THE EFFECTS OF CULTURAL INFLUENCES AND PERSONAL STATE ON ELECTRODERMAL ORIENTING RESPONSES TO PHOBIC STIMULI

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ABSTRACT

Seligman's theory that phobias are biologically prepared associations is challenged on theoretical and empirical grounds. It is argued that a concept of experiential preparedness may be more useful for approaching the problem of selectivity in phobias.

The experimental part of the thesis pursues this argument by investigating the magnitude and habituation of electrodermal orienting responses (ORs) to words denoting ontogenetically fear-relevant (phobic) or neutral stimuli.

In experiment 1 no differences between the ORs to moderately feared and neutral stimuli were found. In experiment 2 subjects were presented with stimuli as in experiment 1 and were threatened by electric shock; the phobic stimuli then elicited larger and more slowly habituating ORs than the neutral stimuli.

In the following three experiments, subjects were presented with stimuli they reported as not feared but of which the majority of their peers reported substantial fears. In experiment 3 there was no manipulation of the state of the subject, in experiment 4 subjects were under threat of shock, and in experiment 5 they anticipated pleasant music. Only in experiment 4 did subjects show larger and more slowly habituating ORs to phobic than neutral stimuli.

In the last two experiments, pleasant stimuli were administered while subjects anticipated shock or music. On the whole, no differences in ORs to pleasant and neutral stimuli were found under either of the two conditions.

The results suggest that the OR is not simply linked to the detection of stimulus change or significance and depends on the state of the subject, with stimuli known to be associated with fear taking precedence in processing when subjects anticipate threat. As phobias are assumed to be learned responses and the OR has important implications for learning it is concluded that phobic responses towards stimuli feared in the culture may be formed when people perceive the future as threatening and unpredictable.

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FOREWORD

In psychology, biological explanations are uniquely attractive for their apparent simplicity in postulating cause-effect relationships which are difficult to pinpoint within other explanatory frameworks. This is particularly true for abnormal psychology and there is hardly a psycopathological condition which has not been attributed to biological causes. Phobias are no exception and they have been discussed within an evolutionary context as early as 1897 by Stanley Hall (Friedman and Goldstein, 1974).

In recent years and on the basis of evidence from animal studies, Seligman (1970, 1971) suggested phobias are instances of biologically prepared learning and as such they are selective, readily acquired, difficult to extinguish and probably noncognitive. Subsequently, in a series of experiments Öhman and his colleagues provided partial support to Seligman's concept of preparedness and a number of writers (e.g. Marks, 1977; Eysenck, 1979) argued that some of the difficulties of the conditioning model of phobias, including the selectivity in phobic objects, are now accounted for by the biological preparedness hypothesis.

Taking my cue from Marks (1977), I initially thought that this research should attempt to construct a "map of S-R valencies" (p. 210), i.e. a list of stimuli of evolutionary significance which can be easily linked with fear responses, using Öhman's methodology (classical conditioning of the electrodermal response to potentially phobic stimuli or studying the orienting responses (ORs) to these stimuli). I soon found that it would be most difficult to define with any degree of certainty what is/is not a biologically significant stimulus. On the other hand, I gradually came to realize that built-in sensitivity to specific stimuli could be adaptively disadvantageous if predators changed more rapidly than genes. As Suomi and Harlow (1976) pointed out, "inasmuch as rhesus monkeys and most higher primates had ancestors during an epoch when this was the case over the ancestors' ranges, it is intuitively compelling to accept the position that most predatory based fears are learned" (p. 7). Öhman's experiments had mostly used slides of snakes as typifying the stimuli with evolutionary significance.

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Karl Popper (1976) wrote that every behavioural innovation by the individual organism changes the relation between the organism and its environment and this amounts to creation and adoption by the organism of new environments which mean a new set of selection pressures. Thus, he argued, "the organism, by its actions and preferences partly selects the selection pressures which will act upon its descendants" (p. 180). This, of course, is particularly relevant to humans who constantly change and create new environments.

Similarly, Smith and Sluckin (1979, p. 411) wrote: "... we are ... drastically changing our environment from that in which our biological evolution occurred. But more fundamentally, as biological evolution is superceded by cultural evolution, 'cultural instructions' (Cloak, 1975) or 'memes' (Dawkins, 1976) may become the more important referrent for selective process, rather than genes".

It is also true that a simple determination that an association is prepared and therefore easily acquired (as certain phobias appear to be) does not carry with it a determination of the origin of the preparedness (Schwartz, 1974). Further, recent works on emotion, conditioning, orienting, etc., clearly suggest a central and often overriding role played by cognitive factors in human behaviour. Many thinkers have noted that what we perceive and experience may be decisively influenced by our beliefs, attitudes, expectations and thoughts. It is possible then that it would be more profitable to investigate the preparedness of phobias in the context of "here and now" rather than evolutionary factors and this is attempted in the present thesis.

Chapter I gives an account of the biological preparedness perspective and the difficulties associated with both its theoretical and empirical bases.

Chapter II presents experiential, including sociocultural influences, on the content of fears though the relevant evidence is largely based on anecdotal rather than objectively and systematically carried out research. The experimental part of this thesis aspires to start such an objective research by using a methodology akin to Öhman's. The problem is approached by studying the ORs to fear-relevant stimuli since the OR is thought to be an index of attention and closely associated with learning. This becomes evident in chapter III in which central aspects of the OR, including its functions, cognitive aspects and its habituation are discussed. The habituation of the OR is particularly examined in the context of arousal of the subject, including arousal due to threat.

Chapter IV is concerned with the electrodermal response, particularly with aspects relevant to this thesis.

In chapter V, the rationale, general methodology and procedure of this research are presented together with a sample of the pilot studies carried out before the experiments proper.

In chapter VI, orienting electrodermal responses to moderately feared stimuli are studied. In one of the experiments, the subjects are threatened by shock since ORs are a function of the state of the subject and clinical phobias have commonly their origin in situations associated with anxiety.

Chapter VII examines the effects of cultural influences on the ORs to fear-relevant stimuli with and without threat of shock and while subjects anticipate music which is assumed to induce pleasant arousal. Chapter VIII examines the ORs to pleasant stimuli in the culture and in the context of threat of shock and anticipation of music. A general discussion of the experiments and conclusions are presented in chapter IX.

All the experiments are carried out on students. Since the experiments make no special intellectual demands on the part of the subjects it is assumed that the findings are applicable to the population at large.

Finally, as Rachman (1977) noted, although in certain cases it is useful to distinguish between fears and phobias, it is preferable to avoid this distinction when assessing fear acquisition. The distinction between normal and pathological fears is difficult to make as their intensities seem to be graded on a continuum (Rachman, 1978a). Thus, the concepts "fear" and "phobia" are used interchangeably in this thesis but a distinction between the two is made whenever it seems to have significance in the context in which they are discussed.

CHAPTER I

BIOLOGICAL PREPAREDNESS IN LEARNING AND PHOBIAS

> "The truth is rarely pure and never simple"
> O. Wilde

1 TRADITIONAL APPROACH TO LEARNING

For a considerable time in the past, it was assumed that general laws of learning may be formulated equally well by using any species and studying any combination of stimulus, response and reinforcement (e.g. Shettleworth, 1972). Thus, as Schwartz (1974) wrote, "it has been assumed that the specific elements of an experiment may be chosen arbitrarily, and may be interchanged without seriously influencing experimental results" (p. 184). This meant that "in classical conditioning the choice of CS (conditioned stimulus), US (unconditioned stimulus) and response is of relative indifference; that is, any CS and US can be associated with approximately equal facility, and a set of general laws exist which describe the acquisition, extinction, inhibition, delay of reinforcement, spontaneous recovery, etc., for all CSs and USs" (Seligman, 1970, p. 407).

Long before Seligman, Pavlov himself had explicitly stated: "Any natural phenomenon chosen at will may be converted into a conditioned stimulus ... any visual stimulus, any desired sound, any odor and the stimulation of any part of the skin" (Pavlov, 1928, p. 86), and "the reflex activity of any effector organ can be chosen for the purpose of investigation, since signalling stimuli can get linked up with any of the inborn reflexes" (Pavlov, 1927, p. 17). Similarly, Skinner (1938) suggested that "the dynamic properties of operant behavior may be studied with a single reflex" (cited in Seligman, 1970). The basis of this theorizing in learning has been called "the assumption of equivalence of associability" and has been thought to lie "at the heart of general process learning theory" (Seligman, 1970, p. 407).

A large body of research todate in both classical and operant conditioning has indicated that similar laws do appear to hold over a wide range of arbitrarily chosen associations. Seligman (1970) noted, for example, that the shape of generalization gradients is very similar for electrodermal responses classically conditioned to tones with shock as the US (Hovland, 1937), and for salivating to being touched at different points on the back when food is the US (Pavlov, 1927).

However, it is possible that the laws of learning which have been described on the basis of studying arbitrary events are not general and are peculiar to such events. Indeed, work within the traditional conditioning paradigms has provided evidence which challenges the assumption of equivalence of associability and suggests that a CS may be more or less associable with a specific UCS (US). For many writers this is exemplified by experiments using the taste-aversion paradigm (e.g. Seligman and Hager, 1972; Öhman, Fredrikson, Hugdahl and Rimmo, 1976).

2 TASTE AVERSION AND PREPARED LEARNING

In the original experiment by Garcia and Koelling (1966) water-deprived rats were trained to drink plain water in the test apparatus and preconditioning baseline rates of licking were obtained while rats received "bright-noisy, saccharin-tasting water", i.e. whenever the rat licked the test apparatus with saccharine flavoured water, audio-visual stimuli (click-flashing light) were also presented. The conditioning procedure involved the pairing of this compound preaversive stimulus (gustatory and audio-visual components) with either X-radiation, or toxic lithium chloride solution or electric footshock (X-radiation and lithium chloride make rats ill). Conditioning took place over a number of days. Two days after their last conditioning trial, the amount of decrease in licking rate was compared to the baseline rate. It was found that rats who were given X-radiation and lithium chloride reduced licking to the gustatory (saccharin) component but not to the audio-visual (click-light) component. In contrast, rats shocked in the presence of the compound stimulus decreased licking rate to the audio-visual component but not to the gustatory component. In other words, rats appeared to associate the taste but not the noise-light with illness. The interpretation of the result was that evolutionary processes, through natural selection, have preprogrammed rats to develop readily avoidance behaviour to interoceptive cues following internal illness and to exteroceptive cues following pain on the surface of the body. As in every instance of inheritance through the operation of natural selection, this means that in a variable population, the elimination of some individuals and the survival of others must depend on how well the different individuals fit the environment. In Darwin's

Origin of Species (1859), the factors responsible for survival in a particular environment are collectively called "favorable variations". Such variations are passed on from generation to generation while unfavourable variations are eliminated.

A number of subsequent experiments have provided further evidence which appears to support the evolutionary explanation of taste aversion. Garcia, McGowan and Green (1972) reported that exteroceptive stimuli are not effective CSs when paired with toxicosis. Other workers showed that taste aversions may be acquired with considerable delays (75 minutes) between taste and subsequent illness, i.e. the interstimulus intervals (ISIs) ranging much longer than the maximum CS-US intervals that produce "arbitrarily chosen" associations (Beecroft, 1966; Garcia, Ervin and Koelling, 1966). Recently, Balcom, Coleman and Norman (1981) found that juvenile rats can learn taste aversion with CS-UCS delays as long as 4 hr. This capability of rats seems to give a selective advantage to the organism since illness often does not appear until considerable time after ingestion of toxic substances.

Studies on taste aversion also indicated that responses may be acquired on a single trial (Revusky and Bedarf, 1967), show slow extinction (Mineka, Seligman, Hetrick and Zuelzer, 1972), and appear to be noncognitive (Roll and Smith, 1972; Kalat and Rozin, 1972). By "noncognitive" it is meant that processes such as "conscious expectations, attention, 'information seeking', hypotheses, and beliefs" (Seligman and Hager, 1972, p. 97) are not involved. Thus, Roll and Smith (1972) found that rats can form taste-poisoning associations under deep anaesthesia. Kalat and Rozin (1972) showed that prior learned aversion to a solution does not affect the amount of interference it produces subsequently, i.e. unlike other associations, taste aversion is not susceptible to "blocking effects" (Kamin, 1969). This, according to Kalat and Rozin, suggests that the rat is not acting as an "information seeker" in taste-aversion learning and possibly that the CS does not become a signal for the UCS but it takes the negative emotional properties of the UCS. In other words, the rat avoids a taste "not because it predicts poisoning, but because it now tastes unpleasant" (p. 121).

There is now a vast literature on taste aversion and the experiments referred to above are, perhaps, amongst the most critical ones.

Some writers took the view that the findings from the taste-aversion experiments could be incorporated into existing, or slightly modified general laws of learning (e.g. Krane and Wagner, 1975; Logue, 1979), while others advocated extensive revision of these laws (see Rozin, 1977). Amongst them, Seligman's (1970) approach to taste aversion and other learning phenomena has been particularly influential.

According to Seligman and Hager (1972), studies on taste aversion indicate instances of "biologically prepared conditioning". Seligman (1970) asserted that associations for a given species can be ordered on a dimension of preparedness defined operationally as follows: "The relative preparedness of an organism for learning about a situation is defined by the amount of input (e.g. numbers of trials, pairings, bits of information, etc.) which must occur before that output (responses, acts, repertoire, etc.) which is construed as evidence of acquisition, reliably occurs" (p. 408). In discussing classical conditioning Seligman (1970) suggested that if an organism makes the indicant response consistently from the first presentation of the CS, such "learning" can be regarded as a case of instinctive responding and therefore the extreme of the "prepared" end of the dimension. If the organism makes the response consistently after only a few trials, it is somewhat prepared. If the organism makes the response only after extensive training, it is "unprepared". Finally, if the organism makes the response only after very many pairings or it does not make it at all, the organism is "contraprepared". Thus, "the number of pairings is the measure that makes the dimension a continuum, and implicit in this dimension is the notion that 'learning' and 'instinct' are continuous" (p. 408).

Öhman, Fredrikson, Hugdahl and Rimmo (1976) have noted that so far the preparedness dimension is a descriptive device for the ordering of associations in terms of the ease with which learning is achieved. Seligman, however, points out that it may be used as a predictive theory if different parametric relationships of learning are shown to be valid for different points of the continuum. The taste-aversion paradigm has been used as a model phenomenon and it has been suggested that, generally, and as compared with unprepared, prepared associations are readily acquired, highly resistant to extinction, not mediated by cognitive mechanisms, and probably have a different physiological substrate

(Seligman and Hager, 1972).

2.1 PROBLEMS IN INTERPRETING THE TASTE-AVERSION DATA

Delprato (1980) wrote that critical examination of the relevant literature reveals that the genetic explanation of the taste-aversion phenomena is not unequivocal. He referred to a number of studies which have noted considerable difficulties with the adaptive-evolutionary interpretation of the data. Some of the difficulties pertaining to methodological and interpretative considerations and highlighted by Delprato and other writers will be discussed briefly.

The taste-aversion studies are basically limited by their failure to consider the developmental history of the organisms and the importance of the experience of animals with exteroceptive stimuli in taste-aversion behaviour. Testa and Ternes (1977) argued that because of the preexperimental history of the rat, taste stimuli used in taste-aversion conditioning were more novel than auditory or visual stimuli. This is due to the fact that laboratory rats are usually given unflavoured water whereas they are exposed to a variety of sounds and visual stimuli. The difference in novelty between the gustatory and audio-visual stimuli would be expected to result in the latter being less effective as predictors of unconditioned stimuli (Rescorla, 1967; Dickinson and Mackintosh, 1978). As Mackintosh (1978) wrote, "animals may learn to ignore stimuli that predict no change in reinforcement" (p. 53). Wagner (1977) had earlier argued that the conditionability of a stimulus declines as its novelty wears off. Also, it has been shown that both wild (Barnett, 1958) and laboratory rats (Jennings and McCutcheon, 1974) have a natural tendency to avoid novel stimuli (i.e. they are "neophobic") and Mitchell (1978) suggested that the conditioning procedures employed in the taste-aversion paradigm are superimposed on the neophobic dispositions of rats. Mitchell, Winter and Moffitt (1980) demonstrated that the relative novelty of interoceptive (taste) stimuli is "an important determinant of the avoidance behavior characteristic of both taste neophobia and conditioned taste-aversions" (p. 526). Further, according to Mackintosh (1973, 1974), from birth, the rat is given opportunities to learn that visual and auditory stimuli are more likely to be associated with changes at the surface of the body than with internal changes. Conversely, changes in gustatory stimulation are more readily associated with internal states than changes at the body surface. Consequently, it could be argued that ontogenetic rather than the evolutionary history of the organism is responsible for the taste-aversion results.

Similarly, Testa (1975) discussed the taste aversion results in terms of the empirical finding that stimuli which have similar temporal intensity patterns and similar locations are more easily associated than stimuli with dissimilar temporal intensity patterns and dissimilar locations. In the taste-aversion experiments, "similar location" applies to the digestive system, while "similar temporal intensity patterns" of interoceptive effects are thought to be produced by the effects of both ingestion and illness, as in even a long delay between taste and illness, stimulation from ingestion may persist until the onset of illness. In short, as Mackintosh (1978) wrote, "conditioning occurs selectively to relatively good predictors of reinforcement at the expense of relatively poor predictors".(p. 52).

Bandura (1977) observed that in the studies on taste aversion food flavours were paired either immediately with shock or, after considerable delays, with nausea. This meant that the type of paired experience varied with the time interval of pairing. Thus, differences in the case with which aversions are learned could be due more to variations in time delays and to stimulus characteristics than to differences in associability of gustatory cues with illness. Bandura cited Krane and Wagner (1975) who showed that delayed shocks produce aversion to sweetened water but immediate shocks do not. On the other hand, immediate shocks produce aversion to water accompanied by bright-noisy cues while delayed shocks appear ineffective. Krane and Wagner explain the variations in aversive learning in terms of the fact that the flavour trace of food is more persistent than the stimulus trace of exteroceptive cues. Bandura also noted that in the taste-aversion experiments the duration, development and intensity of unpleasant experiences are uncontrolled and these may significantly affect how easily aversions can be acquired.

Several studies (reviewed in Nachman, Rauschenberger and Ashe, 1977) have investigated the role of exteroceptive stimuli in taste aversion. The general conclusion has been that such stimuli are of little or no importance in taste-aversion learning. In a more recent study by Archer, Sjödén, Nilsson and Carter (1979), a procedure was used to test for variations in taste aversion in the presence and absence of an exteroceptive compound. The compound stimulus consisted of taste (saccharin) and exteroceptive cues (cage, drinking bottle, and an odour). It was found that the exteroceptive stimuli played an important role in the taste aversion developed after the compound was paired with lithium chloride. That is, change of context from conditioning to extinction resulted in the reduction of saccharin aversion.

In their subsequent study, Archer, Sjödén, Nilsson and Carter (1980) found that while the presence or absence of the odour which was present on the conditioning trial did not influence saccharin intake during extinction trials, the presence of the particular cage in which, and the bottle from which, the saccharin had been consumed decreased significantly saccharin intake as compared to the absence of these cues. In other words, these exteroceptive stimuli played an important modulating role in taste-aversion learning and, thus, the authors wrote, "it is untenable to claim that exteroceptive stimuli are of little or no importance in taste-aversion learning ... In fact, we were able to show strong exteroceptive control after only a single conditioning trial" (p. 212). On the other hand, they thought that the failure of the odour to control consumption of saccharin contradicts the evolutionary explanation of the taste-aversion learning since, from a prepared-learning point of view, the "olfactory cues in taste-aversion learning could be placed on a par with taste cues in contrast to other exteroceptive cues". This is because olfaction is associated with feeding behaviour and therefore "represents a phylogenetically old system which is used by rats to identify food compounds" (p. 199).

Other experiments (Rudy, Iwens and Best, 1977; Willner, 1978) not only have shown conditioning of aversions to exteroceptive cues paired with toxicosis but they have also demonstrated a "blocking effect" as described by Kamin (1969). That is, prior association of an aversion with an exteroceptive cue attenuated subsequent development of an aversion to an interoceptive cue which was paired with illness. Thus, "a cue that supposedly can be only weakly conditioned at best interfered with conditioning to what is hypothesized to be a relevant, evolutionally significant one" (Delprato, 1980, p. 87).

The above indicate that the evidence from the taste-aversion data which has been used in support of the notion that aversive associations are decisively influenced by biological preparedness in learning is not conclusive. However, it should be added that, on the whole, these data do pose considerable difficulties for the general process learning theory and the "assumption of equivalence of associability" (Seligman, 1970, p. 407).

A number of workers have studied escape-avoidance behaviour and put forward the proposition that such behaviour, like taste aversion, is subject to evolutionary constraints (Seligman and Hager, 1972). However, the difficulties with the relevant research seem to parallel those noted for the taste-aversion experiments and therefore any evolutionary interpretation of avoidance learning ought to be viewed with caution (See Delprato, 1980).

3 PHOBIAS AS INSTANCES OF PREPARED LEARNING

Frequently, phobias involve well-defined reactions of intense fear to specific objects or situations. As such, they have been thought of by many theorists as amenable to a stimulus-response analysis in which phobias are seen as classically conditioned responses (CRs) to previously neutral stimuli and resulting from pairing of the latter with some traumatic UCs. However a number of writers have noted several problems with this analysis (e.g. Costello, 1970; Rachman, 1976, 1978a; Eysenck, 1979). These problems include the fact that phobias are rapidly acquired but experimentally conditioned fear is usually established after a number of trials. Phobias, on the other hand, do not extinguish readily unlike conditioned fears which do. Because of the problem of extinction, Eysenck and Rachman (1965) adopted an avoidance-conditioning (two-factor) theory which attaches critical importance to the role of the fear drive in maintaining phobias. That is, once a person acquires an unpleasant reaction to a particular stimulus he tends to avoid the stimulus and his avoidance precludes the extinction of the phobic reaction since the latter can only be extinguished by repeated unreinforced evocations of this behaviour. However, as Seligman and Johnston (1973) have argued, although the motor avoidance response is very resistant to extinction, the conditioned fear which supposedly motivates the avoidance response extinguishes rather rapidly. Another problem with the conditioning theory of phobias is that whereas human conditioned responses are sensitive to cognitive factors (Grings, 1973) phobias are not amenable to reason (Marks, 1969). Finally, conventional conditioning theory has a difficulty in explaining the relatively limited range of the stimuli which become phobic (Marks, 1969). As noted above, in the past the choice of CS in classical conditioning had been thought to be unimportant. The apparent selectivity in phobias is the focus of this thesis and therefore will be discussed in some detail.

Phobias do not occur randomly with respect to all objects and situations. Rather, they tend to comprise a nonarbitrary and limited set of stimuli (Marks, 1969). For example, agoraphobia (fear of going out alone, shopping, travelling, etc.), social phobias (speaking in public, eating, working in company, etc.) and certain animal fears (dogs, snakes, etc.) appear to be relatively common. In contrast, phobias of, for example, electric-outlets or hammers are seen very rarely, even though these objects are frequently associated with traumatic experiences. This implies that people are "selective" as far as phobic stimuli are concerned and a question arises regarding the nature of this selectivity.

Seligman (1971) in an extrapolation from animal studies and particularly taste-aversion conditioning (which, as seen, provided the evidence for coherence between the defining and empirical features of prepared learning) proposed that: "They (phobias) are instances of prepared conditioning", and "phobias are highly prepared to be learned by humans, and, like other highly prepared relationships, they are selective and resistant to extinction, learned even with degraded input, and probably are noncognitive" (p. 314). It appears that this interpretation "not only accounts for the selectivity of phobias, but it also parsimoniously explains their very rapid acquisition, slow extinction, and resistance to rational arguments" (Öhman, Fredrikson, Hugdahl and Rimmo, 1976, p. 316).

