Individual problems can often be solved by manipulation of the environment. Learning is generally considered something desirable that enables the organisms to adapt and to survive in their environment. However, negative experiences mark human behavior in the forms of prejudices, fears, aversions, irrational beliefs, etc., which make learning equally undesirable on some occasions. The study of attention being recently reinitiated by mainstream psychology may shed light on ways, for instance, to immunize against
undesirable learning which underlies so many maladaptive behaviors. There are studies suggesting that manipulation of attention by means of monitoring behavioral problems has a beneficial effect in terms of frequency reductions (Kazdin, 1974; Thoresen and Mahoney, 1974). In the same line, but within the contexts of problem solving and impulse control, Meichenbaum (1971, 1977) works with children teaching them to redirect their attention by means of self speech. Within the context of Meditation-oriented interventions, however, more studies are needed to determine the conditions under which the focusing of attention can actually override the effects of past experience.

The present work represents an attempt to compare attention strategies in a researchable paradigm where differences between treatments can not be attributable to arousal factors. A summary of the results indicates that the direction of attention produces a systematic detectable effects on the conditioning of ANS activity. Although the proportion of the variance in the ANS measures is low (less than 10%), much of this is most likely due to a high degree of measurement noise. These results, however, could have been caused by attention having a systematic and trivial effect on conditioning of ANS responses. Were these results to be later replicated, then the importance would be in the fact that attention can be easily directed by verbal communication.
These results also potentially provide theoretical underpinnings for the clinical technique of directed imagery (Achterburg & Lawlis, 1978). In these techniques, patients are instructed to image physiological processes having to do with their illness (e.g., the immune system and drug action) and to direct these images in a healing manner (e.g., white blood cells eating cancerous cells and drugs killing germs). Like the ANS, the immune system is not typically effected by verbal communication to a patient. Perhaps just as these results allow the suggestion that attention can moderate classical conditioning, attention has the capability to moderate the operation of the immune system. The use of directed imaging in chronic pain is a more likely parallel, there is good reason to believe that the type of learning in the classical conditioning paradigm is directly involved, for example, in low back pain syndrome.

To conclude, this study may have implications in stimulating future research on the development of attentional strategies to allow individuals—when the environmental conditions are either momentarily or permanently difficult to change—to exert control, by redirecting their attention. It is also hoped that such research will shed light on ways to implement a more existential living, in terms of letting past experience (or conditioning) be less obtrusive when it does not provide relevant information for
survival, as in the case of Watson's little Albert whose early experience further developed into useless fears of white colored animals.
Appendix A

Instructions to Subjects

Card #1

The following instruction cards will explain to you about two relaxation techniques. In order for you to be able to properly participate in this study you are to understand, to distinguish and to practice such techniques when you are requested by the experimenter. Please take your time, go at your own pace when you read the instructions.

If you have any questions as you read these cards please do not hesitate to ask the experimenter.

Experimenter

Do you have any questions thus far? . . . Here is the next card.

Card # 2

Now let's see how the called BREATHING TECHNIQUE works. It is very simple, you just sit comfortably on the chair with your eyes closed if you so wish, and concentrate on your breathing and feel the sensations of inhaling and exhaling. If any distracting thought comes to your mind just gently let it pass and go back to your breathing and feel, sense how the air enters into your body and how it leaves. All you have to do is just be aware of the sensations of your breathing. Try as much as possible not to pay attention to anything else.
Experimenter (after card # 2)

Do you have questions? . . . OK, now let's practice the breathing method. Close your eyes for a moment and concentrate on your breathing. (Pause). Just feel the sensations as the air enters and leaves. (Pause). Stay for a moment just feeling your breathing. (Pause). Just feel it. (Pause). If you have any thoughts let them go and stay with your breathing as much as possible, just feel it. (Pause). OK, now gently open your eyes. (Pause). Did you have any problem practicing this method? (Pause). Fine now let's see the next card.

Card # 3

Now, let's see how the SOUNDS METHOD works. You just sit comfortably in the chair with your eyes closed and listen to the sounds of the environment as if they were occurring inside your ears. The rational of this is that whatever you listen to, perceive or touch, you perceive it within your senses. For instance when somebody touches you you do not really feel his or her hand, you can only perceive and sense some pressure in your own skin, within your body not outside it.

In the case of sounds you do not really feel or hear a sound outside you can only feel the vibrations within your ears, the sensations of sounds within you so all you have to do on the SOUNDS METHOD is listen to the sounds as though they were occurring inside you.
Appendix A--Continued

Experimenter (after card # 3)

Do you have any questions? (Pause). OK, now let's practice the sounds method. Close your eyes for a moment and concentrate on the sounds, on any sound you can hear, just feel the vibrations within your ears. (Pause). Feel the sensations within you. (Pause). If any thought comes to your mind let it go and stay listening to the sounds as much as you can. (Pause). Just feel the vibrations within your ears. (Pause). Now gently open your eyes. (Pause). Did you have any problem practicing this method? OK, now let's see the next card.

Card # 4

When you practice these techniques you are not expected to believe the rationale if you do not want to, all you are asked to do is not to think about anything else, nor to try to discover a meaning, but only to concentrate as much as possible on the sensations produced by either the sounds or your breathing. Remember it is important, as much as possible not to engage in thinking.

Experimenter

Do you have any questions thus far? (Pause). OK here is the last card.

Card # 5

The experimenter will instruct you to practice one of the two techniques by means of one of the signs in front of you. So when you see the sign BREATHING please immediately concentrate on your breathing according to the instructions
that you are given. If you see the sign change to SOUNDS (though it may happen the other way around) you focus on the sensations of all the sounds that you can hear, according to the sounds technique.
Appendix B

Personal Data Questionnaire

The following information is confidential and will only be used for research purposes:

Name________________________

Age________________________

Sex________________________

Classification_______________

Race________________________
Appendix C

Informed Consent Statement

In this study you will be asked to:

1. Fill short questionnaires (responses will remain anonymous)

2. Learn about two simple relaxation exercises and practice them, while some physiological measures are taken (which do not involve any physical risk for you)

If you have any question regarding any part of the procedure, feel free to ask.

I have received a clear explanation and understand the nature of this procedure. I understand that this study is investigational, and, that I may withdraw at any time. With my understanding of this, having received this information, and satisfactory answers to the questions I have asked, I voluntarily consent to the procedure described above.

__________________________
Signature

__________________________
Date
Appendix D
Post-experimental Evaluation

1. When any of us tries to concentrate upon only one designated thing (like SOUNDS or BREATHING) we always have some breaks in concentration. In order to make the best use of the data your volenteering has allowed me to collect, I need some indication of how much trouble you had this time concentrating. Please draw a line through the "thermometers" below to show:

(a) How much of the time you were able to concentrate on the sounds according to the sounds technique

(b) How much of the time you were able to concentrate on your breathing according to the breathing technique
2. You were asked to change what you directed your attention toward during the last session. Now use the "thermometer" below to show "How MUCH TROUBLE" you had making the change

- 100% could NOT make the change
- 50% took about 1/2 the time left
- 0% changed at once, NO trouble

3. Write below any thought or distraction you had during the past session

4. Please rate your experience in this exercise

| definitely unpleasant | neutral | definitely pleasant |
Appendix E

Background Information

Have you had experience with any kind of meditation practices: YES___ or NO___ If yes, give a rough estimation of how many times, thus far, have you done it, for at least five minutes__________

Have you had any experience with either Psychotherapy or counseling

Yes____

No____
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