However, a closer examination shows discrepancies between clinical data and the theory. As instances of prepared learning phobias are assumed to have been intimately associated with the survival of the primitive man and it is predicted that they are "largely restricted to ... potential predators, unfamiliar places and the dark" (Seligman and Hager, 1972, p. 465). Nevertheless, common phobias such as agoraphobia and social fears which comprise 60% and 8% of clinical phobias respectively (Maudsley phobics - see Marks, 1969) are not included amongst those predicted by Seligman and Hager (it should be noted that agoraphobics are not necessarily afraid of "unfamiliar places"). In contrast, animal (predator) fears which are mentioned by Seligman and Hager comprise only 3% of clinical phobias (Marks, 1969). Furthermore, the preparedness theory does not account for the onset of common phobias such as agoraphobia and social fears as, while it predicts sudden onset, these phobias are acquired gradually and over long periods of time (Marks, 1969; Rachman, 1978b).

On the other hand, Seligman (1971) acknowledged that phobias are not exclusively instances of prepared learning and wrote that "people sometimes talk themselves into phobias" but such phobias "should be less frequent since they are less prepared" (p. 317). The possibility that people "talk themselves into phobias" suggests the involvement of cognitive factors (expectations, attention, etc.) in the formation of these relatively "unprepared" and unlike the prepared phobias. To the question of whether the same mechanisms are responsible for learning in prepared and unprepared situations, Seligman's (1970) response is that "we can barely give a tentative answer ..." (p. 416). Thus, attractive as it may be for its plausibility, Seligman's theory cannot be regarded as a comprehensive or parsimonious analysis of phobias even in the context of what has already been discussed. However, before referring to further empirical evidence in conflict with the theory (sections 5.2.1 and 5.3) there will be some theoretical considerations of its basic assumptions and of the experimental evidence often cited in support of it.

4 ANIMAL STUDIES, EVOLUTION AND MAN

For a long period in the past, psychologists viewed the human mind and the animal mind as points on a continuum, differing quantitatively but not qualitatively. This was the assumption of "mental continuity" (Lockard, 1971, p. 168) and it was reflected in thousands of animal studies which aspired to illuminate human behaviour. However, after 100 or so years of experimental psychology we have no animal-based science of human psychology and many psychologists have recognised that the assumption of mental continuity was fundamentally wrong.

Works such as those of Lorenz and Timbergen revealed that each animal behaviour has a history of natural selection and any surviving animal species may be assumed as having evolved behaviours adapted to its particular niche. Since each niche is unique, it could be argued that a science of behaviour is not feasible "beyond catalogs describing all the independent behaviours of all species" (Lockard, 1971, p. 172).

However, Lockard wrote, behavioural homologies in different animals may be studied on the basis of the principles of "phylogenetic relatedness" and "ecological convergence". That is, species with a common ancestor may have similar behaviours because they were derived from a common set of behaviors" (p. 172); also, similar behaviours among unrelated species may result from similar selection pressures. The methods of studying behaviours in the context of phyletic relatedness and ecological convergence could be referred to as "comparative" and "ecological" methods respectively (Lockard, 1971).

A radical revision of laws of behaviour is now under way and, as Lockard wrote, it is recognized that, because behaviours have evolved independently, "laws based on specified treatments having specified effects wrongly presume homologous underlying processes and are therefore unlikely to have scientific merit except for restricted cases of related taxa" (p. 175) and for species under similar ecological demands. Accordingly, "valid statements about animals in general or behavior in general obeying some treatment-effect paradigm should remain few" (p. 175).

The theory of preparedness of phobias has been based on animal studies and particularly taste-aversion paradigm in rats. However, as Lockard argued, "rodents and primates either nearly or completely fail to share a common ancestor" and their remoteness (approximately 100 million years) of relationship "makes them irrelevant to each other for all comparative purposes" (p. 174). The same is true about the selection pressures on these two species which, therefore, cannot be studied in the context of the ecological method.

It could be argued that the preparedness theory talks of different associations various species can make with different degrees of readiness and in the extrapolation from taste aversion to phobic responses it has not been claimed that these two types of associations are equivalent. Nevertheless, the theory specifically states that both types of learning are "prepared" associations and as such they share homologous underlying processes and show common characteristics. However, Lockard (1971) wrote, "... what we may perceive as a meaningful and natural category is actually a mere collection of unlike phenomena, unlike because they work in different ways at the basic levels while appearing similar superficially" and "... it seems inappropriate to group together behaviors that seem similar or to assume that the same basic process underlies the various behaviors that might be so grouped" (p. 172). On the other hand, one could also argue, that life on earth had a single origin and certain general processes (including, perhaps, prepared learning) may be shared by animals as, for example, certain genetic mechanisms and cellular construction in the case of DNA. According to Lockard, "it is completely unclear to what extent analogous uniformities might hold for behavior" (p. 175).

Shettleworth (1972) pointed out that the preparedness hypothesis "obscures the fact that apparent differences in learning difficulty may be brought about by a number of different mechanisms, not all of which are specifically associative" (p. 4). This, in fact, was recognised by Seligman and Hager (1972) who wrote "evolutionary pressures may have operated to produce highly peculiar forms of learning, and future theorists may have to content themselves with laws which are restricted to particular species in their particular evolutionary niches" (p. 465). Other theorists, for example Razram (1971) argued that to shed light on human behaviour, evolutionary and ecological studies of animal behaviour must hinge on full-scale analyses (behavioural, neural and chemical) of ontogenetic learning which, of course, are not in evidence in Seligman's theory. It should also be pointed out that some writers argued that human learning, unlike animal learning, may be governed by laws which are in accord with the general process learning theory. Indeed, there are numerous studies indicating that aversive conditioning in humans with "nonprepared" CSs is a commonly observed phenomenon (see Turner and Solomon, 1962 for a review). Thus, in his thoughtful review of the preparedness concept, Schwartz (1974) suggested that analysis of how behaviour is shaped from experience and brought under the control of arbitrary events can be more informative about the factors operating on human conduct than is the study of associations lower animals are genetically predisposed to make.

Bandura (1977) similarly argued that the fact that learning in lower species operates under severe biological constraints does not necessarily suggest that human learning is governed by such constraints. "Humans", Bandura (1977) wrote, "are capable of learning an extraordinary variety of behaviors. They learn to play tennis, to build automobiles, to fly airplanes, to create social systems and bureaucracies, and to espouse ideologies without requiring specific associative mechanisms for each class of activity. The innate preprogramming that enables animals to deal in a stereotyped fashion with the recurring demands of a limited habitat would not be evolutionary advantageous for humans, who must often cope with exceedingly complex and rapidly changing circumstances" (pp. 73-4).

Thus, taste aversion in rats and human conditioning of fear may not be analogous types of learning. The undoubted importance of evolution in animal and human behaviour dictates that these two types of "associations" may be underlain by different mechanisms and extrapolation from one to another may have little more than literary merit.

However, there is evidence suggesting that humans, too, develop strong taste aversions (e.g. Marks, 1977) and these may provide the model of human fear acquisition. Unfortunately, there has been no adequate and/or systematic laboratory research on human taste aversions and we do not know whether these show the same characteristics as taste aversion in rats. The limited evidence that exists does not suggest that taste aversion in humans and rats can be equated. Evans and Busch (1974), for example, found that, in contrast to results from the main rat experiments (section 2), taste in humans can be an effective CS when the UCS is shock.

Rachman (1977) argued that "the evidence on acquired taste aversion is <u>relevant</u> to the conditioning theory of fear acquisition" (p. 383). However, as Carr (1979) wrote, the evidence to which Rachman referred to in order to illustrate the relevance of taste aversion (Wallen, 1945; Adams and Rothstein, 1971) suggests only a suggestibility of some individuals "to develop both fears and taste aversions rather than a common process of acquisition through classical conditioning" (p. 213). Rachman (1977) also pointed out that if the taste-aversion phenomenon is to provide the basis for a conditioning theory of fear we should "de-emphasize the temporal qualities of classical conditioning processes" (p. 378). This is because in taste aversion we see considerable delays between CS and UCS while classical conditioning is established by temporal proximity between the two stimuli. Thus, although taste aversion may be relevant to the persistence of avoidance behaviours, its relevance to the acquisition of fear is not clear (Carr, 1979).

It should be added that a model in psychopathology should have symptoms, causal events and anatomical structures in common with the pathology it models (Maser and Seligman, 1977). The symptoms of taste aversion and fear are hardly similar apart, perhaps, from avoidance behaviour and while the predominant feature of taste aversion is disgust, the predominant one in fear is apprehension. Also, despite physiological changes in both phenomena, we do not know whether similar anatomical structures are active in taste aversion and fear.

In the light of the above, the comparability of taste aversions and fears is questionable. It remains to be seen whether the preparedness theory of phobias can be supported with more direct evidence.

5 EVIDENCE FOR BIOLOGICALLY PREPARED PHOBIAS

The relevant evidence comes mainly from three sources:

(a) Experiments with children
(b) Experiments with adults
(c) Clinical cases studied in the context of the preparedness theory.

5.1 EXPERIMENTS WITH CHILDREN

The original experiment on conditioning of fear is the case of Little Albert. This experiment was carried out by Watson and Rayner (1920) and effectively demonstrated fear acquisition to a previously "neutral" white rat stimulus by its pairing with a loud noise.

A number of writers (e.g. Thorndike, 1935) questioned the extent to which the Little Albert case can be used as a model of conditioned fear. The CS, the argument goes, was hardly neutral, as through natural selection, humans tend to acquire fears of rats (and furry objects generally) and therefore it cannot be claimed that true conditioning was demonstrated. Nevertheless, the Little Albert case seems to be in agreement with the concept of preparedness by Seligman (1970, 1971). Indeed, as Delprato (1980) noted, the same concept appears to account for the often cited discrepancies between the experimental findings of Watson and Rayner on the one hand and those of Bregman (1934) and English (1929) on the other (e.g. Öhman, Fredrikson and Hugdahl, 1978a). However, examination of the studies by Bregman and English reveals that the alleged discrepancies may not be as clear as previously thought.

In one experiment, English (1929) did replicate the findings of Watson and Rayner by obtaining conditioning to a black stuffed cat in a girl aged 28 weeks and 3 days; at the moment that her mother offered her the cat, an older sister screamed in protest "at the invasion of her property" (p. 221). The little girl withdrew in fear and giving a distinct wail would have nothing more to do with the cat with which she had played earlier that day.

In another experiment, English (1929) struck a large metal bar behind the head of a girl of 14 months and 9 days whenever she grasped a toy duck lowered to her by a string. There were no conditioning effects even after 50 trials. The interpretation often given to this result is that, unlike the rat in Little Albert's case, the toy duck had no evolutionary significance for conditioning to occur. However, such an interpretation does not seem to be necessarily valid as English reported that the UCS used (the noise from the metal bar) "failed to evoke fear" in the first place. Only once did the child show "what might be called a worried look" (p. 222). Delprato (1980) thus, is justified in writing "that those who cite this case as failing to produce conditioning because of the nature of the preaversive stimulus ignore the fact that there was no aversive stimulus in the study" (p. 81) - without a functional UCS, of course, no stimulus can become an effective CS. Furthermore, Carr (1979) pointed out, the CS used by English in this experiment, a toy wooden duck, may well have reflected effects of latent inhibition. Thus, both the CS and UCS were far from adequate stimuli for conditioning to occur.

Bregman (1934), one of Thorndike's students, specifically investigated whether "objects having no inherent biological significance" (p. 169) could become stimuli of fear and avoidance or approach in a conditioning situation. In a within-subjects design, she used 15 institutionalized normal children (aged 8-16 months) and a set of six kinds of CSs. Three neutral stimuli were paired with a startling noise from a loud electric bell (aversive UCS) and three other neutral stimuli were paired with an "agreeable" stimulus, i.e. a rattle or a melody (pleasant UCS). The main finding was that subjects showed no more fear (indexed by "negative" behaviour, e.g. crying, puckering) to stimuli paired with the aversive UCS than they did to the stimuli paired with the agreeable UCSs. This result seems to support the preparedness concept as the CSs used (block of wood, wooden triangle and cloth curtain) were presumably of no evolutionary significance. However, as Carr (1979) observed, it is not certain that the UCS elicited fear and Bregman wrote that "the most frequent change was that of increase in interest" (p. 190) rather than fear. Delprato (1980) also noted that Bregman did not evaluate the discriminability of the two sets of stimuli. In the light of the age of her subjects, the fact that for each preaversive CS there was a corresponding similar stimulus which was paired with the agreeable UCS and that differential conditioning was administered only for a small number of trials, the discriminability of the sets of stimuli was of crucial importance. Furthermore, the procedure of the experiment ruled out the possibility that fear conditioning would have been observed. This is due to the way the CSs were presented. A subject who went through one cycle of the experiment was given two conditioning trials (CSs paired with their respective UCSs) and three test trials (CSs presented alone for 90 seconds). Eleven (out of the 15 subjects) went through two cycles of the experiment and therefore they were exposed to four conditioning trials and six extinction trials with each CS. Delprato remarked: "... under these conditions any indication of differential conditioning would have been remarkable" (p. 82). One should, finally, note that the infants' behaviour was observed only by the experimenter herself and, given the nature of the responses recorded (as negative, positive and indifferent), interobserver agreement data would normally have been required. With all these methodological problems considered, the notion that Bregman's study provides support for the evolutionary hypothesis as hinted by Thorndike (1935) and implied by Seligman (1970) does not appear justified.

There is another study by Valentine (1930) which is also quoted (e.g. Gray, 1971a; Marks, 1969) as consistent with the evolutionary viewpoint. Valentine blew a loud wooden whistle behind his one-year old daughter when she stretched out to touch a pair of opera glasses. On each of two such instances the child showed no fear either when the glasses were presented alone nor when the whistle was blown. Later, in the same afternoon, the child turned immediately away and appeared in some distress when she was shown a "woolly" caterpillar. On each of four paired presentations of the caterpillar and the whistle the child gave a loud scream and turned away from the caterpillar at the onset of the loud noise. These tests were repeated over the next few days and the child showed signs of an unstable fear of the caterpillar. Whenever the fear showed signs of spontaneous extinction, it could readily be restored after only slight provocation. According to Valentine the whistle released the innate fear of the caterpillar in the child and he noted: "Here we have again the rousing of the lurking fear by the added disturbance of the whistle" (p. 218). Reviewing Valentine's study, Delprato (1980) remarked that conditioning to the opera glasses should not have been expected in the first place since the whistle was not really effective as a UCS (according to Valentine it evoked only a mild negative reaction), and only two paired trials of the glasses with the whistle were administered. On the other hand, what makes the conditioning claim to the caterpillar more dubious is the fact that Valentine gave no indication of whether fear behaviour toward this animal alone increased beyond the point observed in its original presentation, i.e. prior to its pairing with the whistle. Thus, Valentine's claim that increase in fear behaviour when the whistle was paired with the caterpillar represented the release of innate fear of caterpillars is no more adequate an explanation of the results than the empirical principle of summation (Kimble, 1961; Hall, 1976). This principle would predict that the initial fear behaviour shown by the child when she was confronted with the caterpillar would summate with small amount of startle or fear to the whistle.

It is apparent, then, that the outcome of the study by Valentine is no less equivocal than the results of the studies by English and Bregman. Delprato, therefore, is largely justified in remarking that the contention that Watson and Rayner's results could not be obtained with supposedly survival-neutral stimuli appears to have "minimal foundation" (p. 83).

Finally, before closing this section, one should perhaps question the relevance of studies on children to phobic reactions of adults as innate factors have far more powerful influences on children than adults. As Schwartz (1974) wrote, "organismal flexibility increases with ... development. Simpler organisms profit less from experience than more complex ones", and "infantile behavior is far more rigid than adult behavior" (p. 195). This, however, will be elaborated in the next chapter.

5.2 EXPERIMENTS WITH ADULTS - ŌHMAN'S RESEARCH

The concept of preparedness in learning and particularly the notion that phobias could be seen as instances of biologically prepared learning (Seligman, 1970; Seligman, 1971) generated an innovative series of experiments by Ōhman and his associates. As they were directly derived from the ideas by Seligman and rigorously conducted, these experiments will be reported in some detail.

According to Seligman, highly prepared responses (including phobias) are: (a) rapidly acquired, (b) slowly extinguished and, (c) probably not mediated by cognitive activity. Ōhman, Erixon and Lõfberg (1975) reasoned that "the most basic suggestion in the theory is that the nature of the stimulus is decisive for the characteristics of phobic fears" (p. 41). In their study, therefore, they examined the classical conditioning of skin conductance responses (SCRs) of 64 subjects to colour slides of potentially phobic (snakes) and supposedly neutral (human faces or houses) stimuli. There were 10 different pictures in each set of snakes, houses and faces in order to avoid incidental influences unrelated to the constant feature of each set. The order of presentation of the pictures was randomized individually for each subject. Each slide was shown for 8 seconds. The inter-stimulus intervals (ISIs) varied between 20 and 40 seconds. Each picture was presented twice, the first time in the acquisition phase in which all stimuli in all sets were presented, and the second time in the extinction phase which also included all stimuli in all sets. The unconditioned stimulus (UCS) was an "uncomfortable electric shock" (p. 41) of 50 milliseconds duration. The subjects were instructed that they would experience a number of shocks and three different types of pictures consisting of snakes, houses and human faces. During acquisition, one group of 32 subjects was shocked after each presentation of the phobic (snake) picture. Of the remaining 32 subjects, half were shocked after houses and half after faces. As these two subgroups did not differ, they were combined into one neutral group. With this design, responses to the shocked phobic stimuli in one group could be compared with the responses to the unshocked phobic stimuli in the other group. Similar comparisons could be made between shocked and unshocked neutral stimuli in the two groups. Before the extinction trials started, the experimenter disconnected the shock electrodes and informed half of the subjects in each group that no more shocks would be administered. To the other half of the subjects the experimenter said he only checked the electrodes. Following Lockhart (1966) and Öhman (1971), who have shown that multiple responses are susceptible to different experimental manipulations, Öhman et. al. measured amplitudes of responses as changes in the following latency intervals: 1-4 seconds after CS onset (CS-responses or FARs, i.e. First-interval Anticipatory Responses - Prokasy and Kumpfer, 1973); 4-9 seconds after CS onset (Pre-UCS-responses or SARs, i.e. Second-interval Anticipatory Responses); 1-4 seconds after CS offset during extinction trials (post-UCS-responses or TORs, i.e. Third-interval Omission Responses).

In the 10 acquisition trials of the experiment, both groups showed equal conditioning of FARs and SARs. During the 10 extinction trials, however, there were lasting conditioning effects in FARs, and to a lesser extent in TORs, to phobic but not to neutral stimuli. Furthermore, instructions that no more shocks would be given were ineffective in modifying FARs but not TORs in the group shocked when presented with phobic stimuli. These results appeared to suggest that phobic stimuli are more effective CSs when paired with an aversive stimulus than neutral stimuli. It should be noted that this effect is seen only in the resistance to extinction of the former group of stimuli. The experimenters concluded that "since the phobic stimuli seem to be especially potent as danger signals, the present results offer support for the prepared learning theory of phobias" (p. 44). They also proposed that their paradigm could provide a more adequate laboratory analogue to phobic fears than other conditioning models (e.g. by Eysenck and Rachman, 1965) since it accounts both for the selectivity of phobias and their resistance to extinction. Finally, the ineffectiveness of instructions to modify the subjects' responses to the snake stimuli contrasts with electrodermal data in conditioning studies which suggest that manipulation of instructions significantly affects the level of responding (Grings and Lockhart, 1963) and, in particular, instructions that no more UCSs would be administered facilitate extinction. Öhman et. al. view this finding as being analogous to the fact that phobic fears are not amenable to rational arguments (Marks, 1969).

Many other studies by Öhman and colleagues have followed the above publication. Öhman, Eriksson and Olofsson (1975) found that SCRs conditioned to phobic stimuli (slides of snakes) after only one CS-UCS pairing showed practically no extinction. However, responses to neutral stimuli (slides of houses) showed rapid extinction after both 1 and 5 reinforcements. The experimenters stressed that the observed effect in the group presented with phobic stimuli "was a specific associative one" (p. 624) and not due to sensitization or CS-alone effects. They used 12 groups with 10 subjects in each. The first factor in their 3x2x2 design consisted of treatments (conditioning, sensitization and CS-alone), the second factor was CSs (phobic (snakes) vs. neutral (houses)) and the third factor was reinforcements (1 vs. 5). These results were seen as further evidence in support of the preparedness theory of phobias as "the expectations from prepared learning theory were fully confirmed for the extinction electrodermal data" (p. 625). The acquisition data, however, were less consistent as the prepared learning hypothesis was only partially confirmed for the pre-UCS responses (SARs) and clearly disconfirmed for the CS- and post-UCS responses (FARs and TORs).

In this study, finger pulse volume (FPV) changes were also measured as an additional index of autonomic conditioning. There were no significant effects during acquisition and during extinction the conditioning groups exceeded only the CS-alone group. There were no effects of the stimulus content. This negative finding was seen as indicating that vasomotor responses are less sensitive than electrodermal ones rather than as being evidence against the preparedness theory. In support of such an interpretation, the experimenters cite Furedy and Gagnon (1969) who have suggested that peripheral vasomotor changes are less sensitive to psychological impact than electrodermal responses.

Finally, Öhman, Eriksson and Olofsson recorded subjective "ratings of discomfort" produced by the type of stimulus and the differences between the ratings before and after conditioning were computed. It was found that there were detectable subjective effects of the phobic conditioning procedure and that there was a good agreement between the ratings and the electrodermal measures.

In an extensive paper, Öhman, Fredrikson, Hugdahl and Rimmo (1976) reported three more experiments on conditioning of electrodermal responses to different pictures, using electric shock as UCS. All the experiments involved a long interstimulus interval and a "genuine differential paradigm" (p. 318) which allowed unconfounded assessment of conditioning on a within-subjects basis (Lockhart and Grings, 1963) and therefore it was a more sensitive tool than the between-subjects designs used in the previous studies. This paradigm employs two cues which elicit similar initial responses. One of them is then consistently reinforced (CS+) whereas the other is consistently nonreinforced (CS-). With this design, differences in responses to CS+ and CS- after conditioning can be compared across different kinds of stimuli and independent of initial reactivity differences or differences in sensitization.

The criteria for selecting phobic and neutral stimuli were made explicit. First, the phobic stimuli should include objects which evoke fear among people in the clinic; second, a phylogenetic origin should be suggested; third, these stimuli should be easily represented in a picture. Thus, snakes and spiders were selected. In contrast, the neutral stimuli should include objects for which an evolutionary preparedness to be easily associated with shock-induced fear "would be farfetched" (p. 318) and they should be similar to the phobic stimuli in general characteristics such as background. Thus, flowers and mushrooms were selected. In the first experiment of this study, a third group of stimuli was also used. These represented "conventional laboratory stimuli" (p. 318), typical of those used in electrodermal conditioning experiments. The criteria for their selection were that they were "arbitrary, meaningless and abstract" (p. 318). Thus, geometrical forms, i.e. circles and triangles were selected. The inclusion of the third group of stimuli was dictated by the observation that conditional responses to conventional laboratory stimuli require several trials to extinguish (Öhman, 1974) whereas in the earlier studies (above) responses to pictures of houses extinguished immediately when the UCS was withheld. This had led Öhman, Eriksson and Olofsson (1975) to speculate that their neutral stimuli might have been from the "contraprepared" side of the preparedness dimension (p. 625). This means that the observed significant effects of the 1975 experiments could have been either due to good conditioning to the phobic or bad conditioning to the neutral stimuli. The third group of stimuli in the present experiment was used to elucidate this point as these stimuli are assumed to be from the "unprepared" side and as such their effect should fall between the effects of the other two groups.

Each subject was shown two pictures, either snake-spider, circle-triangle, or flower-mushroom, depending on the group he was alloted to. To facilitate differentiation and limit generalization across stimuli, the subjects were explicitly told about the CS-UCS contingency; that is, each subject was instructed that he would be shown two pictures and was also told which picture would sometimes be followed by shock. Which stimulus served as CS+ and CS- was counterbalanced across subjects. The pictures were presented in randomized orders with the restriction that the occurence of more than two successive presentations of the same stimulus was prevented. Initially, there were 8 presentations of CS- alone, 4 of to-be CS+ and 4 of to-be CS-. In the acquisition phase, there were 5 reinforced presentations of CS+ and 5 unreinforced presentations of CS-. The extinction phase consisted of 10 unreinforced presentations of each of these two categories of stimuli.

The results showed that in the pre-acquisition CS-alone trials the instructions produced differentiation between CS+ and CS- in all groups but there were no differences in degree of differentiation between the three groups. However, the pictures were differentially effective as CSs. Briefly, although all the groups acquired responses at about the same rate, the group conditioned to phobic stimuli (snakes or spiders) showed greater resistance to extinction (as indexed by better FAR differentiation) than the group conditioned to fear-irrelevant stimuli (flowers or mushrooms). The third group fell between these two groups. Thus, although the results of the 1975 experiments (above) were due to comparatively good conditioning to potentially phobic stimuli, this effect could have also been enhanced by bad conditioning to the stimuli used as neutral. The results here then suggest that different categories of stimuli differ in their associability with the shock UCS. The fact that superior conditioning to phobic than neutral stimuli could be shown in a differential paradigm also indicates that there is no extensive generalization across classes of potentially phobic stimuli. This is in agreement with the clinical observation that phobias for small animals are usually monosymptomatic (Marks, 1969).

In their second experiment, Öhman et al. (1976) investigated the potential role that differences in salience amongst stimuli could have played in the previous experiment. Mackintosh (1975) had earlier discussed how the salience of a stimulus affects the rate of learning. It was assumed that salience can be operationally defined in terms of orienting reflex (OR) elicitation. Thus, stimuli differing in their complexity were selected as Berlyne, Craw, Salapatek and Lewis (1963) had shown that perceptually complex stimuli elicit more orienting than simple stimuli. As high-OR stimuli an abstract drawing was presented on a green or yellow background. The low-OR stimuli consisted of the background colours with no superimposed form. To ensure that the two types of stimuli did differ in OR evocation, a group of subjects were exposed to 16 presentations of complex and simple stimuli in randomized order. Their electrodermal responses were found to be larger to the former than to the latter stimuli which also took fewer trials to reach a criterion of three successive zero responses. The apparatus and general procedure in the experiment proper were identical to those used in experiment 1. The results indicated that although a complex CS elicits more slowly habituating ORs than simple stimuli, it fails to result in more conditioning or greater resistance to extinction than a simple CS. From this, the experimenters inferred that their earlier results could not be accounted for by the salience theory. However, this inference assumes that, firstly, salience can be adequately defined simply by OR elicitation - something of which the experimenters do not seem certain (p. 326); secondly, as Mackintosh (1975) discussed, the salience factor may be specific for a certain reinforcement and therefore it is doubtful whether the extrapolation made from experiment 2 (using meaningless stimuli) to previous experiments (using different types of meaningful stimuli) is valid.

In their final experiment, Öhman et al. (1976) found superior resistance to extinction for phobic stimuli as compared to neutral stimuli when the UCS was an electric shock but not when it was a tone to which the subject was required to produce reaction times by pressing a key. This result was interpreted as indicating that resistance to extinction for phobic stimuli is specific for aversive UCSs and excludes the possibility of any general property of the phobic CSs being the basis for superior conditioning. However, this interpretation is not the only one and the result could be accounted for by past experiences of the subjects, a point to be discussed below (section 5.2.1.).

In 1977, Hugdahl and Öhman carried out two further experiments in order to elaborate on the effects of instructions on the electrodermal conditioning to fear-relevant stimuli. In the first experiment, SCRs of different groups of subjects were conditioned to potentially phobic (snakes, spiders) and neutral (circles, triangles) stimuli in a long interstimulus interval differential paradigm with shock as the UCS. Then, half of the subjects were instructed that no more shocks would be administered. This resulted in complete elimination of responses to neutral stimuli but left responses to phobic stimuli unaffected. In the second experiment, instructions involving the administration of a single shock at the offset of the CS+ sometime during the experiment were given. The results showed that responses to phobic stimuli were significantly more potentiated than responses to neutral stimuli. Instructions, therefore, had a "symmetrical effect" (p. 615) on acquisition and extinction to neutral stimuli, whereas for the phobic stimuli instructions facilitated acquisition but were ineffective in modifying responses once they were acquired. The results of experiment 1 were thought to fullfil a defining characteristic of phobias, i.e. their "irrationality", the fact that logical arguments do not modify them (Marks, 1969 - see also Öhman, Erixon and Lõfberg, 1975, above). The results of experiment 2 were seen as demonstrating that threats or warnings may be sufficient to elicit elevated responding to phobic stimuli and this could account for the fact that some phobics cannot recall a specific traumatic experience as the origin of their phobia (Marks, 1969).

In a study by Hygge and Öhman (1978), it was further shown that threat to a model is sufficient to condition electrodermal responses to preceding stimuli vicariously and the content of the stimulus is of critical importance. That is, for phobic stimuli (snakes, spiders and rats), the resulting electrodermal CRs failed to extinguish, whereas for the neutral stimuli (flowers, mushrooms and berries) the extinction was immediate. The CRs to phobic stimuli were also difficult to extinguish even when the subjects were instructed that the danger to the model was over. The results, therefore, were very similar to findings from the direct conditioning studies described above.

Resistance of electrodermal responses to extinction was also observed by Öhman and Dimberg (1978) when the CS was a picture of an angry face with an electric shock as UCS in a differential conditioning paradigm. Responses to happy or neutral expressions, on the other hand, extinguished immediately when the shock was withheld. The results were interpreted as relating to conditioning to phobic stimuli with evolutionary significance since "several lines of evidence converge to suggest that facial expressions provide a biologically meaningful stimulus category" (p. 1251).

In a study by Fredrikson and Öhman (1979) the heart rate (H-R), finger pulse volume (FPV) and SCR of subjects conditioned to phobic (snakes, spiders) and neutral (flowers and mushrooms) stimuli were examined. The UCS was electric shock and a differential conditioning paradigm was used. The results showed reliable acquisition effects for FPV and SCR, with superior resistance to extinction for the phobic than neutral stimuli. In contrast, the H-R data did not differentiate between reinforced and unreinforced cues either during acquisition or extinction in either type of stimuli. These results replicated and extended previous findings by Öhman and colleagues. Unlike the finding by Öhman, Eriksson and Olofsson (1975) the FPV data closely paralleled the SCR data. This discrepancy could be due to the fact that in the 1975 study a between-subjects design was used while in this study a differential, withing-subjects conditioning paradigm was employed. As discussed above, the latter, being more sensitive than the former, optimizes the conditions for observing differences as a function of fear-relevance of stimuli. The finding that the H-R data did not show any significant stimulus-UCS pairing effects and did not differentiate between phobic and neutral cues was interpreted as being mainly due to different mechanisms involved in conditioning of SCR and FPV on the one hand, and H-R on the other; the former responses reflect sympathetic activity whereas the latter, in conditions such as those used in the study, reflect primarily parasympathetic activity (Obrist, 1976; Obrist, Wood, and Perez-Reyes, 1965 - all cited in Fredrikson and Öhman, 1979).

A study which attempted to relate the concepts of preparedness and arousability in the context of electrodermal conditioning ought to be mentioned, too. Hugdahl, Fredrikson and Öhman (1977) investigated the effect of arousal as indexed by spontaneous electrodermal responses on conditioning to phobic and neutral stimuli. They used a differential conditioning paradigm and electric shock as UCS. It was found that conditioning and resistance to extinction were better for phobic and high-arousal groups. The conclusion was that "conditioning to potentially phobic stimuli is jointly determined by stimulus content and arousal (as indicated by spontaneous responding)" (p. 350). It should be noted that during acquisition there were main effects of both these factors and the stimulus content effect contrasts with the lack of such effects in the experiments reported above.

Finally, the results of a study by Öhman, Fredrikson, and Hugdahl (1978c) appeared to imply that different peripheral effector mechanisms are involved in the conditioning of SCRs to fear-relevant and fear-irrelevant stimuli. Öhman et al. compared the magnitudes and half-recovery times of SCs (the time taken for the post peak amplitude values of the SCRs to recover to half the peak amplitude values - Martin and Venables, 1980) from the dorsal and palmar sides of the hand. On the basis of Edelberg's (1973) theory on the electrodermal effector mechanism, it was hypothesized and confirmed that defense responses (DRs - see ChapterIII) are conditioned to phobic and ORs to neutral stimuli. That is, unlike neutral stimuli and phobic stimuli used as CSs in non-aversive conditioning, phobic stimuli used as CSs in conditioning with shock as UCS showed stable palmar but not dorsal conditioning effect, and slower recovery times to the reinforced than to the nonreinforced stimulus. (The level of skin hydration is increased by sweat from the sweat glands and it is decreased by absorbing membranes in the gland. Öhman et al. reasoned that since the dorsal surface of the hand has few sweat glands it reflects mainly the membrane component while responses from the palmar surface where sweat glands are many reflect both components. Also, the recovery time of the response depends on which component is dominant; if the sweat is dominant the recovery is slow but when the membrane component is dominant the recovery is rapid. According to Edelberg, orienting is accompanied with medium hydration in response to non-threatening situations and thus ORs should be associated with no differences in responding from the palmar and dorsal sites. In contrast, threatening stimuli produce DRs and are accompanied with high hydration; thus, Öhman et al. argued, DRs should be characterized by superior palmar to dorsal responding and slow recovery).

The main results from the studies by Öhman and his associates may be summarized as follows: classically conditioned SCRs to phobic stimuli are acquired rapidly and show minimal extinction. These responses occur to the onset of the conditioned stimulus (FARs) and not at all in the pre-UCS interval suggesting that "the effect of phobic stimuli has to do with changes in the meaning of the CS rather than being related to expectancy of UCS" (Öhman, et al., 1976, p. 332). Once acquired conditioned responses to phobic stimuli are not responsive to instructions that no more UCS will be delivered. In addition, mere threat of shock facilitates acquisition of responses to phobic stimuli. Such responses can be established vicariously and are also most readily acquired by subjects in a state of high arousal. In contrast, conditioning to neutral stimuli is found to develop gradually and extinguishes readily; it is also sensitive to instructions and the locus of the conditioned response is at the pre-UCS interval. Furthermore, there is evidence suggesting that different peripheral effector mechanisms may underlie the conditioning to phobic and neutral stimuli. In the light of these findings, Öhman argues that the conditioned SCRs to phobic stimuli show important characteristics of phobic fears since they are readily acquired either after a single reinforcement or after mere threat of an aversive event, they are persistent in the sense that they fail to extinguish and they are "irrational" in the sense that they cannot be instructed away. Finally, since these stimuli are assumed to share the attribute of being potentially dangerous to the pretechnological man, the data give support to the preparedness theory of phobias (Seligman, 1971).

5.2.1 PROBLEMS WITH ÕHMAN'S EXPERIMENTS

The work of Õhman and his co-workers is most impressive. It is characterized by a persistent effort to elucidate many aspects of conditioning of electrodermal responses to stimuli which the experimenters have selected as having evolutionary significance. Also, the model of phobias presented, i.e. conditioning of electrodermal responses to potentially phobic stimuli appears to be plausible and useful for exploring pathological fears as well as for generating new research ideas. It is an adequate model in the sense that it has symptoms, causal events, and even anatomical structures in common with the pathology (Maser and Seligman, 1977). Given the consistency of the findings and the sophistication of the methodology used by Õhman and his colleagues, their conclusions would be expected to be valid. However, difficulties pertaining to the findings and the stimuli used in the experiments, render such conclusions equivocal.

The preparedness theory specifically predicts rapid acquisition and slow extinction of phobic behaviour to stimuli with evolutionary significance. In Õhman's work, however, while extinction effects were found consistently, acquisition effects were observed only rarely. An elaboration of this point may be useful. The difficulties with the acquisition effects in Õhman's experiments were noted by Rachman (1978b) who suggested that "these findings support the idea that the main defining feature of biologically relevant phobic stimuli might preferably rest on persistence rather than rapid acquisition". If this is accepted, it would mean that the definitions of prepared phobias and other forms of putatively prepared learning (e.g. taste aversion) would be different with respect to acquisition effects. On the other hand, there is a discrepancy between the resistance to extinction of certain "unprepared" phobias (see next section) and the definition of unprepared associations according to which such associations extinguish rapidly (Seligman and Hager, 1972.) From such observations it becomes apparent that either we classify phobias as prepared/unprepared wrongly (see next section about the difficulties in defining biological significance of a stimulus) or the theory of preparedness cannot predict acquisition and extinction effects on the preparedness continuum consistently and with respect to phobias it "may have few clinical implications" (Rachman, 1978b, p. 237; see also section 3, above). Öhman, Fredrikson and Hugdahl (1978b) admit that their data "may confidently be applied only to specific fears, such as animal phobias" (p. 240) but even this is by no means certain (see below).

Like the taste aversion research, Öhman's work does not take into account the past experience of the subjects. This is a most serious omission and, perhaps, invalidates the claim that the stimuli which were employed in the experiments qualified as either "potentially phobic" or "supposedly neutral" in the evolutionary sense. From the various papers cited above, it appears that the selection of the stimuli was based upon clinical experience (whose experience is not specified) and speculations about the stimuli that could have been threatening (phobic) or of no importance (neutral) to the pretechnological man (Öhman et al., 1976). As seen, pictures of snakes, spiders and angry faces have been used as representative of phobic stimuli and pictures of houses, nonthreatening faces, flowers, mushrooms, triangles and circles were chosen as neutral stimuli. However, as Bandura (1977) remarked "in everyday life, houses and faces are repeatedly correlated with neutral and positive experiences as well as with negative ones, whereas references to snakes are almost uniformly negative" (p. 76). Recently, Burgess, Jones, Robertson, Radcliffe and Emerson (1981) commented: "One does not have to look further than the Book of Genesis in the Bible to find such associations for snake stimuli" (p. 241). Bandura (1977) argued that "snakes acquire threat value through a combination of experiences, involving fearful parental modelling reinforced by frightening personal experiences, grisly folklore, and illustrations of reptiles as menacing animals" and "differential rates of extinction are more likely due to differential correlates here and now than to snake bites suffered by a few ancestors generations ago" (p. 76). Consequently, Delprato (1980) wrote: "Any of several factors in the subjects experiential histories ... rather than natural selection could account for the results of the Öhman experiments" (p. 89). In discussing the fact that learning is markedly affected by "experiential preparedness" Bandura (1977) stated: "Experience makes predictive stimuli more distinctive, furnishes prerequisite competencies, creates incentives and instills habits that may either facilitate or retard learning of new behavior patterns" (p. 75; see also section 2.1, above). In contemporary conditioning theory the role of "latent inhibition" has often been highlighted (Mackintosh 1974, p. 37). That is, it has been shown that nonreinforced preexposure to a CS interferes with subsequent conditioning to that stimulus. Levis (1979) argued, therefore, that "two factors must be considered when comparing the conditionability of prepared and nonprepared stimuli: (1) the preconditioning aversive level of each stimulus, and (2) the degree of latent inhibition from nonreinforced preexposure" (p. 173). None of the studies reported above has considered the stimuli for such attributes.

Öhman and his associates are aware of these problems and occasionally they recognize the possibility that past experiences of the subjects and not evolutionary history could have "prepared" them to respond to phobic stimuli the way they did. The experimenters also recognize that their results "have no bearing on the genetic basis of phobias" (Öhman, Erixon and Löfberg, 1975, p. 44) and that "the preparedness concept leaves us with the problem of determining the genetical or experiential basis for the preparedness" (Öhman, Eriksson and Olofsson, 1975, p. 626). However, they always conclude that their findings are best interpreted by the preparedness hypothesis.

In one of the most recent publications on the subject, Öhman (1979a) reiterates that "the basis for the effect (i.e. that the phobic stimuli result in superior conditioning than neutral stimuli) might as well be previous learning as biological readiness" (p. 118). He suggests that the problem could be somehow resolved if stimuli which are dangerous to modern man (i.e. "ontogenetically" but not "phylogenetically" fear relevant) were to be used and their effect compared with that of stimuli with evolutionary significance. He briefly reports an unpublished experiment by Hodes, Öhman and Lang (1977) in which three kinds of stimuli were employed using, as previously, a differential conditioning design, "a loud complex noise" (p. 118) as UCS and SCR as the dependent variable. The stimuli employed were: (a) potentially phobic stimuli, i.e. snakes and spiders; (b) "non-evolutionary" fear-relevant stimuli, i.e. revolvers and rifles; and (c) neutral stimuli, i.e. household objects (he does not specify their exact nature). It was found that the potentially phobic stimuli resulted in superior resistance to extinction to the other two groups and this, according to Öhman, indicates "some evolutionary specificity to the effects observed with potentially phobic CSs" (p. 118).

However, it appears that this experiment could hardly have resolved the initial problem. The selection of revolvers and rifles as "ontogenetically fear-relevant" appears most unsatisfactory. This is because the subjects consisted of American college students and guns should have been far too familiar objects; from an early age, for example, Americans not only play with toy-guns but they are also daily "bombarded" with films (from cowboy to modern police-stories) in which guns are constantly displayed. Probably, in most of their homes a gun is within their reach and it should be added that these weapons are often associated with pleasant experiences (e.g. sports and hunting, while in almost every film, a "bad-guy" would be killed). All these must have had at least some desensitizing effect on the subjects as far as guns are concerned and therefore it would have been surprising if any conditioning effects similar to those associated with unfamiliar and always threatening snakes and spiders have been observed.

In a similar study by Hugdahl and Kärker (1981), SCRs were conditioned in three groups of subjects to either slides of snakes and spiders (potentially phobic), electric outlets (ontogenetically fear-relevant), or geometric shapes (control stimuli) as CSs, using electric shock as the UCS. As in previous experiments, a differential paradigm was used. The main finding was that responses to potentially phobic stimuli were more resistant to extinction than responses to the other two classes of stimuli and this was thought as indicating biologically prepared learning. In connection with the electric outlets the authors wrote: "... it seems reasonable to presume that previously memorized negative experiences would be more salient during the experimental session than the corresponding positive experiences, comparable to the negative emotionality associated with the snake-spider CSs". Thus, "there is no reason to believe that preconditioning exposures to the ... CSs should have resulted in different amounts of latent inhibition (Mackintosh, 1974) being built up, with greater inhibition to be seen in the 'ontogenetic' group" (p. 114). All these, of course, are speculative; even if negative associations were predominant with respect to the slides of electric outlets, these would have not necessarily rendered them "comparable" to the exclusively negative emotionality associated with snakes and spiders. It should be added that electric outlets are known to the subjects to be associated with potential danger but rarely with fear whereas snakes are associated with both potential danger and widely reported fear and consequently they are more "predictive stimuli" for aversive events than electric outlets (see Bandura, above). Apart from these, "early discrimination training is given in how to use these objects properly to avoid danger" (Levis 1979, p. 173).

Delprato (1980) talked also of "the sheer arbitrariness encouraged by concepts such as the survival value of behaviors" (p. 89). As an example, he referred to the slides depicting mushrooms which were used as neutral stimuli in some of the experiments by Öhman and his co-workers. However, there have been approximately 100 species of poisonous mushrooms identified in the United States alone (Lincoff and Mitchell, 1977). As a result, "it is reasonable to suspect that mushrooms have posed a greater threat to the survival of the human species than have spiders and snakes combined" and more so since "mushroom toxicosis is especially a threat to humans because poisonous mushrooms are usually extremely difficult to discriminate from nonpoisonous varieties" (p. 89).

On the other hand, Bandura (1977) pointed out: "Among the things that are correlated with aversive experiences, animate ones are more apt to give rise to phobias than are inanimate things" (p. 76). This, he explains, is because animate threats by being mobile and able to act, can be unpredictable (see also next chapter) and "active unpredictable threats over which one has only partial control give more cause for generalized anxiety than equally aversive threats that are predictable, immobile and safe as long as one chooses to stay away from them" (p. 76). Thus, slides of animals with no apparent evolutionary significance, e.g. sheep should have been used as neutral stimuli, at least in some of the experiments by Öhman, if the effects of the attributes of mobility and unpredictability of the stimuli were to be dissociated from those of alleged threat of certain stimuli to the pretechnological man.

We may also consider the role of cognitive factors in the work of Öhman and his co-workers. As seen above, Hugdahl and Öhman (1977) showed that instructions were ineffective in modifying responses to phobic stimuli. They argued that in the conditioning of SCRs to phobic stimuli it is the meaning of the fear-relevant CS which is changed rather than the expectancy of shock and suggested that "the optimal conditions for finding unaware conditioning should involve fear-relevant CSs for aversive UCSs" (p. 616). In other words, in this conditioning there is no awareness that CS is signal for UCS. Their argument seems to be supported by the fact that resistance to extinction of SCRs to phobic stimuli was observed in the onset of the CS component (FAR) rather than the pre-UCS interval component (SAR - see summary of Öhman's experiments above). However, our knowledge regarding the precise nature of the underlying processes of the SCR is limited (see Chapter IV) and it is possible that the criterion of "unaware" conditioning used by Hugdahl and Öhman does not reflect the implicated higher processes accurately. Maltzman (1979a, p. 343) also argued that "differential GSRs (i.e. electrodermal responses) persist in extinction because they are a reflection of a voluntary OR (see Chapter III) and telling someone to stop thinking about a stimulus is not always effective. It is not a manifestation of primary conditioning ..." ("Primary" conditioning means unmediated, i.e. with no awareness of a relationship between the CS and UCS).

Öhman, Fredrikson and Hugdahl (1978a), stated that the preparedness theory talks about "noncognitivity" of prepared learning in general terms and they suggest that it (the theory) "might deal with 'conditioning' on a symbolic level in terms of degradation of input, which is a defining characteristic of prepared learning" (p. 107). Thus, it is claimed that the preparedness theory may incorporate acquisition of phobias as a result of threats, warnings and modelling processes which provide more degraded input than the actual pairing between a phobic stimulus and an aversive event. In doing so, it is suggested, the theory may also manage to be in accord with clinical evidence regarding acquisition of phobias. However, according to Seligman (1971), phobias in which cognitive factors may influence their development and to which people "talk themselves into" (p. 317) are relatively unprepared (see section 3). Thus, while experimental evidence suggests that cognitive factors may readily establish prepared phobias, the preparedness theory implies that cognitive factors influence the formation of unprepared ones. Here we have yet another discrepancy between theory and empirical work (see also above, in this section, and sections 3 and 5.3).

Finally, research employing different paradigms to those reported above has provided evidence in conflict with both the theory of preparedness and the findings in the previous studies.

Seligman and Hager (1972) defined the preparedness continuum in terms of non-sensitivity to degradation of input (see section 2). On the basis of previous experimental evidence, Hugdahl and Öhman (1980) assumed a direct relationship between input degradation and length of interstimulus interval (ISI); they subsequently predicted that conditioning to phobic stimuli would be less dependent on the ISI parameters than conditioning to neutral stimuli and their difference would increase from experiments using a delay paradigm (the CS is present throughout a long ISI) to experiments using a trace paradigm (the UCS is administered after an interval following termination of CS). The hypotheses were not confirmed and the only evidence of an ISI effect was on the opposite to the predicted direction. According to Hugdahl and Öhman, this "provides problems for Seligman's ... version of preparedness theory", and "this failure of the theory is not a trivial one, because the hypothesis was derived from the explicit definition of the key construct (of) the preparedness continuum ..." (p. 353).

In another study (Mcnally, 1981), the role of cognitive-instructional variables in conditioning to fear-relevant stimuli was tested. Sixteen college students were presented with two potentially phobic stimuli, a picture of a snake and a picture of a spider. Initially, four habituation trials were given and these were followed by 12 discrimination trials during which one of the stimuli (CS+) was reinforced with shock while the other (CS-) was not. Then, the subjects were instructed that the CS-UCS contingencies would be reversed, i.e. they were told that shock would no longer follow the previously reinforced stimulus but might follow the previously nonreinforced stimulus. In fact, no further shocks were administered in the subsequent 8 test trials. The instructions produced a reversal of the conditioned anticipatory as well as UCS-omission electrodermal responses. It was concluded that human electrodermal conditioning to fear-relevant stimuli is not insensitive to cognitive factors. The result was thought consistent with work by Wilson (1968) who obtained the same effect using fear-irrelevant stimuli (a yellow rectangle and a blue rectangle). Mcnally plausibly argued that if electrodermal conditioning to fear-relevant stimuli is immune to cognitive factors, then the instructed contingency reversal would have minimal effect; also, if prepared associations with fear-relevant stimuli are sensitive to threat - but not safety - instructions (e.g. Öhman 1979a), then, while responding to CS- should increase during the test trials, responding to CS+ should not decrease.

Emerson and Lucas (1981) reported 2 experiments in which they attempted to replicate some of the results by Öhman utilizing different and "more naturalistic paradigm" (p. 293). In both experiments, acquisition and extinction of EDRs to potentially phobic (slides of snakes) and neutral (slides of flowers) stimulus components were investigated within an aversive compound (slide of snake and flower) signal conditioning paradigm. In accordance with the preparedness model it was predicted that stimulus content should be an important variable moderating transfer from compound to component, i.e. there would be greater incrementation and greater resistance to extinction of responses to potentially phobic than neutral CSs after CS-UCS pairing(s). The designs and procedures of the two experiments were almost identical. There were 12 adaptation trials (six presentations of each CS component), one/three acquisition trial(s) (compound CS paired with UCS, i.e. a 95 dB white noise), and 40 extinction trials (20 presentations of each CS component). First-interval SCRs (FARs) to the two components were recorded and compared. The results of both experiments indicated significant incrementation of responses to CS components after reinforcement(s) but failed to provide evidence of differential acquisition or extinction effects between responses to potentially phobic and neutral CS components over trials. The authors concluded the results "raise the question of the 'psychological' significance of previous research on this subject", and ".... it still remains to demonstrate the generality of the supposedly important role that stimulus content may play in the development of aversive associations" (p. 294).

In summary, the series of experiments by Öhman and his colleagues have struck yet another blow to the premise of equipotentiality of the traditional learning theory by showing that there is a substantial difference in the associability of "potentially phobic" and "supposedly neutral" stimuli with aversive events. However, there were a number of serious problems with this research, the most important of which are: contrary to predictions, acquisition effects were not but exceptionally demonstrated; there was a lack of control for past experiences of the subjects and for other relevant attributes of stimuli apart from their purported evolutionary significance; there were discrepancies between theory and data regarding the role of cognitive factors in the formation of prepared and unprepared phobias and about the content of common fears. Furthermore, recent research employing different paradigms produced results in conflict with the earlier ones by Öhman and his associates. All these render Öhman's conclusions equivocal and, therefore, claims that the preparedness hypothesis for phobias is supported by research with adult human subjects (e.g. Eysenck, 1979) are, at least, premature.

5.3 CLINICAL CASES AND DIFFICULTIES IN DEFINING BIOLOGICAL SIGNIFICANCE

In recent years there have been attempts to relate clinical phobias to the hypothesis of biological preparedness. Rachman and Seligman (1976) reported the treatment of two patients who had some rare phobias from the "unprepared" or even "contraprepared" side of the preparedness continuum. One of them was a female patient who suffered from a severe fear and showed strong avoidance of chocolate and any object or place which could be associated with it, including a large variety of brown objects. Because of her fear she had become housebound. Neither of the two authors or any of their colleagues had encountered a chocolate phobic before. The patient received an intensive course of behavioural treatment that, according to Rachman and Seligman, normally has a success rate of between 70 and 80% but the patient "responded only slightly" (p. 336). Another patient was a young woman who was virtually blind from early infancy and who had a strong fear of vegetables and plants and particularly their leaves. The phobia had its origin in early childhood and the patient showed strong anxiety and distress and engaged in excessive avoidance of the feared objects. After 48 hours of treatment, in which desensitization in vivo supplemented by modelling and other therapeutic procedures were used, she made only little progress.

The authors recognize that these phobic cases have "the defining features of unpreparedness (lack of biological significance and probably gradual acquisition), but the empirical properties that are hypothesized to cohere with preparedness (resistance to extinction, irrationality and wide generalization)" (p. 337). They suggest that the inconsistent features of these fears with preparedness may be due to "overlearning" of the symptoms (both were long lasting cases), "symbolic transformation" (objects of fear being associated with strong emotional reaction to a very frightening scene) or complicated "psychopathology" of the patients concerned (both had a wide range of other problems). The authors also suggest the possibility that "it need not follow that comparatively unprepared phobias will necessarily show easy extinction ..." (p. 338). However, the experimental data with human subjects cited by many in support of the preparedness theory (section 5.2) rest almost entirely on the extinction phase of conditioning which indicates that unprepared and contraprepared associations extinguish readily.

In another retrospective study by de Silva, Rachman and Seligman (1977) on patients who were treated at Maudsley Hospital over a 5-year period, the usefulness of the preparedness concept for naturally occuring clinical phobias was examined. They investigated a large sample of 69 phobic and 82 obsessional cases. Initially, ratings of the content of the disorders indicated that in their large majority, this (the content) was judged as having evolutionary significance. However, "contrary to expectations, preparedness was not related to therapeutic outcome, mode of onset, severity, intensiveness of treatment received, stimulus generalization" or "age of onset, effect on life style, impaired reproductive capacity, or 'abnormal personality'" (p. 76). The failure to find a systematic relationship between preparedness and acquisition or therapeutic outcome was considered as seriously weakening the clinical usefulness of the concept of preparedness (pp. 74-5). In particular, "the lack of relationship between ease of acquisition and evolutionary preparedness is a potentially serious theoretical problem, as this relationship is a definitional, rather than an empirical matter ..." (p. 75).

From the above studies it is apparent that specifically conducted clinical research to relate phobias to the theory of preparedness has failed to produce evidence consistent with the predictions of this theory. However, the latter assumes a continuum of preparedness and it may well be that clinical fears are hardly representative of the whole range of human fears. It is possible, as de Silva et al. (1977) wrote, that "the cases reaching the clinic for treatment are of high degree of severity anyway" and such sampling constraints make it impossible to demonstrate, for example, differential effects of treatment as "one may have inadvertently masked the differences between prepared and unprepared phobias" (p. 76).

At this point, one of the aspects of the research by de Silva et al. which also highlights an inherent difficulty of the preparedness theory should be elaborated. This is related to the problem of how one goes about classifying the stimuli which may have evolutionary significance. As de Silva et al. argued, if the theory is to have any utility it must provide a satisfactory classification of objects and events which have such a significance. This is by no means an easy task and one of the reasons for this has already been hinted at when discussing the selection of stimuli by Öhman and his colleagues in the previous section. It was stated that it was difficult to distinguish evolutionary from ontogenetic significance of the stimuli. Öhman, Eriksson and Olofsson (1975) recognize that the hypothesis that phobias are based on an inherited disposition to associate certain stimuli with fear "was not tested ... nor can it ever be directly tested in the present context". They continue: "This is, in fact, a fundamental weakness of Seligman's theory, since, instead of suggesting a 'resolution of the instinct-learning controversy (Seligman and Hager, 1972, p. 1)' the preparedness concept leaves us with the problem of determining the genetical or experiential basis for the preparedness" (p. 626). As Schwartz (1974) also wrote, "a simple determination that an association is prepared does not carry with it a determination of the origin of the preparedness" (p. 190).

De Silva et al. (1977) carried out their rating of phobias and obsessions by defining as prepared those "which facilitated survival and/or promoted differential reproduction of homo sapiens in pretechnological society" (p. 67). The ratings were made on a 1-5 scale from least to most prepared. Each phobia was separately rated for: (a) The content of fear/obsession; (b) the associated behaviour involved; (c) the purpose, that is, the relationship between content and behaviour. It turned out that the inter-rater agreement (between 2 of the authors) was less than satisfactory (r varying from 0.179, $p > 0.05$ to 0.743, $p < 0.01$). The authors decided, therefore, to adopt a more detailed and explicit set of criteria for rating preparedness. They also decided to abandon the category of purpose as they found it redundant and it was almost impossible to rate it independently of the other two categories. We are told that the subsequent "development of a detailed set of criteria went through several stages of revision" and a final "version" was produced (p. 67). These "several stages of revision" suggest the inherent difficulties in reaching a consensus for such criteria. The authors tell us that in their final attempt there was a high agreement between the two who did the rating for preparedness of content and behaviour. For content, the inter-rater agreement was $r = 0.784$, $p < 0.01$ and $r = 0.902$, $p < 0.01$ for phobic and obsessional cases respectively. However, for behaviour, the agreement was reduced to $r = 0.27$, $p < 0.05$ and 0.563, $p < 0.01$ respectively for phobics and obsessionals. In the light of the less than satisfactory agreement between raters in the assessment of preparedness of behaviour and because they found that behaviours could not be rated independently of content in some cases, only the ratings for content were used as index of preparedness. The authors argued that their classificatory scheme of phobias according to the degree of their preparedness was "partly successful" (p. 74) and the same could be stated with respect to obsessions. They contended that from these findings it could be concluded "that the preparedness of <u>content</u> of both phobias and obsessions is capable of definition and reliable identification" (p. 74). Given that there were only two raters who had apparently taken part in the development of the criteria which were used, it seems premature to claim that the preparedness of phobias is capable of "reliable identification". It is also arguable that the agreement reached by the raters was due to the fact that they have similar perceptions of the natural world as they are both psychologists, they have done similar reading, etc. It would be instructive to study the ratings of individuals with different backgrounds including biologists and/or persons from different cultures (the comment on mushrooms used as "neutral" stimuli by Öhman illustrates the point - see previous section).

However, even if the reliability of ratings were to be accepted as unequivocal, the authors admit that "little can be said of the <u>validity</u> of the ratings" (p. 74). Associated with this problem is the authors' effort tc "translate" fears of modern gadgetry into "their pretechnological equivalents" before they were rated. Although this translation was supplemented by "evidence of the underlying pretechnological fears (e.g., fear of hospitals; with underlying fear of blood or injury)" (p. 67), one remains sceptical about the validity of the outcome. The authors illustrate the problem by questioning: "While we reliably rated the fear of catching or transmitting disease via contact with animal faecal matter as more prepared than a fear of eating in public places, was there really more danger to pretechnological man in the former than the latter?" And they add: "Evolutionary arguments, we recognize, are rather slippery and can be glibly made" (p. 74). Subsequently they point out: "The only way of validating the view that, say, avoiding going out in the dark has been selected for in evolution to a greater extent than avoiding eating in public places, would be to recreate past evolutionary pressures and see which phobia is more amplified over generations. Such an experiment verges on the impossible and is unlikely to be funded" (p. 74).

The above, then, illustrate a fundamental problem of the biological preparedness theory in learning generally and phobias in particular, i.e. the inability to define with any degree of certainty which stimuli have phylogenetic vs. ontogenetic significances or, in fact, the inability of separating these two types of potential influence. This, combined with the fact that clinical studies provided data in conflict with the preparedness theory, limit its usefulness substantially.

6 CONCLUSIONS

Seligman's attempt to integrate the experimental demonstrations of constraints on learning by suggesting different degrees of associative "preparedness" is far from unequivocal. It appears that the "preparedness continuum" is merely an operational classification of learning tasks and, as Shettleworth (1972) remarked, "it substitutes one oversimplification (that animals are more or less "prepared" to learn things and that "prepared" behaviors are acquired and extinguished differently from "unprepared" or "contraprepared" ones) for another (that the laws of learning are the same for all arbitrarily selected elements)" (p. 4). Differences in learning may be the result of a number of different and not necessarily associative mechanisms as, for example, adaptive specializations related to ecological demands of the different species. In this sense, extrapolation from the taste aversion phenomena to phobias is of doubtful validity.

On the empirical side, the taste aversion data remain the subject of controversy. This is not only because alternative interpretations to the preparedness concept may often provide a plausible account of them, but also because modifications in experimental methodologies result in outcomes which contradict the notion of biological preparedness. Research with human subjects is no more convincing. Studies with children which in the past have been thought to give support to the concept of preparedness are limited by methodological difficulties. Similarly, Öhman's innovative work is far from conclusive as he and his colleagues have failed to consider in their methodology the "experiential preparedness" of their subjects. Yet, as Schwartz (1974) wrote, "a demonstration of preparedness ... may have either a phylogenetic ... or an ontogenetic origin" (p. 190). In addition, acquisition effects, as predicted by the preparedness notion have only exceptionally been demonstrated. There have also been discrepancies between theory and data regarding the role of cognitive factors in the formation of prepared and unprepared phobias and about the content of common fears. Furthermore, recent experimental work produced results not in agreement with the theory. Finally, clinical studies specifically undertaken to relate phobias to biological preparedness provided evidence in conflict with this concept.

One may conclude therefore that both on theoretical and empirical grounds, Seligman's theory of phobias is far from satisfactory, and given the difficulty in the *a priori* definition of the stimuli as biologically significant, Seligman's approach to phobias may be of limited usefulness.

CHAPTER II

DEVELOPMENTAL AND SOCIOCULTURAL INFLUENCES ON THE CONTENT OF FEARS

> "Men are not moved by things but the views which they take of them"
> (Epictetus)

This chapter will focus on experiential influences on the content of fears. Life experience of a person includes, apart from direct, indirect experiences. The latter refer to others' experiences as observed by the person concerned or contained in the general knowledge within a culture. The relevance of sociocultural factors to individual personality and psychopathology is now widely accepted and reflected in a fast developing body of psychological literature. This is often undertaken as a reaction to the tendency in psychology to readily attribute cause to biological predisposition (King, 1978) and the present review is no exception. It will attempt to show that fears, though selective, are flexible, in the sense that developmental and sociocultural factors affect their content and therefore experiential rather than biological preparedness may account for the observed selectivity in phobic objects.

1 DEVELOPMENT AND CONTENT OF FEARS

Many a writer, e.g. Schneirla has cautioned against studying a particular behaviour only in mature organisms, thus ignoring its earlier stages of development. It is noteworthy that Freud's work has been more concerned with the early experiences of life than with maturity and, indeed, the description of a phobia in a child (Little Hans) was the case in which the central notions of the psychoanalytical point of view on pathological fears were articulated (Freud, 1909). Insight into the content of phobias may be gained by concentrating on "normal" fears in early life because phobias are nothing but particularly intense fears (Marks, 1969), and often childhood fears of e.g. animals (Jersild and Holmes, 1935; Marks and Gelder, 1966) or fears of physical injury and psychological stress (Miller, Barrett, Hampe and Noble, 1972) persist well into the adulthood and form the basis of phobias. The early fears are considered to be normal in the sense that they often seem to signal some potential danger and therefore have obvious adaptive function; they are also common among children and many of these fears tend to diminish readily with age (Miller et al., 1972; Rachman, 1974).

According to a number of writers, including Marks (1969), fear is an unlearned response but what is feared by a young organism is the outcome of an interaction of innate, maturational and learning phenomena and there are many difficulties in separating out the relative contribution of each of these factors. However, it is noted that "the contribution of these three sources ... varies roughly according to the degree of evolution of the cerebral cortex. The more primitive the species, the more it depends on innate mechanisms of response, the shorter is the time it takes to mature, and the less is its capacity for learning ..." (p. 13). The reverse is the case with higher primates in which "innate responses show appreciable change after learning by individual and social experience", and "much that was thought to be innate in the past has turned out to be the result of learning. Man is not a species rich in inborn reactions and has evolved more as a learning machine" (p. 14). Valentine (1930) has also pointed out that the fact that learning begins very early in life should make one cautious in inferring that fear responses, considered to be instinctive, are genuinely innate.

However, there are fears seen at a very young age in animals and man and before any adequate experience or training occurs and as such they could be said to be genetically determined. These fears are probably very few but they are important in the sense that they become building-blocks of more complex fears through selective association, including conditioning (Marks, 1969). Some of these early fears will be examined below.

1.1 INNATE FEARS

It has been frequently reported that organisms are born with an ability to recognize and avoid specific threatening objects. However, it is possible that evolution has endowed organisms with other and, perhaps, more efficient ways of protection than a "gallery" of the threatening objects in the brain with the instruction that they should be avoided. One of the theorists who has argued for such an approach was Schneirla.

According to Schneirla (1965), both in the evolution and ontogenesis of behaviour, operations which appropriately increase or decrease distance between the organisms and stimulus resources (approach/withdrawal or A/W processes) must be crucial for their survival. These operations (e.g. reaching for food, mating, avoiding noxious stimulation) depend upon the efficiency of a species in dealing with differences in the intensities of stimuli characterizing such situations. In all animals, from protozoa to primates, and from an embryonic stage onwards, low stimulative intensities tend to elicit and maintain approach behaviour while high stimulative intensities tend to arouse withdrawal. Both in evolution and ontogenesis, these biphasic mechanisms are related to the fact that "low-intensity stimulative changes are likely to be followed by beneficial results, high-intensity stimulative changes by noxious results" (Schneirla, 1965, p. 6). It was stressed that these mechanisms hold for different modalities. Accordingly, Schneirla (1965, p. 63) wrote, "the visual effects of a disk or of regular flicker, or the hearing of repetitive sounds, if not too intense, are quantitatively equivalent for arousing A-processes ... Conversely, abrupt visual changes or harsh noises are equivalent for arousing W-processes".

Thus, an alternative to the ethologists' view that organisms are endowed with "innate schemata" (specific qualitative configurations) of threatening stimuli which they avoid is that their avoidance behaviour depends upon the quantitative characteristics of these stimuli. It is apparent that within this framework, as Marks (1969) observed, the number of characteristics which need to be inherited by organisms are greatly reduced as noxious properties can be shared by many different stimuli. On the basis of the innate tendencies to withdraw from high intensities and the influence of maturational factors (see next section) animals may gradually differentiate the stimuli which are feared by contiguity conditioning and selective learning. Schneirla (1956, 1957) argued that maturational and experiential processes constitute a "fused" system. That is, from the time of conception experiential effects operate in concert with evolved structures and functions and contribute to the development of withdrawal processes. Thus, "behaviour is the product of an ever-evolving, dynamic interchange between the organism, through which genetic effects operate, and its internal and external environment" (Delprato, 1980, p. 95).

Schneirla (1965) discussed the widely reported experiments of the "hawk-goose effect" and "visual-cliff" within the framework of the

A/W theory. Both these experimental paradigms have often been presented as evidence of innate ability of neonates to recognize certain complex and potentially threatening stimuli and respond toward them with fear behaviour. One of these paradigms, the "hawk-goose effect" will be briefly discussed to illustrate that alternative explanations to that of "innate schemata" are possible. It is not suggested that fears of species so different to humans have necessarily a bearing on fears of man (see section 4, chapter I and section 1, chapter II).

In the "hawk-goose" experiments, Lorenz (1939) and Tinbergen (1948) passed artifacts over the nest of young goslings. They found that the artifacts elicited escape responses as a result of one aspect of their shape, i.e. the "short neck" of the bird-like figures, hence this type of artifact was called the "hawk-figure". When this was passed in the opposite direction and it looked and referred to as "goose-figure" (with long neck), the animals did not show escape responses. According to Tinbergen (1951), geese and ducks are able to distinguish models of hawks flying above them from those of geese because they are equipped with an innate mechanism for the detection of a hawk's short neck from the long one of a goose. The experiments have been repeated by other investigators with many different species but variable effects, and alternative interpretations to innate "hawk-schema" have been put forward (Gray, 1971a; Delprato, 1980). For Schneirla (1965), "the necessary factor for the hawk effect is a <u>sudden, massive increase in retinal stimulation</u>" and "... is not a figural effect in the sense the innate schema hypothesis would predict" (p. 16). The "hawk-effect", when observed, may thus be due to "high quantitative potency" of the stimulus properties "for the forced arousal of W-processes". In support of his view, Schneirla reported data by Melzack, Penick and Beckett (1959) who, among others, observed the "hawk-effect" in naive hatching gallinaceous birds with objects as different as stuffed birds and a tea tray.

In agreement with the view that it is stimulus characteristics rather than specific objects which elicit fear, particularly in the young, Yerkes and Yerkes (1936) reported that to elicit fear in young and adult chimpanzees stimuli had to present "visual movement", "intensity", "abruptness", "suddenness" and "rapidity of change in stimulus". Bowlby (1973) and Russell (1979) wrote that when critical features appear in a compound with others they become most effective in eliciting fear. According to Marks (1969), since a writhing snake provides all the stimuli referred to by Yerkes and Yerkes, it would "automatically lead a chimpanzee towards a fear of a snake, without the apes being born with a small portrait of a snake, labelled 'danger', inside their brain" (p. 29).

With regard to fear of snakes much has been said about its innate nature, particularly in primates (Hebb, 1946, Morris and Morris, 1965, Gray, 1971a) and therefore it should be given special consideration. Yerkes and Yerkes (1936) found no evidence of avoidance response prior to or apart from individual experience with snakes in chimpanzees. Their conclusion was based on the observation that adult chimpanzees showed greater fear in their reaction to snakes than did infant chimpanzees (see below about maturational factors). Haslerud (1938) reported that chimps do not show more avoidance of live or dead garter snakes than other novel animals or objects. Other writers, e.g. Schiller (1952) have reached similar conclusions. Joslin, Fletcher and Emlen (1964) tested wild- and lab-reared rhesus monkeys to snakes and snake-like objects. The lab-reared monkeys had not had any prior experience with snakes as they were raised indoors. It was found that only the wild-reared monkeys showed a strong fear response to either live or lifelike snake models. In a more recent study by Mineka, Keir and Price (1980) a replication and extension of the Joslin et al. study was attempted by observing the reactions of wild- and lab-reared rhesus monkeys to a live boa constrictor and to other snake-like objects. In this study, the live snake was presented unrestrained in an open box rather than in clamps in order to determine whether the confinement procedure used by Joslin et al. had minimized the level of fear exhibited by their lab-reared monkeys. It was found that most (8 out of 10) wild- and unlike lab-reared monkeys showed considerable fear of the real, toy, and model snakes. Furthermore, the fear of the wild-reared monkeys did not appear to be simply a reaction to novelty (see below) as it persisted across both of the stimulus presentations. Considerable evidence is therefore consistent with the conclusion by Yerkes and Yerkes (1936, above). Marks (1969) also pointed out that in primates, including man, "it is difficult to exclude the role of tradition in the origin of this fear" as "infants require prolonged contact with a mother or mother substitute to develop normally, and endless precautions would be needed to ensure that the mother and child never saw snake-like objects over several years" (p. 28). This point will be further elaborated in the next section.

From the above it is apparent that there are several studies which give no support to the widely held view that there are innate fear responses for snakes and, according to Rachman (1974), the origin of fears of snakes "remains an open question" (p. 41). However, in the light of the evidence, this may be an overcautious statement.

As mentioned, movement appears to be an important feature associated with innate fear. Russell (1979) wrote that the effectiveness of movement is largely predictable since "it is both attention-getting and a reliable (though obviously not infallible) cue to the presence of life" (p. 89). The effects of movement were earlier discussed by Valentine (1930, 1946) who found that a 14 months old girl (one of his children) showed great fear of a teddy bear when this was moved toward her but when it was kept still she would make an approach response, pick it up and kiss it. It should be added here that toys which elicit fear in children include those depicting harmless animals. Thus, Valentine (1946) mentioned that a 21 months boy (his son) showed "great fear of a velvet rabbit" (p. 214). He noted that it is unlikely that there is "a specific definite fixed innate fear of, say, all furry animals" (p. 219). Rather, there is a general tendency to fear the very strange, particularly when closely associated with the familiar (see also section 1.2 below) and to fear "especially live, moving things" (p. 219).

The direction of movement is also an important feature. Russell (1979) argued that an approaching object subtends an increasingly large angle at the retina as it draws closer, and since the angular size is geometric a sudden optical "explosion" or <u>looming</u> effect occurs as the object begins to fill the entire visual field, indicating thus imminent collision.

Human infants also show distress reactions suggestive of fear to loud noises, pain and sudden loss of support (e.g. Gray, 1971 a) all of which, of course, may come under Schneirla's "high stimulative intensities" (see above).

Another widely reported stimulus property associated with fear is that of novelty (e.g. Schaffer, 1971). However, novel stimuli may also elicit attraction or exploratory behaviour (Berlyne, 1960). Occasionally a "conflict" between approach and avoidance responses may be seen but extreme novelty usually elicits avoidance while moderate novelty results in approach behaviour (Berlyne, 1960).

Bronson (1971) stated that "the appearance of wariness as a reaction to the visually unfamiliar is a ubiquitous phenomenon of early development" (p. 59). The widely researched fear reaction towards strangers in infants is often seen as an instance of fear associated with novelty and perhaps deserves special consideration.

At the beginning, the behaviour of infants is indiscriminate in the sense that whether an object has been encountered before or not does not influence the direction of their behaviour, i.e. whether they will show approach or withdrawal. In time, however, they start to show selectivity with e.g. monkey infants ceasing to cling to all furry objects which they happen to contact, and human babies smiling only toward familiar individuals instead of any face-like configuration, while showing fear responses toward strangers (Schaffer, 1971). Such fear usually starts at about 8 months, hence "eight-month anxiety" (Rachman, 1974, p. 42). According to Mussen, Conger and Kagan (1974), "the child has schemata for people he knows; strangers represent slight discrepancies. If he cannot relate the new event to one that he knows, he is likely to become afraid" (p. 144).

Hebb (1946) has also argued that the fear of the young towards the unfamiliar arises from the perceived incongruity between sensory input and a central standard within the organism as a result of past experiences and therefore the ability of the infant to differentiate familiar from unfamiliar is a sufficient condition for the fear behaviour to be aroused. Schaffer (1971) pointed out that such "one-process" interpretations are not adequate and he challenged Hebb's position that as soon as the infant has acquired a central representation as a result of experience he has free and spontaneous access to it. According to Schaffer, observations of human infants have clearly indicated that discrimination of strangers occurs a few months <u>before</u> fear of strangers emerges but "infants in the first half year of their lives are severely limited in the extent to which they can make use of centrally stored as opposed to peripherally available stimulation ..." (p. 257). Schaffer and Emerson (1964) found that fear of strangers would initially appear only if the mother was present at the same time as the stranger (unlike older infants in whom fear was much more likely to occur when the mother was absent). Schaffer (1971) argued that if the task of infants is made easier by providing them with the standard of comparison either simultaneously or in immediate succession to the familiar stimulus with which it has to be matched, the fear of the strange can be seen at an earlier age to the one generally discussed. When the standard of comparison is not present and has to be retrieved from the infant's memory store, "a much more sophisticated cognitive operation is demanded which does not become evident till rather later ...", and "the growth of selectivity is (thus) ... intimately linked to the manner in which central representations function in infancy" (p. 260). These observations, however, are related to maturational factors which will be elaborated in the next section.

1.2 MATURATION-, AGE-, AND INTELLIGENCE-RELATED FEARS

The fact that certain fears and phobias appear only at particular ages in humans suggests that maturational influences are at work (Marks, 1977). Maturational factors associated with the onset of fears have been discussed by a number of authors. As suggested in the previous section, when a child is very young, its receptor and effector systems are not fully functional. As these systems mature, "so the fear responses grow in intensity and variety" (Sluckin, 1979, p. 240).

W. James (1891) reported that he gave a live frog to his son at the age of six to eight months and again when he was a year and a half old. The first time he seized it and eventually got its head into his mouth. He then let it crawl up his chest and face without showing signs of distress. The second time, however, it was not possible to induce the child to touch it. Marks (1969, 1977) observed that because of maturational effects fears and phobias of animals almost invariably start in childhood and rarely begin in adult life.

Valentine (1946) reported that fear of the dark became first apparent in 2 of his 5 children at about 5 years of age but he thought that, apart from maturation, suggestion might have contributed to this fear (see below).

One of the most commonly reported works on the effects of maturation is that by Sackett (1966). He studied 4 male and 4 female rhesus monkeys reared in isolation. Slides showing monkeys in poses of threat, play, fear, withdrawal, exploration, sex, inactivity, and slides showing infant monkeys and mother with infant were projected onto a screen in a daily test session. Sackett found that at 2 to 2½ months with a peak at 2½ to 3 months monkeys started showing disturbed behaviour whenever slides of threatening monkeys were projected. In contrast, slides of infants elicited more vocalisation and playful behaviour while the remaining slides elicited no responses. According to Sackett, the threatening behaviour functions as an "innate releasing stimulus" for the fear response and is maturational in character. However, as discussed in the previous section, though maturational factors evidently play a part in the elicitation of fear responses, arguments about "innate schemata", particularly in primates, are not conclusive. Schneirla (1965) referred to additional problems associated with the interpretation of findings of experiments like Sackett's when he wrote that "even with subjects that are defined as visually 'naive' ... only the first test may be considered a strict measure of naiveté ..." (p. 11). Sackett's subjects were exposed to the same slides repeatedly before they showed their most disturbed behaviour.

Habituation of the fear responses of the monkeys to the "threat-stimuli" appeared at about 110 days after birth as no consequences followed the fear behaviour. The waning of these responses is, according to Marks (1969), reminiscent of the waning of the babblings of deaf infants who spontaneously babble in the first year of life but cease to babble in the second year, presumably due to lack of social reinforcement, as they cannot hear the response of adults to their babbling. In a normal child the responses of the adults to the infant's babbling shape the child's sound into language. This analogy is supported by the fact that when Sackett's isolated monkeys were later brought into contact with other monkeys they did not show fear or withdrawal when attacked. Marks remarked: "The appropriate response had atrophied and did not develop, not having been reinforced at the time it first appeared" (p. 24).

It is thus apparent that fearful behaviour towards potentially threatening stimuli may readily be modified by the environmental conditions encountered by the organism at an early age of its development. This indeed seems to be true even for non-primate animals in which innate mechanisms are thought to be more stable and less amenable to learning experiences. Dimond (1966), for example, reported that the earliest fears of birds are modified by as early as embryonic experience (cited by Marks, 1969).

Hebb (1966) discussed the increase of emotional susceptibility with age and intelligence. He remarked that "intelligence may ... through imagination, increase the causes of emotional disturbance", even to the point that "man and ape can feel fear for others" and "it is the higher animal of whom fear of innocuous objects ... is characteristic" (p. 246). The number of fears a dog shows is greater than that of a rat and the list of fears becomes even larger in the case of a chimpanzee. Hebb (1966) described experiments in which chimpanzees, when young, i.e. 1 to 2 years old (corresponding roughly to 2 to 3 years in humans), may not show any interest to a "death mask", i.e. a plaster of paris cast of an adult chimpanzee; at the age of 5 to 6 years (corresponding to human 8 to 10 years) they may become very interested in it; however, at the age of 9 years and above chimpanzees show a strong fear response with erection of hair and avoidance of the test object. The same reactions were elicited by a clay model of an adult chimpanzee head about half life-size and by an actual chimpanzee's head that had been preserved in formalin. According to Hebb, a life-like model of a human head, sawn from a display dummy and various other related objects, e.g. a detached human hand (from the same dummy) produced identical fear reactions as due "to the limited intelligence of the chimp a model of a head may be in the same class as an actual head severed from the body of man" (p. 243). Hebb pointed out that there is a clear parallel to the chimpanzee's behaviour in the different reactions of human children and adults to distorted and damaged human bodies. "It is not children but their elders who are most upset by scenes of violence and broken bodies on T.V.; a color movie of a major operation can produce nausea and fainting in adults, but not in children ..." (p. 243). The arousal of fear in chimpanzees above was attributed to "perceptual discrepancy" between what the animal knows from past experience and what it sees when presented with parts of the body of either a chimp or a man. Hebb (1966) thinks that such incongruities are instrumental in eliciting other powerful emotional responses in man, e.g. race and religious prejudice in which there is a "conflict of ideas" arising from "what is the same and yet different" (p. 245). Marks (1969) also talks of "the uncanny quality of the object (which elicits fear and which) may (reside) in the combination of strangeness and very familiar" (p. 26). More recently, Smith (1979) and Sluckin (1979) suggested that the incongruity view of fear development in the child requires to take into account the advancement with age of cognitive as well as social learning factors. Thus, Sluckin wrote, "perceived incongruity in the environment has to do with the child's expectations" and "these expectations depend on perceptual exposure learning as well as on specific associative learning". As the child grows older, Sluckin continued, fear based on associative learning increases in importance in relation to fear based on incongruity and, thus, "the roles of maturation, exposure learning and associative learning ... appear more complementary than contradictory" (p. 241).

A number of studies have concentrated on the content of fears at different ages in children. Graziano, De Giovanni and Garcia (1979) wrote that after reviewing "a mass of research data" they concluded that age is an important variable influencing the content of fears in children. However, they noted that the relationship between kinds of fears and age is not a simple linear one as some fears remain operative while others lose their value and some new ones emerge.

One of the early studies on fears on the content of fears showed that children of preschool age tend to adopt their parents' fears, e.g. fears of dogs, insects and storms (Hagman, 1932 - reported by Mussen, Conger and Kagan, 1974). Similarly, Pratt (1945) found the influence of suggestion in the fears of rural children 4-16 years who reported as fearing many animals, e.g. bears, snakes, lions, tigers, none of which were found in their area and the fears could have been passed on by cultural tradition. This study was carried out in the U.S.A. and similar results were found by Newson and Newson (1968 - cited in Smith, 1979) in a British urban community with 4-year-olds (mothers were asked about children's fears); that is, many of their fears were of fantasy and included tigers and ghosts which could have probably been brought out by e.g. animal-patterned wallpaper.

Jersild and Holmes (1935) also wrote that as children grow they respond to imaginative impulses and images. They described children's fears at different ages and observed that fears in infants arise in response to events in the immediate environment but as they get older the range of fears becomes wider. Many other writers have made similar observations and Mussen et al. (1974) stated: "Fears of actual objects or unusual stimuli such as unexpected movements, strange objects, settings, or people ... decline with age during the preschool years. But fears of anticipated imaginary, or supernatural dangers, such as the possibility of accidents, darkness, dreams, ghosts, increase" (p. 388)(cf. Sluckin, 1979, above).

Heilbrun (1970 - cited in Mussen et al., 1974) thus found that children between 9-12 years were only moderately afraid of immediate and possible dangers, e.g. getting hit by a car, while they reported strong fears of remote or impossible events, such as a lion attack or ghosts. These imply that the child's cognitive development - his increased understanding of the world and greater use of representations and symbols - influences his fear responses (Mussen et al., 1974).

Symbolic thought, Marks (1969) argued "forms a fertile source of new fears" as thought, along with speech (Pavlov's 'second signal system'), may be responsible for "long chains of conditioned events" (p. 65). It is a widely familiar phenomenon that a word within a certain context may elicit intense fears (e.g. "fire" in a crowded theatre). Marks added: "Man's capacity for symbolism is infinite, and any cue may serve as a symbol for any idea. Any appropriate cue may therefore trigger fear through symbolic mediational processes" (p. 66).

It is apparent that with the advancement of age not only the content of fears changes, but also different mechanisms become operative in their acquisition. Indeed, according to Carr (1979, p. 204), differences in the incidence of fears and phobias at different ages "may reflect the importance of different learning processes at different ages, e.g. classical conditioning in early years and vicarious learning in later years ...". Commenting on the role of vicarious processes in fear acquisition, Rachman (1974) wrote: "It is plain that we acquire much of our behaviour, including emotional responses, by vicarious learning experiences", and "recognition of this process helps to account for the skewed distribution of fears in the population (e.g. snakes vs. lambs). Partly no doubt because of its intrinsic qualities and largely because it is rarely seen to provoke fear, the lamb is seldom a cause of fear. On the other side, snakes are widely feared and widely seen to provoke fear. There are many opportunities for the social transmission of snake fears and of course, these opportunities do not require the presence of an actual snake" (p. 82).

Social transmission of fears may also be brought about by transmission of information and particularly instruction. According to Rachman (1977), "information-giving is an inherent part of child rearing and is carried on by parents and peers in an almost unceasing fashion, particularly in the child's earliest years. It is probable that informational and instructional processes provide the basis for most of our commonly encountered fears of everyday life ... Like the acquisition of fear by vicarious experience, informational and instructional processes have no difficulty in coping with the fact that people display fears of situations and objects which they have never encountered" (p. 384).

At this point a brief reference to Bandura's Social Learning Theory (1977) should be made as it has stressed the prominent roles played by vicarious, symbolic and self-regulatory processes in psychological functioning. Bandura's theory acknowledges: (a) human thought, emotions and behaviour can be markedly influenced by observation (vicarious process), as well as by direct experience; (b) the capacity of humans to use symbols enables them to represent events, to analyze their conscious experience, to communicate with others across time and space, to plan, to create, to imagine, etc., (symbolic processes); (c) people are not simply reactors to external influences but they select, organize, and transform the stimuli that impinge upon them (self-regulatory processes).

These notions have led to the development of experimental paradigms by which processes such as observational learning and modelling were studied (Bandura, 1973; Liebert, Neale and Davidson, 1973). The experimental findings as well as the data on fear content presented above give support to Bandura's theory. Further indirect supportive evidence will be presented in the next section.

In summary, fear is an innate response but its content is strongly influenced by experience. It appears that we are born with the propensity to fear intense, sudden and novel stimuli and these may become the basis on which other fears for specific objects and situations are established through association. Reinforcement or lack of it, suggestion, observation, transmission of information and symbolic thought may also greatly modify the early fears so that fears of grown up children and adults are selective and complex and may only remotely be related to the fears of early infancy.

Before closing this section some comment on the data presented above and based on verbal reports ought to be made. It has frequently been argued that self-report of experienced fear seems a relatively satisfactory method of investigating fears (e.g. Agras, Sylvester and Oliveau, 1968) and given the difficulties, i.e. practical and ethical problems, in obtaining other indexes of fear (physiological and behavioural measures), subjective reports have been widely used. Rachman (1974) warned, however, that research based only on such data may be "a crude basis for predicition of fear" (p. 22), hence the evidence reported above (as well as much of what follows) ought to be treated with caution. This is particularly important regarding mothers' reports of fears of their children. Lapouse and Monk (1959), for example, found discrepancies between the reports of fears of 8-12 years old children and their mothers who tended to under-report their children's fears.

2 SOCIOCULTURAL INFLUENCES ON THE CONTENT OF FEARS

Landis (cited in Hallowell, 1938, p. 25) stated: "Emotional life is modified more rigorously in the growth and education of an individual than perhaps any other variety of human experience". According to Hallowell, the importance of sociocultural variables as constituents of affective experiences emerges from the recognition of the following general considerations:

1. Human behaviour differs markedly from that of the higher primates and lower mammals in that responses, acquired through social interaction with other human beings, predominate over innately determined behaviour patterns.

2. The socially transmitted responses "are intimately related

to a definable body of traditional concepts, beliefs, institutions, etc., that are historic products, transcending the lifetime or experience of the individuals whose lives they mould" (p. 27). As examples of the "social heritage we call culture", Hallowell mentioned religious beliefs and practices, language and sets of moral standards.

3. Since culture is found to vary across time and space, it must be recognized that emotional experience, in part, is a function of the variability in culture.

Subsequently, Hallowell reasoned that since culture includes the content of socially transmitted experience to which every person born into a society is exposed, "it provides the primary frame of reference to which all varieties of learned behaviour may be related" (p. 27). As far as emotional responses are concerned, culture defines: (a) The situations which will evoke certain emotions and not others; (b) the extent to which a response is supported by custom or inhibitions demanded; (c) the form which emotional expression takes. "It is to these norms that the individual will learn to accommodate his behaviour and in terms of which his affective experience will function" (p. 27).

In discussing the role of cultural influences on emotion, other writers have presented similar arguments. In this context, Lazarus, Averill and Opton (1970) wrote about the plasticity of human perception and thought. They cited Tursky and Sternbach (1967), for example, whose work on pain has shown cultural influences on differential perception. Schachter's work, on the other hand, has shown that "any feelings that occur are subordinate and highly manipulable in terms of our perceptions and interpretations of the situation" (Thomson, 1979, p. 19). Lazarus et al. (1970) argued that "through socialization, a culture may impose upon its members certain belief systems, standards of conduct, etc., which shape the appraisal of emotional stimuli (say, by determining what is threatening) ..." (p. 219). Thus, according to Lazarus et al., while phylogenesis may provide the ingredients for the "emotional pie", culture determines how the pie is cut.

The relevance of sociocultural factors to the content of fears and phobias has not been studied systematically but many publications have suggested their crucial importance. Hallowell (1938) commented that while such factors "are extremely complex and difficult to evaluate with precision, (they) cannot be ignored" (p. 25). This appears to be true irrespective of time and space onestudies. Based on studies by Laughlin (1956), Ashem (1963) and Kerry (1960), Marks (1969) remarked that "broad cultural influences" affect the "popularity" of certain phobias. While in the 16th century, for example, the most prevalent fears were about demons, witches and sorcery, in this century some common fears are about cancer, venereal disease, means of transport and atomic destruction. Thus, it seems that as new concepts and objects evolve, individuals develop and express phobias in new ways (Marks, 1969).

Broadly speaking, "social" refers to "a multiplicity of events in the human development" such as socioeconomic status, age, sex, race, nature of ecological stress, i.e. social is seen "in the context of here and now" (King, 1978, p. 408). On the other hand, "culture" refers to "a multivariate entity from child rearing practices to kinship systems ... (and) it is the total way of life of a group of human beings, primarily the shared patterns of values, beliefs, and feelings which are characterized by a distinct world view, codes of conduct, definition of reality ...", i.e., "culture is in its essence, history" (King, 1978, p. 419).

It should be pointed out that today, as countries develop and their social structure is more and more dictated by the requirements of increasing industrialization and technological advancement, they become more and more alike. However, as Caudill (1973) noted, "this does not mean that the traditional culture is lost, rather it persists in many important ways that deeply influence a person's way of thinking, emotional response and behavior" (p. 255). On the other hand, it could be argued that local cultures are also rapidly disappearing from the world's map. Dunham (1976), for example, commented: "In the present time where ... travel and communication are central characteristics of the world, cultural barriers are falling fast. As a result, anthropologists are fast losing their traditional data" (p. 153). Because of these reasons, it would perhaps be instructive to consider disorders associated with anxieties and fears which are still localized and indigenous to the cultures in which they appear (see below).

Caudill (1973) advocated that modern social structure and historical culture should be treated as separate variables as both have "fairly independent effects" on behaviour (p. 255). Unfortunately, the relevant studies in the field have rarely complied with this advocacy and this, as well as the fact that they have predominantly been concerned with only cultural influences, is reflected in the review below.

The discussion below will be concerned with the following:

(a) Fear content in certain complex syndromes
(b) Neurotic fears based on shared knowledge and beliefs in the culture
(c) Influences on the content of fears within the family subculture
(d) Normative research on fear content as related to social parameters.

2.1 FEAR CONTENT IN CERTAIN COMPLEX SYNDROMES

During the last few years research has shown that the major psychiatric disorders are found across different cultures and therefore the much discussed "cultural relativism" with regard to manifestation of psychopathological conditions may be invalid (Dunham, 1976; Strauss, 1979). However, "in all psychiatric disorders symptom profiles and specific content appear to be influenced by local norms and beliefs" (Strauss, 1979, p. 412). These become particularly evident in syndromes like "Koro" (Yap, 1965), "Latah" (Yap, 1952), "Wiitiko" (Parker, 1960), "El-Duende" (León, 1975), etc., all associated with intense anxiety and fears.

The syndrome koro refers to a "... state of acute anxiety with partial depersonalization leading to the conviction of penile shrinkage and to fears of dissolution" (Yap, 1965, p. 43). To prevent this, the sufferer holds his penis tightly in his fist and is assisted by his wife and other relatives as "he dare not let go of it, even for a second" (Dunham, 1976, p. 153). According to Yap (1965), koro is confined to South China and the lower Yang-tse valley. It is also found among overseas Chinese in S.E. Asia, especially Malaysia and Indonesia and with less frequent incidence among the Malay and Indian inhabitants of these two countries. The local character of this disorder is also indicated by the fact that a female type of koro has been reported too in which the sufferer feels that her breasts are shrinking and labia are being sucked inward (Dunham, 1976). In a footnote Yap (1965) commented: "Undoubtedly the koro phenomenon must have spread from China to Indonesia and adjoining lands with Chinese migration" (p. 46). However, sporadic cases of koro have been reported in other countries where the syndrome is not endemic.

Yap argued that the reason the syndrome is to be seen among certain large sections of the Chinese populace is to be found in traditional ideas of sex and physiology. These ideas are founded on a theory of humours, the harmonious equilibrium of male (yang) and female (yin) principles. During normal coitus a healthy exchange of yang and yin is supposed to take place but with masturbation or even nocturnal emission this healthy exchange cannot take place and the unbalanced loss of the yang humour causes koro. Yap studied 19 koro cases whose sexual history generally revealed an unusual story of conflict and maladjustment. All these patients resorted to masturbation. Most of the koro episodes occured typically at night "when thoughts are apt to stray on to sexual interests" (p. 45). The precipitating causes varied, e.g. koro occured after masturbation, urination, coitus, simple sexual arousal, etc. Interestingly, three of the patients started having their attacks after hearing of people allegedly dying from koro or after hearing koro being discussed. In the light of the evidence, Yap proposed that koro is being regarded as "culture-bound psychogenic disorder" as "its coherence is essentially dependent on the patient's learning a certain cluster of beliefs ..." (p. 48).

In an earlier paper, Yap (1952) described the "latah reaction" as "a specialized form of fright neurosis, with minimal hysterical features, culturally maintained ..." (p. 562). Patients with this condition are prone to react with fright to stimuli which normally do not evoke fear and additional symptoms include cloudiness of consciousness, and "echo-reactions" (echopraxia, echolalia, etc.) which render latah a complex disorder to study and, more than koro, it exceeds the features of neurosis. This illness has been described by travellers to the Malay Archipelago in the late 19th century but similar disorders have been observed elsewhere. Yap, like Hallowell (above) believes that "a person may be culturally conditioned to become afraid of certain stimuli which are neither in their physical aspects frightening nor in themselves real threats to human life or security" (p. 538).

Similar influences and particularly social factors appear to be operating in yet another localized syndrome called "wiitiko" which is seen among the Cree and Ojibwa Indians of Canada's forested northland (Parker, 1960). This condition may begin with feelings of morbid depression, nausea and distaste for most ordinary foods and progressively the sufferer becomes obsessed with paranoid ideas which may result in violent homicidal cannibalism. It is thought that wiitiko is an exaggeration of an ever-present and objective fear of starvation among the people in the area (Landes, 1938 - cited in Parker, 1960). Thus, "... the illness reflects an exaggeration of a normal anxiety, conditioned by objective determinants in the environment" (Parker, 1960, p. 603).

2.2 NEUROTIC FEARS BASED ON SHARED KNOWLEDGE AND BELIEFS IN THE CULTURE

The notion that native beliefs may result in intense fears was discussed, among others, by Hallowell (1941). In describing the animal fears of Indians living on the Berens River in Canada, Hallowell (1938) wrote: "It would be impossible ... to make any <u>a priori</u> judgement, based upon our attitude towards wild life, as to which animals are feared and which are not. Wolves and bears ... are common in this region, but the Indians are never afraid of them. The creatures they fear most are snakes, toads and frogs ..." (p. 28).

With regard to the fear of snakes, Hallowell (1938) pointed out that it becomes intelligible if reference is made to mythology. There was a time that the earth was inhabited by monster snakes and some of these are still about. A few persons claim to have seen them, yet they are much feared. "It is the identification of actual snakes with the mythical variety that accounts in part for the attitude of the Indians toward the former" (p. 29). It should perhaps be added that what is good for Indians is good for the rest of humanity and this may explain the relatively widespread fears of snakes. However, Hallowell claims that in the case of Indians, their emotional responses towards snakes are distinctly different to those of the rest of us since "the approach of a wild animal of any sort to their camp or habitation is an ill omen. It is a sign that someone is trying to bewitch them. The animal is thought to be the male-volent agent of the sorcerer" (p. 29). This being so, it should be pointed out that while Hallowell stated that any wild animal may be such an agent and therefore feared, he had earlier mentioned that wolves and bears (presumably wild animals too) do not evoke fear. It could be argued that the reason the latter do not arouse fear is that these animals "are common in this region" (p. 28) and as a result people become desensitized toward them. However, frogs and toads must also be very common as these Indians live by a river and it may, therefore, be speculated that only certain wild animals (irrespective of the objective threat they pose) are feared because only they are commonly portrayed in the Indians' mythology.

Similarly, Hallowell (1941) described very intense fears of non-dangerous diseases among the Saulteaux (American Indians in Canada). For Saulteaux, one of the major causes of illness is bad moral conduct either on behalf of the person concerned or his parents. Another cause of illness is witchcraft which however is seen as in retaliation for some bad act carried out by the sufferer. Thus, "native theories of disease causation invest certain disease situations with a traumatic quality which is a function of the beliefs held rather than of the actual danger threatened by the illness itself ..." and "the quality of affect suggests neurotic anxiety" (p. 875) which can only be relieved by resorting to certain rituals like confession of the alleged sins in public.

Nearer to home, Ryle (1948) in his Maudsley lecture under the title "Nosophobia", considered the anxiety caused by fear of disease. He referred to Geraldine Coster (1932) who had stated that fear of disease is, in fact, one of the commonest causes of adult neurosis.

Ryle noted that "in studying fears of disease, we can trace the whole gradation from the natural reactions of healthy people and the physically sick or injured, through the anxious preoccupations of the neurotic, to the morbid obsessions of the insane" (p. 2). The element that makes nosophobia of interest here is that it is "both as an individual and, by reason of its prevalence ... a social problem" (p. 5). Although nosophobia has a multiple factor aetiology, including the constitution of the individual, variables which contribute to its manifestation include "a half-knowledge of the disease feared due to reading, acquired through gossip, or prompted by public pronouncements or actual acquaintance with a sufferer from the disease" (p. 9). Ryle also remarked that "popular fears of disease are variously propagated ... Errors of belief and practice are passed as old wives' tale from neighbour to neighbour and mother to daughter ..." Geraldine Coster (1932, cited in Ryle, 1948, p. 2) had previously written: "Foolish newspaper articles and half-understood fragments of conversation heard in youth prey upon the minds of people who would shrink from admitting their anxiety even to a physician". Consequently, Ryle stated, where treatment and prevention are concerned, it is necessary to think not only in terms of individual but also of social psychiatry and appropriate public actions.

According to Ryle, in common with other social diseases, nosophobia's extent and influence fluctuate within the community and vary from community to community. As such, it must be commoner in urban populations than in the country and "among mental rather than manual workers" (p. 6).

It should be stressed that nosophobia is not always linked to a real illness. Indeed, nosophobia without a definite disease is "by far the largest category" (p. 9) as, for example, "cancer phobia without cancer is ... far commoner than cancer phobia with cancer" (p. 13). Interestingly, amongst 31 cases of cancer phobia, Ryle reported 12 patients who had lost a near relative or friend or neighbour from cancer illness or they had "intimate knowledge" of a case or cases. "Two were in the habit of reading articles in the papers and other literature bearing on cancer" (p. 13). Amongst Ryle's case-records, there were even a number of medical men and women who visited him in fear of cancer or other organic disease, "a fear frequently based upon symptoms which would scarcely have given them pause in the case of their own patients" (p. 9).

There is a relevant point which ought, perhaps, to be raised here and it is related to the problem of whether biological or cultural factors underlie nosophobia. It could be argued that disease has always been threatening to man, including the pretechnological one, and therefore it is biologically based. This could be true, however, if the content of fears of diseases were evidently related to diseases (or injuries) of significance to the pretechnological man - something that is very difficult to conceive when considering specific fears of e.g. cancer of the blood or syphilophobia. Furthermore, it is apparent from the above that the content of disease fears is directly related to certain beliefs within a cultural group (i.e. are not seen widely spread as the evolutionary hypothesis would predict) or they appear to depend on information provided by the media and observations of other people. A category of fears which is also based on such factors and which has emerged in relatively recent years is associated with the outer space. Kerry (1960) described "space phobias" in four patients; he wrote that these cases are worthy of interest "because they demonstrate the influence of cultural factors on neurotic symptoms" (p. 1386).

Marks (1969) argued that since certain fears including "superstitious fears", "taboos" and "collective beliefs" about dangerous situations are common among the members of a particular cultural group they should not be regarded as phobias. However, in addressing this aspect of certain phobias Savage, Leighton and Leighton (1965) pointed out that with such reasoning "... it is possible to take one's respect for culture too far and assume that fear of witches (for example) could not be a phobia. This could lead to finding no phobias in a cultural group in which they were actually present" (p. 57). Thus, common fears within a culture should perhaps be recognized as phobias if these fears acquire the characteristics of a phobia, i.e. they become excessive, persistent, unadaptive and cannot be reasoned away (Marks, 1969) in the way childrens' fears (e.g. animals) are. There seems to be no justification for considering the latter (i.e. those based on early fears) as phobias and not the former (those based on fears in the culture). However, "the genuine neurotic, in addition to sharing the culturally constituted fears of his fellows, has fears which in quantity and quality deviate from those of the cultural patterns" (K. Horney, 1937 - cited in Hallowell, 1938, p. 38). This may sound vague but Hallowell referred to an additional differentiation between "genuine neurotics" and persons experiencing "normal" fears in their culture: the former are inevitably suffering individuals (there is impairment of vitality, enjoyment of life) while the latter are not (they suffer as anybody else and in general enjoy life).

2.3 INFLUENCES ON THE CONTENT OF FEARS WITHIN THE FAMILY SUBCULTURE

A number of writers have noted that fears and phobias may be shared by members of the same family. Thus, Bloch (1974) wrote that repeatedly anxious, phobic patients are viewed as expressing emotion present in other members of the family, often a husband or wife, and referred to Fry (1962) who had previously said that upon careful study of the patients in this group the spouses reveal a history of symptoms closely resembling, if not identical to, the symptoms of the patient.

Marks (1969) also wrote that phobias tend to run in families and this is exemplified by studies in which the fears of children were correlated with those of mothers. John (1941) studied the effects of evacuation among children of pre-school age who had experienced air raids in the second world war. He found "a high correlation (.59) ... between the fear evinced by the child and the fear experienced by the mother" (p. 179). The most prominent fears of the children which persisted and even increased 6 months after the raids were fears of noise, of the dark and of strange persons. John noted that the children's fears were not so much affected by the noise of the proximity of the raid as the amount of fear that the childrens' own mothers had exhibited in their vicinity.

Similarly, Lewis (1942 - cited in Rachman, 1978a) reporting on the effects of air raids during the war wrote that frightened mothers communicated their fears to the children. In his study of San Francisco children on blackouts and alerts, J. Solomon (1942 - cited in Rachman, 1978a) also wrote that their fears were largely due to the contagion of anxiety from their parents. As a result of such studies, I.L. Janis (1951), according to Rachman (1978a, p. 38) concluded that "the incidence of acute emotional disturbances among young children in a community exposed to air raids will tend to vary directly with the incidence of overt excitement and emotional upset among the adults in that community". Ryle (1948) referred to the "contagious fear or panic ... in times of war or civil disaster" (p. 5) more generally. This, of course, applies both within and without family in a community. Thus, seventy percent of 1700 infantry veterans in the Italian theatre of war had some negative reaction to seeing a comrade "crack up" and half of them reported that this increased their susceptibility to fear (Stouffer, 1949 - cited in Rachman, 1978a, p. 78). Rachman referred to another similar study by Dollard (1944) in which 75% of soldiers reported fear-contagion.

Hagman (1932 - cited in Carr, 1979) studied children ranging in age between 23 months and 6 years and interviewed their mothers. He found a correlation of 0.67 between the gross number of children's fears and the gross number of their mothers' fears and children tended to show fears corresponding to those of their mothers. May (1950 - cited in Rachman, 1974) also found a close correspondence between the fears of children within the same family, with correlations ranging between 0.65 and 0.74.

Finally, Ryle (1948), in discussing the fears of diseases (see previous section) wrote: "A fear about disease, whether real or imagined, in a near relative, and especially in a consort or child, constitutes another kind of nosophobia. In this case anxiety can be transferred from one person to another, may react unfavourably upon the patient and may even come to involve a whole family" (p. 5). Marks (1969) also argued that sickness phobias can be based on childhood anxieties inspired when the threat of sickness is made as punishment for wrongdoing. The content of such a fear depends upon the health history of the individual which "may have fixated anxiety on a particular body system upon identification with illness in a close relative ..." (p. 81).

2.4 NORMATIVE RESEARCH ON FEAR CONTENT AS RELATED TO SOCIAL PARAMETERS

There have been several reports, particularly on children and adolescents, in which the fears of subjects have been studied in the context of the demographic parameters of sex, age and socioeconomic status. Data related to age have been presented in section 1.2 above. The review below will focus on the parameters of sex and socioeconomic status. The relevant studies, apart from using fear questionnaires (e.g. Bernstein and Allen, 1969; Bamber, 1974), they have used the method of asking subjects (or, if very young, their mothers) to report fears either with direct reference to themselves or indirectly with reference to their friends (e.g. Newstatter, 1938, Angelino, Dollins and Mech, 1956). Only rarely the method of direct observation of subjects in a fear provoking situation has been used (Macfarlane, Allen and Honzik, 1954; Jesild and Holmes 1935) and, therefore, the reservations made in section 1.2 regarding the validity of data based only on verbal reports apply equally well here.

2.4.1 SEX DIFFERENCES IN FEARS

Graziano, De Giovanni and Garcia (1979) wrote that a consistent finding in this type of research among young people is that however fear is measured, girls obtain higher fear scores (numbers of reported fears) than boys (Angelino et al., 1956, Spiegler and Liebert, 1970, Bamber, 1974, etc.). They have noted, however, that while no study has found generally higher fear scores for boys, three papers have reported no sex differences (Maurer, 1965; Nalven, 1970; Miller, Barvett, Hampe and Noble, 1971).

The data related to the content of fears of young people appear also somewhat inconsistent and some representative studies will be reported. Lapouse and Monk (1959) found significant sex differences in fear content and specifically in the percentage of children fearing certain objects. Earlier studies, however, (Pratt 1945; Macfarlane et al., 1954) suggested no sex differences in the content of childrens' fears. More recently, Bamber (1974) compared the percentage of top 10 fears in different categories as described by Wolpe and Lang (1964), i.e. "animal", "tissue damage", "classicalphobias", "social", "noises" and "miscellaneous". He found that among his adolescent subjects girls reported more animal fears. Interestingly, the fact that "bats" appeared in the top 10 fears of the large majority of girls of different ages was interpreted in terms of the popular superstition that bats tangle themselves in womens' hair. On the other hand, boys reported more miscellaneous fears than girls and the item "failure" was in a dominant position. Bamber thought that this is related to anxieties regarding job expectations and this is supported by the fact that the same fear is also prominent among grammar school girls but not secondary school girls (grammar schools are thought to be attended by brighter and higher socioeconomic status pupils). The majority of secondary school girls, according to Bamber, tend to regard jobs as time-fillers between the end of compulsory schooling and early marriage.

With regard to intensity of fears, Russell (1967), Scherer and Nakamura (1968) and Bamber (1974) found that girls reported greater intensity of fears than boys. Graziano and De Giovanni (1979) also reported that a higher percentage of girls than boys are referred for treatment. These reports are consistent with similar ones on adult subjects (see below). Relatively recently an interesting finding was reported (Evans and White, 1980) with respect to the intensity of fear of snakes in children 11-15 years. Analysis of the ratings of how the subjects would feel about picking up a snake showed that sex differences in fear emerge gradually, with boys showing a significant decrease in fear as they become older. This was thought as consistent with the view that sex differences in certain fears are based on the social learning of stereotyped roles (see below).

Gray (1971b) surveyed emotionality in humans and concluded that women are more often phobic or report other symptoms of psychoneurotic nature or, at least they more often claim to have or admit having these symptoms, than men. Hersen (1973) also wrote that when total fear scores (on Fear Survey Schedules/FSSs) are considered, research has shown consistently that females report significantly higher degrees of fears than males. Furthermore, this consistency is found both among college students (Geer, 1965; Manosevitz and Lanyon, 1965; Bernstein and Allen, 1969), and among psychiatric samples (Lawlis 1971; Hersen, 1971). In accounting for such data it has often been argued that a "social desirability" factor inhibits males from admitting to fears whereas in females such admission is in accordance with social expectations (Hersen, 1973). Thus, Öhman, Fredrikson and Hugdahl (1978a) argued, differences in fears between the sexes emerge in puberty which "involves more explicit pressures towards conforming to the sex roles. For boys, this implies social pressure towards 'male behavior', an important ingredient of which is to be brave and unfearful. Boys therefore are likely to deny their fear and to force themselves to face the feared situation, which ultimately may result in extinction of the fear" (p. 109).

Geer (1965) analysed all the 51-items of the FSS used by testing for sex differences beyond those expected on the basis of sex differences in the total scores. He found 11 significant such differences with 7 of them indicating higher scores for the female subjects. Subsequently, Bernstein and Allen (1969) used the same questionnaire and found 17 significant sex differences, all indicating high ratings by females and including the 7 items which were found in the study by Geer (1965). An inspection of the items on which females scored higher than males suggests that these are distributed across different categories of fears with the notable exception of social fears in which no significant sex differences were apparently found. Manosevitz and Lanyon (1965), using ordinary t-test comparisons found 30 significant sex differences - all but two indicating higher ratings for females; the FSS which was used consisted of 98 items. The items on which females scored higher than males were found to be, more or less, evenly distributed across the categories described by Wolpe and Lang (see above) so that the investigators concluded that women are more prone than men to report fears in general·rather than specific ones.

Among patients receiving psychotherapeutic treatment, Lawlis (1971) found higher ratings for females on 71 of the 122 items of the questionnaire used. Inspection of these items indicates that they, too, are distributed across different categories of fears.

It is apparent from the above that females report greater numbers and more intense fears than males. However, the evidence regarding sex differences in the content of fears is somehow inconsistent. It is interesting nevertheless that in early childhood the sexes seem to share most fears but among adolescents the fears appear to diverge. The latter may be related to the differences in the incidence of certain phobias and particularly agoraphobias - they comprise, 60% of all phobias and 75% of them are found in women (Marks, 1969). Thus, in contrast with data from some surveys on the distribution of fears, the content of phobias as seen in the clinic seems to be related to the sex of the individual and this is not surprising when considering that behaviour is often acquired through observational learning which is known to be influenced by the similarity of the observer to the model (e.g. Mussen, Conger and Kagan, 1974). However, as noted above, this may also be related to the social pressures more generally which may not only dictate which sex is "allowed" to be more fearful than the other but also which fears are more "appropriate" than others for each sex as suggested by the study of Evans and White (1980 - see above). It could be therefore concluded that, generally, sex is a relevant variable as far as the content of fears is concerned.

2.4.2 SOCIOECONOMIC STATUS AND FEARS

A number of studies on children and adolescents have reported that content as well as number of fears are related to socioeconomic status (SES). Jersild, Markey and Jersild (1933) examined the fears of approximately 400 children aged between 5 and 12 from two different schools of the New York city. One group (240 subjects) came from "relatively poor homes" and the other (160 subjects) came from "relatively well-to-do and cultured" homes. Typically, the poorer children were found to report more fears of animals, bad people and robbers, while the well-to-do children reported more fears of bodily harm and physical danger, of the dark, of being alone and of strange sights. It is noteworthy that a greater proportion of well-to-do children reported they had no fears at all.

In a subsequent study, Jersild and Holmes (1935) found no differences in fears of children between 2 and 6 years old. In the age group of 6 to 12 years, however, the lower SES group had more fears of a supernatural and remote nature such as strange persons, criminal characters, being abandoned by parents, etc., and animals. The higher SES group showed more fears of dangers like fire, falling, drowning, and dying, and of noises.

Newstatter (1938) studied the fears and worries of children aged between 7 and 14 years. The subjects were selected from 3 groups of 50 families of the London area. Group I consisted of "poor-working-class" families (35 out of 50 had no money for the B.M.A. minimum dietary requirements); Group II were better-off families comprising "professional and clerical" workers. Finally, Group III were "well-to-do" families, the parents being "middle-class", i.e. professional workers, in business, etc. The investigation was carried out by oral interviews mainly with mothers. It was found that generally the SES did not affect the nervousness of children as the well-to-do children appeared to have as many fears as the poor children. However, the working-class children were found to worry about their parents quarreling, food, exams, money and showed greater fear of noise and punishment, while the better-off children had more generalized fears and worries. An additional interesting finding was that there was a statistically valid relationship between worry in the parents and worry and fears in the children "irrespective of social class" (p. 1441).

In a study by Davidson (1943 - cited in Angelino, Dollins and Mech, 1956), 102 children (60 boys and 42 girls) aged between 9 and 14, with IQs between 120 and 200 and from different backgrounds were asked to list their most intense fears. It was found that fears or lack of them were significantly associated with differences in SES. Thus, 65.6% of the poorest and 48% of the wealthiest reported having no fears. In general, Davidson concluded that although fears and worries are present in all groups of children the content of fears is often different in the different socioeconomic groups.

Angelino et al. (1956) studied the fears of 1100 pupils (562 boys and 568 girls), aged between 9 and 18 in Oklahoma City area. The subjects were classified as either from a "high" or "low" SES and they were asked to list their fears and worries they thought persons of their age group had. According to Angelino et al., qualitative inspection of the protocols showed that boys of "low" SES were more concerned with matters of violence such as robbers, killers, guns, switchblades, dope peddlers and whippings and of their parents than the "upper" SES boys. The latter, in turn, were more concerned with car accidents, storms and more or less nebulous phenomena, such as being hurt or getting killed, juvenile delinquents, school accidents and disaster. "Lower" girls, on the other hand, were more afraid of animals, strangers, acts of violence, being alone at night and drunks than "upper" girls who were concerned with kidnappers, heights and a variety of other stimuli and situations such as ship and train wrecks, roller coasters, communist attack, riots, getting hurt while playing hockey, etc. The authors concluded that both content and number of fears varied with SES, with lower SES children having more fears than upper SES children.

Nalven (1970) studied "the manifest fears and worries of middle-class vs. ghetto children" among 251 subjects of 5th and 6th grade. A hundred and one of them attended a Brooklyn, New York ghetto school in which 99% of the pupils were black and 150 were from predominantly white middle-class schools in Southeastern New York. The subjects were requested to list the fears and worries they thought persons of their age group had. The major difference which was found was that a greater number of specific animal fears (including many "rats" and "roaches") were reported by the ghetto subjects. This finding may reflect, according to Nalven, the actual problems in their ghetto dwellings. Commenting on these results, Graziano, De Giovanni and Garcia (1979) wrote that the fears of the ghetto children strongly suggest the socially-determined nature of fear content and an immediacy and reality basis for the expressed fears. These children might perceive their immediate environment as far more hostile than the higher SES children, a hypothesis which is worth testing (Graziano, et al., 1979). Bamber (1974) reported a study in which 1112 adolescents aged 12-18 years took part and to whom a slightly modified version of the FSS-III by Wolpe and Lang (1964) was administered. Among other findings, it was reported that grammar school (i.e. of higher socioeconomic status) girls (38%) and boys (35.3%) had more social fears than secondary school (i.e. of lower socioeconomic status) girls (27.5%) and boys (30.2%). In contrast, secondary school girls (52.5%) and boys (53.5%) had more tissue damage fears than grammar school girls (38%) and boys (47%). In the light of his findings, Bamber wrote that socioeconomic status (as well as intellectual ability and age) "tend to be reflected in specific rather than general variations within the area of adolescent fears" (p. 139).

Finally, it should be pointed out that data on the intensity of fears as related to SES have not been reported.

In summary, the evidence presented in sections 2-2.4.2 suggests that fear stimuli are often culturally and socially determined. As Graziano et al. with reference to children's fears (but it could be generally applied) wrote, fears are appropriate to age, social class and role, culture and even moment in history.

3 CONCLUSIONS

People are born with the propensity to fear certain characteristics of stimuli rather than specific objects and situations and these innate fears may form the basis on which more complex ones are established through selective learning. However, life experience both in the context of development as well as through social interaction greatly influences the extent to which people fear and the kinds of fears they have. The content of fears changes with age, sex, culture and socioeconomic status. In other words, fear responses are far more flexible than Seligman's theory (Chapter I) would allow and as Suomi and Harlow (1976) pointed out, this flexibility should not be without evolutionary significance. Indeed, in a constantly changing world and with a predictably unpredictable future (cf. Plotkin and Odling-Smee, 1979), it would have been maladaptive for humans to predominantly associate with fear stimuli threatening to the pre-technological man and be less able to profit from the changing conditions and their direct and indirect life experiences. In this sense fear responses retain their biological significance but it is suggested that these are far more complex and flexible than envisaged by the biological preparedness hypothesis.

CHAPTER III

THE ORIENTING REFLEX AND ITS HABITUATION

1 INTRODUCTION

Various theories have been put forward regarding the acquisition of phobias and some of these were mentioned in the preceding chapters. Even though different theoretical frameworks propose different paradigms for studying phobias (e.g. classical conditioning, vicarious conditioning), it is widely recognised that phobias are learned and, in this respect, even psychoanalytic thinking seems to be in agreement (cf. Freud, 1933, p. 83).

However, for a phobia to be learned the phobic stimulus must first be attended to. Pavlov observed, for example, that only stimuli which elicited some attentional reactions in animals could serve as effective conditioned stimuli. In this sense, the orienting reflex (OR) is of central importance to the study of the content of phobias since the OR is thought to activate a person for information processing and to be a convenient index of attention (e.g. Haywood and Burke, 1977).

This chapter reviews some central features from the extensive literature on the OR, concentrating more on human orienting and aspects relevant to this thesis.

2 GENERAL CHARACTERISTICS OF THE OR

Sokolov (1960) wrote that the term "orienting reflex" was first introduced by Pavlov in 1910. Pavlov (1927) defined the OR as "the immediate response in man and animals to the slightest changes in the world around them" (p. 12). Since then, a large body of studies has indicated that the initial presentations of a stimulus of low to moderate intensity and irrespective of its modality elicits a number of separate responses which are referred to as "component responses" of the OR. Operationally a component of the OR could be defined "as any response which is elicited by the first presentations of a novel stimulus and which, with repeated presentations of the stimulus, ceases to be elicited by it ..." (Gray, 1969, p. 12). The progressive decrement and extinction of the OR is referred to as "habituation" (see section 3).

There are many readily available accounts of the OR components and their classifications (e.g. Berlyne, 1960; Lynn, 1966). Briefly, the OR is thought of as a central-nervous-system event signalled by increased cortical arousal, behavioural arrest, orientation and increased sensitivity of the receptors (threshold lowering even by stimuli of different modality), increased muscle tonus and by vegetative changes which include the electrodermal response (EDR), respiratory-rate changes and heart-rate changes and a combination of vasoconstriction in the fingers with vasodilation in the head.

From the above it appears that the OR has at least two aspects: a syndrome of peripheral responses and a change in central excitability. The peripheral responses are often inconsistent with one another as each peripheral system has its own peculiarities and they vary not only across but also within the same species (Lacey and Lacey, 1958; Lacey, 1959). Thompson, Berry, Rinaldi and Berger (1979) commented: "The various components of the different peripheral-response measures often do not behave in a manner consistent with each other, particularly in response to a repeated stimulus. It would be very surprising if they did. The peripheral systems measured in studies of orienting do not exist for the purpose of exhibiting orienting ..." (p. 39). However, they also wrote, "it should be possible to develop a series of equations that relate the idiosyncratic changes in each component of each peripheral response system to the central state of arousal" (pp. 40-1). Workers in the field have used the EDR far more frequently than any other index as this response is both the most sensitive and readily accessible component of the OR (e.g. Lykken, 1968; van Olst, 1971).

Sokolov (1963) distinguished between "phasic" and "tonic" reflexes or what Berlyne (1961) described as "transitory jumps and more lasting upward drifts in the level of arousal" (p. 476). Sokolov (1963) also wrote about the "localized" reflex which is confined to a particular analyzer, i.e. to a single receptor with its projection system and corresponding cortical area vs. the "generalized" reflex which is elicited first and involves activation of all the analyzers. With stimulus repetition the generalized OR becomes confined to the localized one.

Sokolov (1963) differentiated between the OR and defense response (DR) on the one hand, and adaptive response on the other. Stimuli of low to moderate intensity elicit ORs but intense stimuli evoke DRs which, like the ORs, are generalized reactions and many physiological changes are shared by both types of responses. For Sokolov the major distinction between the two is that the OR is characterized by vasodilation in the head and the DR by vasoconstriction. Graham and Clifton (1966) suggested that the acceleration component of the cardiac response is also associated with defensive and the deceleration component with orienting responses. The habituation processes of ORs and DRs differ, i.e. OR usually habituates after 3-12 stimulations but the DR does so with substantially more trials, often more than 30.

The adaptive reflex is confined to the sense organs and sensory pathways which are stimulated, it continues throughout stimulation and fails to extinguish with repetition of stimulus. Also, unlike the OR, the adaptive response does not reappear (dishabituate) after a change in a habituated stimulus. Thus, as van Olst (1971) wrote, both the adaptive and defensive reflexes serve to restrict the effect of the stimulus with the adaptive reflex being limited to a specific analyzer and the defensive reflex extending to the whole organism. On the other hand, ORs may show "transformability" (Lynn, 1966), i.e. after repeated presentations and depending on the intensity of a stimulus an OR may be replaced by an adaptive response (if the stimulus is relatively weak) or by a DR (if the stimulus is relatively intense).

A stimulus is thought to acquire "signal" value after its pairing with an important event or instructing subjects to attend to it or make a particular response (motor, verbal association) upon its presentation (Lynn, 1966). The habituation process is much slower with signal than non-signal stimuli; ORs to the former can be evoked for dozens of times (Sokolov, 1963).

3 FUNCTIONAL SIGNIFICANCE OF THE OR

Pavlov (1927) wrote: "The biological significance of this reflex (i.e. OR) is obvious. If the animal were not provided with such a reflex its life would hang at every moment by a thread". He described this important role of the OR as follows: "This reflex ... brings about the immediate response in man and animals to the slightest changes ... so that they immediately orientate their appropriate receptor organ in accordance with the perceptible quality in the agent bringing about the change, making full investigation of it" (p. 12).

Pavlov gave various names to this reaction; he called it "investigatory", "orienting", "adjusting", "attitudinal" and "what is it?" reflex. Although the word reflex implies its innate nature, in calling it "what is it?" Pavlov chose the Russian phrase "Shto eta takōe?" instead of the more simple expression "Shto eta?" (Kimmel, 1979). According to Kimmel, the addition of "takōe" emphasizes the stimulus in the question whereas the simpler version would refer "to whatever it may be that is happening out there more generally" (p. xii). The addition of "takōe" may have had a more literary meaning, too. For the Russian intellectual of Pavlov's time a question of this form inquired the essence or nature of a concept, state, condition, etc., and Pavlov's "Shto eta takōe?" reflex may have conveyed, therefore, both the general, attentional meaning of the "what is it?" reflex as well as the selective, deeper investigatory "what is the nature of this thing?" (Kimmel, 1979). The voluminous publications on OR reflect this double aspect and relevant studies will be presented below.

Sokolov's (1963, 1966) work concentrated largely on elucidating the functions of the OR which he primarily saw as producing heightened sensitivity to stimulation and increased intake and processing of information. Thus, Sokolov (1969) wrote, "the OR guarantees that the organism will be in the best position to predict the operation of stimuli" (p. 684). However, the mechanisms underlying these activating processes were left somewhat unclear. The most important mechanism is thought to be the lowering of sensory thresholds which may facilitate the identification of low-intensity stimuli. This is brought about by changes in both central and peripheral (e.g. pupil dilation) activities. Kahneman (1973) argued that these views of Sokolov should not be accepted uncritically as, for example, "the argument that a large pupil enhances sensitivity is doubtful ... because gains in sensitivity to light are probably offset by a loss in the quality of the retinal image" (p. 46). No adequate relevant psychophysiological work has been done directly. However, there is considerable indirect support for Sokolov's views given by "a wealth of evidence" from studies in the fields of e.g. sensory interaction and intersensory facilitation (Siddle and Spinks, 1979, p. 487).

Jeffrey (1968), following Sokolov, has also stated that the OR sharpens attention and focusses it on a cue or a salient feature of that cue. It is apparent therefore that the OR is seen as preparing the organism to deal with potentially important stimuli. The preparatory function of the OR components is often obvious as e.g. turning the head towards the stimulus and increasing the muscular tension. Occasionally, the function of certain OR components is not so obvious as e.g. in the case of the EDR (see chapter IV).

The OR is generally considered to play a central role in learning and particularly in the formation of conditioned responses (CRs) since this reflex is associated with focus of attention and the role of the latter is "to select the percepts that will be constructed or synthesized" (Kahneman, 1973, p. 126). More specifically, the first phase of classical conditioning is the development of a marked OR to the CS. If a stimulus is repeated extensively so that the OR is totally habituated, the stimulus is no longer effective as a CS (Sokolov, 1963). As Kahneman (1973) wrote, "when one no longer pays attention to the occurence of an event, it is difficult to learn anything new about it" (p. 46). Similarly, Anokhin (1958) had earlier discussed the facilitation of conditioning by the OR as the latter increases the excitation of the cortex to a level optimal for the association, i.e. linking of cortical representations. During conditioning, the parallel processes of a kind of cortical excitation and habituation of the OR to the CS take place and before the CR has been fully established a reciprocal inhibition between the two responses exists, with the OR inhibiting the CR so that the organism has time to evaluate the stimulus. The actual formation of a stable CR coincides with the extinction of the OR. Kreitler and Kreitler (1976) pointed out that this apparently necessary role of the OR in the formation of CRs is not invalidated by those cases in which conditioning has been established in drowsy adults who had possibly not shown orienting prior to conditioning (Paramanova, 1958; Vinogradova, 1958). On the contrary, it is the irregularities of such conditioning, i.e. short latency and duration, its instability, its alien character for the subject and so on, which prove the indispensability of orienting for normal conditioning. Any change in the conditioning procedure or the CS restores the OR until the response to the altered situation becomes again habituated. To sum up, the OR increases the excitation level of the cortex up to an optimal level for the formation of CRs and, through its discriminatory role, prevents the fast development of rigid, overspecialized connections under changing conditions that require constant adaptations (Kreitler and Kreitler, 1976). Zaporozhets (1958) extended these notions and suggested that by the OR the initial discriminations among stimuli and their interconnections which are necessary for the production of an image or program of what to do are made and these are the basis for any voluntary action.

More recently, Öhman (1979b)proposed a model of the OR (see section 8) within an information-processing perspective. According to Öhman too, "the OR is a prerequisite for learning, because information can be stored in long-term memory only through processing in the central processing channel" (p. 445). In his model, the autonomic concomitants of an OR denote a "call initiating processing" in a central channel of limited capacity. Öhman argued that we learn primarily about events which evoke intense ORs as central processing relates the stimulus to the content of the short-term store which results in the forming of new associations that can be transferred to the long-term store. It may be pointed out that the above views are consistent with Luria's (1963) explanation of the difficulties of mentally deficient persons in learning. He argued that these difficulties are due to defects in the OR system as a result of which verbal behaviour cannot develop normally. Similarly, Zaporozhets (1961) attributed the difficulty in acquiring and performing certain skills in infants (e.g. doing-up buttons) to the haphazard and poorly directed ORs of young children.

4 THEORIES OF THE OR ELICITATION AND HABITUATION

Habituation may be defined as the process which manifests itself by a decrement of response magnitude with repeated stimulation and this decrement cannot be explained in terms of fatigue or receptor adaptation (Thompson and Spencer, 1966). The decrease in response is usually a negative exponential function of the number of stimulus presentations (Hinde, 1970). Habituation is one of the most pervasive phenomena of the biological kingdom (Harris, 1943) and it can be observed in a variety of response systems though it is premature to assume that the processes underlying it are the same in all instances (Hinde, 1970). It is thought to be "a fundamental and elementary form of behavioral plasticity" (Thompson and Glanzman, 1976, p. 49) and an important mechanism for adaptation and survival in the natural state as, were it not for habituation, we would spend the greater part of our lives orienting (Thompson, Berry, Rinaldi and Berger, 1979; Cotman and McGaugh, 1980).

Thorpe (1963) described habituation as a simple type of learning in which the animal learns to stop responding to insignificant or irrelevant stimuli. Floru (1975) also wrote that psychologically the extinction of the OR is "a selective, learned inattention" (p. 247). Other writers, for example Razram (1971) thought habituation is a "rudimentary precursor" of learning (p. 44). However, whether habituation is discussed as some type of learning or not, it must be remembered that it is manifested by a decrease of response intensity and the same cannot be said of most learning processes (van Olst, 1971).

Sokolov (1963, 1969) summarized the findings of a long series of experiments which suggested that following habituation training the OR re-emerges (dishabituates) when "its application, removal, intensification, weakening or change of nature" are ensued (Sokolov, 1963, p. 41). The magnitude of the OR elicited by a change in stimulation was found to be a function of the amount of change. To account for these observations, Sokolov (1960) and Voronin and Sokolov (1960) proposed a "neuronal-model" theory of the OR elicitation. According to this theory, the nervous system produces an exact model of the properties of the stimulus impinging on the sense organs. The signal properties are detected by special "neuronal nets" (Sokolov, 1975, p. 224). If a stimulus does not match an established neuronal model or hypothesis (Sokolov, 1969, p. 686) an OR is evoked. More specifically, Sokolov wrote that impulses from stimulation pass-up the classical sensory tracts to the cortex and via afferent collaterals impulses are also conveyed to the reticular formation (RF). Following cortical analysis, if a stimulus does not match a pre-existing neuronal model, an excitatory impulse is sent to the RF by the cortex; if a stimulus matches a neuronal model, the cortex sends an inhibitory message. The activation of the RF by both the afferent collaterals and the cortex initiates the OR. Conversely, inhibitory impulses by the cortex cancel the excitation of the RF and therefore the OR (Fig. III.1). Thus, the RF serves as model comparatory-amplifier.

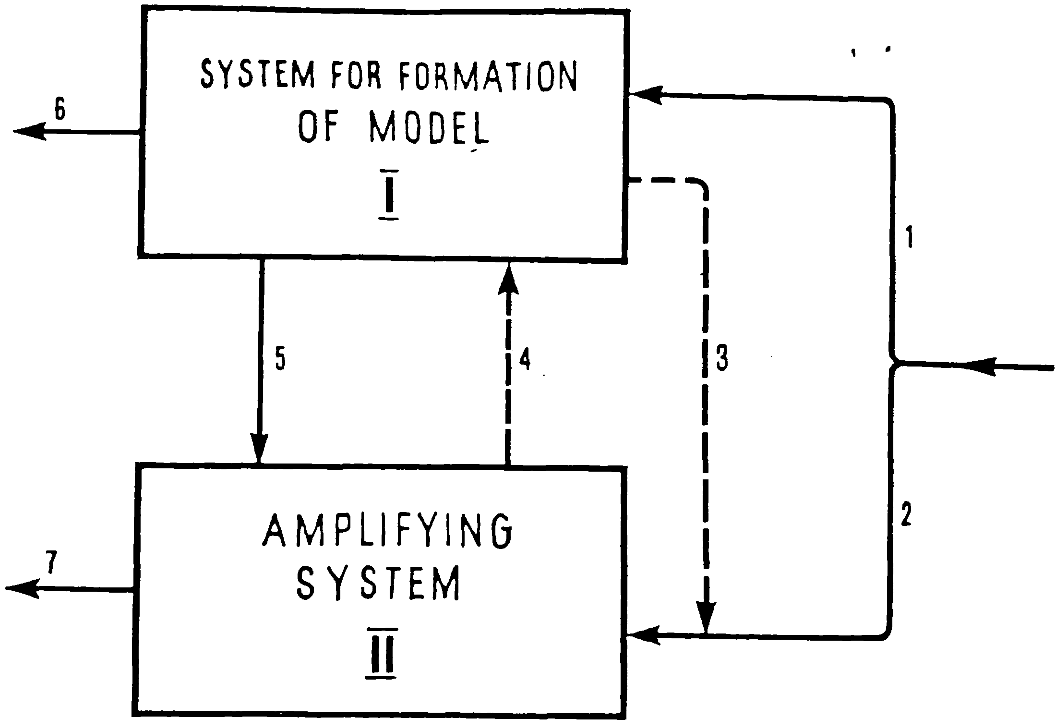

Figure III.1. Sokolov's schema for the OR. I. Modeling system. II. Amplifying system. 1 = specific pathway from sense organs to cortical level of modeling system; 2 = collateral to reticular formation (represented as an amplifying device); 3 = negative feedback from modeling system to synaptic connection between collaterals from specific pathway and RF; 4 = ascending activating influences from the amplifier (RF) upon modeling system (cortex); 5 = pathway from modeling system to amplifying system (this is the pathway through which the impulses signifying concordance are transmitted from the modeling system to the amplifying system); 6 = to the specific responses caused by coincidence between the external stimulation and the neuronal model elaborated in the cortex; and 7 = to the vegetative and somatic components arising from the stimulation of the amplifying system (RF) (Sokolov, 1960).

The role of the RF in the regulation of various OR components has been reported by several writers. It has been shown, for example, that receptor sensitivity (Granit, 1955) and activation of the vasomotor system and the pupil (Bonvallet, Dell and Hiebel, 1954) are influenced by the RF (Lynn, 1966) and stimulation of the RF also results in autonomic arousal as evidenced by electrodermal response (Dell, 1963; see also chapter IV). More recently, Sokolov (1975) suggested that the process of the model-comparison occurs in the hippocampus the "novelty detectors" of which may switch on the activating system of the reticular system.

It is especially interesting to note that Sokolov's theory assumes that stimuli are analyzed in the cortex and before decision is made whether an OR is warranted. Indeed, as Kahneman (1973) stated, the cortex appears to be the only structure capable of performing the precise analyses required by the theory. Furthermore, the cortex itself is influenced by the elicitation of the OR. That is, "the processing of a novel stimulus is ... recursive: the output of a preliminary analysis at the cortex is eventually fed back to control subsequent cortical activity" (Kahneman, 1973, p. 44). The role of the cortex in Sokolov's model is in agreement with the fact that stimulation can reach the cortex and then pass-down again excitatory/inhibitory impulses in time to block the stimulation of the collaterals because of their slower conduction rates (Lynn, 1966). Further evidence for the central role of the cortex is the observation that phylogenetically higher animals (i.e. animals with more efficient cortices) habituate quicker than phylogenetically lower ones (Razram, 1961). Also, "decortication abolishes or severely impairs habituation and partial decortication retards habituation according to its extent" (Lynn, 1966, p. 46). Pavlov (1927) described this phenomenon "in a dog with extirpated cortex" (p. 259), a study carried out by Zeliony. Lynn (1966) also referred to Sharpless and Jasper's (1956) work which showed that habituated stimuli continued to elicit evoked potentials in the cortex. This suggests that stimulation reached the cortex but the autonomic components were blocked by inhibitory impulses from the cortex which is the last to show habituation (see also section 2, above). The process of cortical habituation is progressively shown by the appearance of EEG-alpha-rhythm, followed by slow and large amplitude waves and drowsiness. While the subject is drowsy there is a "paradoxical re-emergence" of the OR (Sokolov, 1963, p. 120) but this too subsides and the subject goes to sleep. The dishabituation of the OR at this stage is thought to be due to the weakening of the control of the subcortical reflexes by the cortex and to which the inhibition spreads.

Another theory of habituation with marked similarities to that of Sokolov's was proposed by Wagner (1976). According to Wagner, habituation is a process of "short-term memory" and this is discussed in the context of information-processing theories (e.g. Atkinson and Shiffrin, 1968).

The information-processing view of the person takes the computer as its guiding metaphor with sensory receptors receiving inputs from the environment, effector units producing responses, memory store(s) holding data structures or programs, and with a central processor in which the focus of mental activity (thinking, reasoning, judging, deciding) takes place (Bower, 1978). Within an information-processing perspective Öhman's model (1979b) has also been developed and it will be discussed in section 8.

Another influential theory of habituation, known as "dual-process" theory was proposed by Thompson (Thompson and Spencer, 1966; Groves and Thompson, 1970). To explain the response decrements of the habituation process, this theory posits a stimulus-response (S-R) pathway in the central-nervous system (CNS). That is, it is argued that the decremental process occurs in the inter-neurons of the CNS and that habituation is an intrinsic property of certain neurons in the CNS which are thought to operate in similar ways in both the spinal cord and the brain (Groves and Thompson, 1973). More specifically, it is suggested that the mechanism underlying habituation is a form of synaptic depression localized at presynaptic terminals in interneurons. (For a relatively recent review of the relevant experimental evidence see Cotman and McGaugh, 1980. It may be pointed out here that Sokolov did not specify neural mechanisms which may underlie his theory.) Apart from habituation, a central concept in Thompson's theory is that of "sensitization" which refers to the general level of excitation or arousal and which purports to explain the recurrence of a previously habituated response when the parameters of the stimulus change. Sensitization is an incremental process and, like habituation, it occurs in the CNS (synaptic facilitation) and represents a temporary increase in responsiveness. For Thompson, dishabituation (as described by Sokolov) does not occur. Instead, dishabituating stimuli induce sensitization. Also, when the habituating stimulus is of moderate to strong intensity an initial increase in responding, i.e. sensitization, occurs even before habituation starts to set in. This is seen in such diverse systems as hindlimb flexor reflex of acute spinal cat to shock on the skin (Groves and Thompson, 1970) and human skin potential level to sound (Raskin, Kotses and Bever, 1969). For the dual-process theory, each peripheral response system, including the electrodermal, is an example of a particular S-R pathway. The processes of habituation and sensitization are thought to develop independently and the behavioural outcome depends on their interaction. This interaction may be compared to Sokolov's notion of the interaction between phasic and tonic ORs which may also be seen as analogous to Thompson's concepts of habituation and sensitization (Raskin, 1973). However, Sokolov's theory requires a model of the stimulus be developed in some region of the cortex and any change in stimulus properties will be detected by comparison with this model. The dual-process theory, on the other hand, assumes that the mechanism of habituation is simply a decrease in synaptic transmission with repeated stimulation and this "homosynaptic depression is itself the 'stimulus model'" (Thompson, Berry, Rinaldi and Berger, 1979, p. 45). It is evident that the validity of the view of habituation as an index of higher cortical processing depends on which model of habituation receives greatest empirical support. (For further reviews of models of habituation see Lynn, 1966; Tighe and Leaton, 1976.)

5 VARIABLES AFFECTING THE HABITUATION PROCESS

The habituation of the OR is influenced by aspects of stimulus and organismic variation (Lynn, 1966). The former include intensity, duration, discrimination, signal value of the stimulus and interstimulus intervals (see Graham, 1973). The organismic variables include phylogenetic variation, cortical integrity, individual differences and state of the individual (e.g. Lynn, 1966). In this section, the effects of the state of the individual and more specifically those of arousal on habituation will be discussed. It may be pointed out that there is no general agreement on how habituation is to be measured (see Chapter V) and the various methods which have been used are not always in agreement. However, most studies in the review which will follow measured habituation by the number of trials before three successive zero (i.e. below criterion) responses were recorded. This is also the most commonly employed index of habituation with human subjects (O'Gorman, 1977).

5.1 AROUSAL AND HABITUATION

The OR is by definition a phasic response to a stimulus the various components of which are elicited and subside in a matter of seconds. However, these changes are superimposed on the tonic state of the organism which may influence the course of habituation. Thus, habituation has often been studied in relation to arousal which is "a measure of how aware the organism is" (Berlyne, 1960, p. 48).

It was suggested above (section 2) that the components of the OR do not intercorrelate to any degree that useful inferences can be made across them (Lader, 1963). It may be added that studies on habituation per se showed differential effects on different physiological components (e.g. Johnson and Lubin, 1967, Bohlin, 1973a, 1976). Davis, Buchwald and Frankmann (1955) also found that the pattern of the various responses changes with stimulus repetition. Therefore, for consistency and because the relevant research has mostly used electrodermal measures the review below will focus on studies using the EDR as dependent variable. Despite wide variation in methodological procedures, it seems that some comparability of electrodermal data across the various studies seems possible as major effects seem to survive the almost complete lack of standardization of technique and experimental procedure (Lader and Wing, 1966).

This review is organized around three topics:

(a) Arousal, electrodermal activity and habituation
(b) State manipulated by drugs and habituation
(c) Experimental manipulation of state and habituation

Perhaps, another relevant topic would have been the study of habituation in relation to personality dimensions as in certain personality theories (e.g. Eysenck, 1967) the construct of arousal is of central importance. However, there are inconsistencies in the way this construct is used and/or is supposed to affect performance in different theories and empirical studies, and any inferences made on the basis of the largely inconsistent findings will be premature. Nevertheless, some relevant material will be mentioned below. (For reviews on the subject see Stern and James, 1973 and particularly the detailed account of O'Gorman, 1977.)

5.1.1 AROUSAL, ELECTRODERMAL ACTIVITY AND HABITUATION

Lindsley (1951) was probably the first to propose the theory of a central state of "activation" or "arousal" using as its index the cortical EEG desynchronizing. The cortex was thought to be activated by the upward discharge of lower centres (thalamus, hypothalamus and diencephalic RF). Lindsley assumed a continuum from the state of sleep or drowsiness (low activation) to extreme emotions (terror and rage - high activation), depending on the level of discharge.

Apart from EEG changes, peripheral autonomic measures have also been used as indices of arousal. However, selecting one peripheral measure as operational definition of arousal is not necessarily equally acceptable and/or interchangeable with another. Indeed, "a difficulty for hypotheses based on arousal constructs is their tenability in the light of evidence on the dissociation of response systems" (O'Gorman, 1977, p. 264). Lacey (1967) showed that arousal as a unitary system may be an oversimplification of the relationships among physiological systems. On the other hand, in psychophysiological literature the concept of arousal has often been applied in terms of the electrodermal system aspects of which are thought to reliably reflect central arousal..

Electrodermal responses which occur in the absence of specific exteroceptive stimuli are referred to as spontaneous fluctuations (SFs) or nonspecific responses (NS). It has been shown that the number of SFs increases during experimentally induced stress (see e.g. section 5.1.3 below). Lacey and Lacey (1958) discussed extensively the behavioural significance of SFs and* .

Burch and Greiner (1960) found, for example, that increasing dosages of Pentothal (a CNS depressant) resulted in a decrease in the number of SFs while increasing doses of Metrazol (a stimulant) increased the SFs. These experiments showed "a monotonic relationship" between the level of arousal and the number of SFs (Raskin, 1973, p.. 136).

In addition, SFs are associated with skin resistance level (SRL) and skin conductance level (SCL), i.e. tonic changes of the electrodermal system (e.g. Martin, 1960; Martin and Rust, 1976). It was found, for example, that mean conductance at rest has a significant positive correlation with the total number of SFs and the conductance at the end of the experiment correlates with the number of fluctuations both at rest and during the stimulation procedure (Lader and Wing, 1966). It may be added that the tonic SC shows considerable diurnal variations.

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* found them to increase during experimental tasks. Spontaneous activity also decreases during drug induced drowsiness.

Thus, it is lowest during sleep and rises sharply with the awakening of the subject (Sokolov, 1963). It tends to increase during the morning hours and decrease towards evening, falling rather rapidly as the subject goes to sleep. In the awake state, the SC is lowest during relaxation, higher during attentive listening or active work, increasing further during excitement. Thus, Lykken (1968) stated, there is considerable support for the view that tonic SC varies with some dimension of psychological arousal and indeed increase in the SC (or fall in SR) reflect "increased level of excitation of the cortical cells" (Sokolov, 1963, p. 242).

Despite the evidence suggesting that both SFs and SC are satisfactory indices of arousal, the two measures cannot be generally regarded as interchangeable (Lader and Wing, 1966). Stern and Janes (1973) pointed out that although low arousal in one measure is generally accompanied by low arousal in the other measure, when one turns to other points of the arousal dimension one measure cannot be predicted by the other, though arousal as expressed in one measure places upper limits on arousability as measured by the other variable. A number of studies also suggested that SC and SFs may index different types of activity. Thus, according to Hassett (1978), there is "a growing body of evidence that spontaneous activity increases under emotional stress while level changes reflect both emotional and cognitive problem-solving demands" (pp. 43-4).

Now a strong correlation between SFs and habituation of the EDR* has been consistently reported in the literature (Crider and Lunn, 1971; O'Gorman, 1977). That is, subjects showing high spontaneous activity (and therefore being highly aroused) appear to habituate more slowly than subjects showing less spontaneous activity. In a study by Mundy-Castle and McKiever (1953) subjects were divided into three groups: (1) "stabiles" who showed no spontaneous activity, (2) "labiles" who showed much activity, and (3) an intermediate group who showed both patterns at one time or another. All subjects were administered auditory stimuli repeatedly and the habituation was measured by the number of trials before three successive zero responses occured. It was found that there were significant differences in habituation of the three groups with labiles showing the least degree of habituation. The same relationship between habituation and spontaneous activity was reported by Stern, Stewart and Winokur (1961).

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*EDR substitutes for a response measured either in resistance or conductance units

As part of an experiment by Lader and Wing (1966), a group of subjects were given a placebo (placebos by definition are pharmacologically inert) and administered 20 identical tones. It was found that personality dimensions (Neuroticism and Extraversion as defined by the Maudsley Personality Inventory (MPI), Eysenck, 1959) did not differentiate between "habituators" and "non-habituators" as determined by analysing the significance of each subject's regression equation, i.e. be regressing each subject's skin conductance response (SCR) amplitude on log stimulus number. However, there were correlations between these habituation scores (H-scores) and the number of SFs of +0.40 and +0.37. There was also a significantly greater number of SFs for the group of non-habituators than that of the habituators. Lader and Wing concluded that one may predict a subject's rate of habituation from the frequency of his SFs. As far as the relationship between tonic levels and habituation is concerned, they found no significant correlations but the habituators tended to have lower SC than the non-habituators.

Anxiety is frequently related to arousal and specifically to autonomic lability. It is therefore reasonable to assume that anxious individuals may show "impaired habituation" (Lader, 1975, p. 128). In a study of Katkin and McCubbin (1969) the role of individual differences in anxiety as indexed by both TMA (Taylor Manifest Anxiety Scale, 1953) and autonomic lability (number of SFs) on habituation of EDRs to auditory stimuli was investigated. No relationship between TMA scores and habituation was found for low and moderate stimulus intensity. However, autonomically labile subjects showed no habituation to the moderate tone though they did habituate to low intensity tone. Autonomically stabile subjects habituated to both kinds of tones. It was noted that the results were consistent with earlier data by Koepke and Pribram (1966).

Lader and Wing (1966) studied the habituation of EDRs of patients with anxiety states and normal controls to 20 identical tones. For the most part of the experiment the SCL was significantly higher in patients than normals and there was a greater number of SFs in patients than the controls throughout the experiment. The habituation of the EDRs yielded a significant difference between the two groups with anxious subjects displaying slower habituation and higher degree of overt anxiety than normal controls. Similar findings were reported by Lader (1967), Lader and Sartorius (1968) and Lader (1975).

It may be argued that in the studies above arousal reflects a dispositional rather than a state variable. However, in the next two subsections evidence which is more clearly related to the latter variable will be presented.

In summary, the frequency of SFs and SR/SC levels reflect the state of arousal of the subject. There is strong evidence in support of the notion that SFs and, to a lesser extent, tonic electrodermal levels are closely related to habituation process, with highly aroused individuals, including anxious neurotic patients, taking longer to habituate than individuals with low levels of arousal.

5.1.2 STATE MANIPULATED BY DRUGS AND HABITUATION

This area of research has mainly employed drugs depressing the CNS. Whether the depression is primarily in the cortex or reticular formation is often a matter of dispute (Lader and Wing, 1966, p. 37). Such drugs include barbiturates and tranquilizers. Occasionally, stimulant drugs have also been used.

In his review on the subject, Lynn (1966) referred to a study by Rothballer (1955) who found that chlorpromazine (a tranquilizer) may abolish or reduce the generalized OR (see section 2 above) though it has no effect on the localized OR. According to Lynn, this finding was also consistent with data reported by Jus and Jus (1960). He also referred to a study by Lynn and Eysenck (1963) in which a derivative of meprobamate (a tranquilizer) called carisaprodal (350 mg) was administered to a group of subjects. The stimulus was auditory and the dependent variable was PGR (i.e. EDR, see chapter IV). It was found that there was a nonsignificant tendency of the subjects who received carisaprodal to habituate more rapidly than subjects who received a placebo or subjects who received no drug.

Martin (1960) studied the EDRs to a tone of 24 subjects on three consecutive days. On two of the three days two doses of meprobamate of 400 mg and four hours apart and two doses of glutethimide (an hypnotic akin to barbiturates) of 250 mg and four hours apart were given orally. She found that the drugs increased the skin resistance (lowered conductance) and reduced the number of EDRs to tones.

In a study by Scholander (1961) the effects of 50 mg chlorpromazine and 10 mg methamphentamine (a stimulant drug) were compared to placebo effects. It was found that the SCL decreased with chlorpromazine and tended to increase with methamphentamine and the mean EDR to the series of tones was diminished by the former drug while increased with the latter. There was a more rapid habituation of the EDR following ingestion of chlorpromazine when compared with the non-drug group. However, ingestion of the stimulant drug had the same effect on habituation.

Lader and Wing (1966) reported that in a study by Lienert and Traxel (1959) it was found that both meprobamate (800 mg) and alcohol (20 mls) resulted in a decrease of the mean EDR to a series of word-stimuli as compared to placebo administration. In another study, Benjamin, Ikai and Clare (1957) found that prochlorperazine (10 mg) and phenobarbitone (10 mg) diminished the EDR to an ischaemic-pain stimulus. Lader and Wing pointed out that as no placebo treatment was included in these experiments, "the results are not strictly acceptable" (p. 31). They also referred to another experiment (Schneider and Costiloe, 1957) lacking proper placebo control and in which no effect on the EDR to an electric shock was observed for either 200 mg of amylobarbitone sodium or 50 mg of chlorpromazine. However, this seems not an entirely valid argument on the part of Lader and Wing as an electric shock is hardly a "habituating stimulus" - being an intense stimulus, it probably elicited defensive responses (see section 2 above) which may not be as readily affected by levels of arousal as ORs.

According to Lader and Wing, it has been established by a number of studies (Alemà and Benassi, 1949; Perez-Reyes, Shands and Johnson, 1960; Burch and Greiner, 1958, 1960) that the size of EDRs and the number of spontaneous fluctuations are diminished by intravenous injections of thiopentone sodium. However, no quantitative data were given for any of these studies.

In an experiment by Lader and Wing (1966), 64 student subjects were given successive identical tones and were administered either cyclobarbitone or a placebo (lactose) orally. Forty-eight of the subjects participated in the drug part of the experiment. There were six groups forming a balanced incomplete randomized block design in which each block, i.e. subject, attended on two occasions and received two out of three possible drugs, i.e. either the placebo, or 200 mg cyclobarbitone or 300 mg cyclobarbitone. It was found that the habituation of the EDRs to stimuli (H-scores) yielded significant differences between the placebo and the two doses of cyclobarbitone and also a significant difference between the two doses (i.e. slower habituation with the smaller dose). The number of spontaneous fluctuations showed also definite drug effects but the SCL was not a very sensitive index of drug action.

O'Gorman (1977) reported another experiment by Lader (1969) on habituation of EDR following administration of stimulants. Two dosage levels of caffeine, 300 mg and 500 mg and of amphetamine, 5 mg and 10 mg were used and slower habituation was found at the higher dosage levels of both drugs.

Patients with anxiety states have also been used in this type of research (e.g. Lader and Wing, 1966) and the findings seem to be consistent with the data from studies using normal subjects and reported above. On the other hand, research with schizophrenic subjects has yielded inconsistent findings. This, however, is not surprising when considering the variability in symptoms and psychophysiology of schizophrenics (e.g. Mednick, 1958, Arieti, 1956; Venables, 1964; Thayer and Silver, 1971). Furthermore, and to paraphrase Venables (1975), a dosage of medication may not differ when administered to a group of subjects but the extent to which the drug is effective in modifying the arousal of different schizophrenics may be so.

Finally, a caution regarding some of the studies reported above. Peripheral components of the OR may be influenced not only by central changes but also by direct effects of drugs peripherally. In instances where drugs like barbiturates are administered, the changes detected peripherally and specifically EDRs can be presumed to be a direct result of central effects because these drugs have a limited, if any, peripheral action. In contrast, chlorpromazine has, among other, anticholinergic effects and this means that "its administration will result in gross alteration in autonomic functioning such as diminution of sweating" (Lader, 1975, p. 205 - see also chapter IV below).

On the whole, however, the conclusion drawn from the material presented above is that drugs which depress the CNS result in fast habituation and drugs with stimulant effects delay it. Also, the effects of drugs on habituation parallel those on SFs and, to a lesser degree, on SCLs.

5.1.3 EXPERIMENTAL MANIPULATION OF STATE AND HABITUATION

Several studies have focussed on how different states such as degree of alertness, expectancy, apprehension and attention affect habituation.

Scholander (1960) studied the habituation of EDRs to a white noise. There were two groups of subjects and two sessions. All subjects participated in both sessions the order of which was counterbalanced. In one session subjects were asked to relax while keeping their eyes open and in the other session they were instructed to maintain an exact position of the head in front of a camera. It was assumed that the alertness of the subjects was higher when the subjects were preoccupied with the camera. The results showed that the increased alertness in this "attentive state" tended "to increase the average levels of the parameters and to counteract the habituation of both the tonicity and the phasic reactivity" (p. 263).

In a subsequent study, Scholander (1961) found that the habituation of the EDR was also delayed in a condition in which sleep deprived subjects were administered monotonous auditory stimulation. These effects were thought to be due to a "conflict" situation created by a wish to stay awake and the successively increasing sleepiness due to sleep deprivation and the monotony of the experimental situation. The experimenter discussed the similarity of his results with those of an experiment by Burch and Greiner (1958) - they, too, showed a progressive increase in the EDR amplitude when subjects were deprived of sleep and tested under continued pressure for performance.

In a study by Tizard (1966), an attempt was made to study responses to stimuli in a range of states, from alertness to sleep, induced by instructions to the subjects. The stages of sleep and degree of drowsiness were estimated by means of EEG recordings and it was confirmed that the instructions were "very effective" in producing the differential states. It was found that the evoked changes in skin potential (ECSPs) to auditory stimuli occurred more often when the subjects were alert and attending but the conditions did not seem to affect the rate of habituation of the ECSPs.

Bohlin (1973b) employing the diurnal variation and deprivation of sleep subjected 3 groups of subjects to habituation to an auditory stimulus while recording EEG and skin conductance. One group was tested in the morning following a night of sleep deprivation. The two other groups were tested in the morning and afternoon following a normal night's sleep. The sleep deprived group showed signs of sleep quicker than the other groups but the groups did not differ in the rate of habituation of EDRs to stimulation.

The picture emerging from the account above seems not very clear and the effects of alertness on habituation may after all be negligible. However, no sound conclusions could be drawn from these studies since the conflicting findings may be due to methodological differences. As Bohlin (1976) wrote, different manipulations may affect habituation in ways other than through arousal changes.

The effect of level of alertness upon rate of habituation of the EDRs was also studied while subjects were either standing or seated (Goldwater and Lewis, 1978). According to these workers, there is evidence that the energy cost and thus "arousal value" is greater in standing than in sitting conditions. Indeed, the standing condition showed higher heart rate and greater frequency of spontaneous electrodermal responses (SFs). It was found that subjects in the standing condition started with amplitude and frequency of EDRs to a tone stimulus comparable to those in the seated condition but they showed a smaller decline in response frequency during the habituation process and a lesser incidence of nonresponding over the last 10 trials. There was also a correlation between the frequency of spontaneous and evoked responses. The results were interpreted as supporting the notion that increased arousal results in delay of the habituation process.

In a different vein of research the habituation process was examined in relation to levels of arousal associated with stress. Maltzman, Smith, Kantor and Mandell (1971) studied ORs to innocuous visual and auditory stimuli in two sessions. For half the subjects (graduate students), the second session preceded a final oral examination; for the remaining subjects (undergraduate students), the second session was simply a repetition of the first. It was found that in the first session the undergraduates showed slower habituation of their EDRs than the graduates but in the second session the graduates showed slower habituation. It was concluded that habituation is slower during real life stress than nonstress conditions.

That tonic arousal due to stress may affect the process of habituation is also evidenced by a study in which threat of electric shock was used in order to increase the "sympathetic arousal" of a group of subjects who were compared to a group of non-threatened subjects (Gatchell and Gaas, 1976). All subjects were administered an innocuous tone. The experiment was repeated after a 15-minute rest in order to test long-term habituation effects. In the latter session no group was threatened. It was found that the higher arousal of the shock-group was reflected in significantly higher skin conductance levels (SCLs) relative to the non-shock group and also resulted in a decrease in habituation of EDRs in both sessions. These results were replicated in a subsequent study by Gatchel, Gaas, King and McKinney (1977). Delayed habituations of EDRs and SCLs in subjects threatened by shock have also been shown by others, e.g. Watts, 1975; Carroll and Pokora (1976).

In a study by Bohlin (1976) the arousal level was manipulated in two ways, one involving stress and the other cognitive effort. There were three groups. Subjects in the two groups performed arithmetic tasks in the interstimulus intervals. In one of these groups threat of shock was added so as to include stress in the arousal manipulation. The third group simply was administered the same 80 dB tone stimuli as the other groups and was instructed to relax. This group was found to be less aroused than the other groups as indicated by EEG recordings as well as SCLs and SFs. The latter two groups tended also to be different in level of arousal as shown by a difference in SFs. The results showed that all groups differed from each other in number of trials to habituation criterion for EDRs to stimuli. However, as the delay of habituation was observed for both the task-group and the shock-group it was concluded that the delay of habituation is not specifically tied to conditions of stress or aspects of emotional arousal and it rather reflected a general effect of increased arousal. Bohlin explained his previous failure to find an effect of decreased arousal on rate of habituation (Bohlin, 1973b, see above) in terms of the possibility that "there is some threshold in level of arousal in the awake state below which the rate of (EDR) habituation is fairly constant" (p. 350).

In a study by Hulstijn (1978) results not entirely consistent with the reported findings above have emerged. In a series of three experiments arousal was manipulated by a different task. In experiment 1, this was done by pressing a dynamometer; in experiment 2, by asking subjects to remember words; in experiment 3, by instructions to the subjects to react as quickly as possible to hardly noticeable stimuli, including an electric current of small intensity and perceivable as a tingling sensation. None of these stimuli were presented during the experiment proper. Although the arousal of the subjects was increased in all experiments as indexed by the number of SFs and SCL (the third task failed to increase the SCL), delayed habituation of EDRs to 8 identical tones was observed only in experiment 3. The results of experiment 3 were replicated in an additional experiment (4) suggesting that slower habituation may be specific to arousal in these experiments. Hulstijn argued that the rate of habituation is not determined by arousal per se but, instead, it is under the influence of attentional factors which have played different roles in the different tasks. He wrote that since the stimuli in experiments 3 and 4 (to which responses were required) were described vaguely the subjects had to remain attentive to any signals, including the tones ; consequently, the tones may have received signal value and as such they delayed habituation (see section 2 above). He also pointed out that the results of these experiments are in agreement with those by Scholander (1960 - reported above) who used a similar task, i.e. one requiring attentiveness. However, his results are also comparable to those of studies which used threat of shock since the instructions of experiments 3 and 4 may have induced apprehension by reference to electric stimulation. The slower habituation during an arithmetic task reported by Bohlin (1976) was not replicated in experiment 2 but, as Hulstijn observed, the methodologies of these two studies were not identical.

Hulstijn suggested that his results justify rejection of the statement by Lader and Mathews (1968) that a higher arousal level as indexed by SFs results in slower habituation. In making this assertion, however, he opted to ignore the extensive literature in support of the statement though, admittedly, Hulstijn's results did not fully comply with what appears to be the "norm" in this field.

In summary, in the awake state, increased alertness (induced by instructing subjects to attend a stimulus or requiring them to remain standing or carrying out a cognitive task) tends to result in slower habituation. Studies in which subjects' arousal is below certain levels have yielded inconclusive findings. Real life stress and threat of electric shock delay habituation. Tonic indices of arousal (SCL and SFs) have mostly been found to correlate with habituation, i.e. high arousal is associated with slow habituation.

6 COGNITIVE ASPECTS OF THE OR AND ITS HABITUATION

Razram (1961) wrote that the cognitive status of the OR is related to facts such as its relatively recent phyletic emergence, its dependence upon newer regions of the cortex, its high plasticity in both phylogeny and ontogeny and its ready functional lability.

In section 3 (above) it was suggested that in naming the OR "What is it?" reflex, Pavlov may have conveyed both the general attentional meaning "what is it?" and the selective, investigatory "what is the nature of this thing?" (Kimmel, 1979). However, both Pavlov and Sokolov have emphasized the mismatch of a stimulus with a neuronal model or "disconcordance signal" (Sokolov, 1975, p. 217) in the elicitation of the OR. One of the implications of this emphasis was that research, both in Russia and the West, has predominantly concentrated on simple physical aspects of stimuli (tones, flashes) in which measurable changes could be brought about and their effects studied relatively easily.

However, some researchers have turned their focus on ORs to meaningful stimuli and more complex experimental situations and found that the OR reflects characteristics other than simple quantitative aspects of stimuli and it may be a function of the meaning of a stimulus or its meaning within a certain context, or of the instructions and the way these are interpreted by subjects. Thus, although the process of matching the incoming stimulus may occasionally be relatively "automatic", it often presupposes complex cognitive processes which seem to reflect the "what is the nature of this thing?" role of the OR. It should be noted that Sokolov (1963) himself has noted the importance of <u>all</u> information of a stimulus in the elicitation of the OR, including the semantic content of verbal stimuli. He mentioned, for example, a work by Marushevskii (1957) which showed "various types of a-rhythm depression reaction produced by verbal stimuli of different significance", depending on the meaning of words (p. 237).

In this section the cognitive aspects of the OR will be discussed by reference to empirical work which manipulated:

(a) Meaning of words

(b) Affective stimuli

It may be pointed out that another relevant area of research is the experimental work on what Berlyne (1960, 1961,) called the "collative" properties of stimulus since these, too, are associated with the "collation of information" from different sources. The collative variables include "novelty", "surprisingness", "complexity" and "incongruity" and, according to Berlyne (1961), they are all underlain by a common denominator, i.e. "conflict", of which Pavlov had, of course, talked about much earlier. However, studies which manipulated collative variables (e.g. Berlyne, 1961; Berlyne, Craw, Salapatek and Lewis, 1963; Fried, Welch, Friedman and Gluck, 1967; Spinks and Siddle, 1976; Verbatten, Woestenburg and Sjouw, 1980), including experimental works which have used infants as subjects (e.g. Dodd and Lewis, 1969; Lewis, 1970 ; Clifton and Nelson, 1976), have dealt with what we may call relatively simple cognitive processes and, therefore, in a review that attempts to illustrate the relatively "high" cognitive status of the OR, they may be redundant.

6.1 MANIPULATION OF THE MEANING OF WORDS AND THE OR

Luria and Vinogradova (1959) reported an experiment in which the vascular components of the OR (finger and head blood-vessel changes) to a series of "neutral" words were studied. The subjects were 10 normal school children, aged 11-15 years. The words were spoken aloud by the experimenter (Vinogradova) with 20 to 180 seconds intervals. Initially, the ORs (i.e. contraction of finger blood vessels and dilation of blood vessels of the head) were observed for 15-20 stimulations. Following their habituation, the experimenter induced a special "signalling" meaning to the word "koshka" (cat) by asking the subjects to press a button every time they heard this word. This resulted in "a distinct contraction of the finger blood-vessels, which pointed to the presence of an orienting reaction" both when the word "koshka", and when other semantically related words, e.g. "kotyonok", "mysh", "zhivotnoye", (i.e. "kitten", "mouse", "animal" respectively) were spoken (p. 92). It is noted that for the semantically related words there was a complete absence of motor reaction. The results of the experiment were explained by assuming "a functional semantic connexion"

(p. 93) of these words with the signal one (koshka). This connexion could only be based on the past experiences of the subjects (p. 92) and "in evoking an orienting reaction to one word, we bring about, at the same time, a whole system of meanings" (p. 93). It should be added that words which were not semantically related to the critical word and had only a superficial phonetic resemblance to the key-word did not evoke vascular reactions. Thus, Luria and Vinogradova wrote, in evoking an OR to a single word "... the semantic is the dominant system, while sound resemblances, pertaining to the outward aspect of the word, are not included in the dominant system" (p. 93).

The same experiment was carried out in a group of 15 mentally retarded children aged 13-17 years. The results showed that although the system of verbal connexions which Luria and Vinogradova were able to ascertain was of a selective nature, this was different and less distinct than in the normal children. It was also observed that the more profound the mental defect the greater was the disturbance of the semantic systems. Thus, "the system of links resulting from a word is distinctly altered and pathological in character, and ... the dominant position of selective semantic connexions disappears here, while sound resemblance, not of a selective sense-link nature, begins to occupy the leading position" (p. 95). The findings were thought to be in agreement with earlier investigations into the "higher nervous activity" of these children suggesting underdevelopment of the functions of the speech system.

In another series of experiments, Luria and Vinogradova (1959) presented 7 normal adult subjects with a list of words. After the orienting vascular reactions to these words were habituated, one word, "skripka" (violin) was accompanied with a painful stimulation. Initially, the reinforcement (electric shock) resulted in "a reaction of an orienting nature" to the word "skripka" (i.e. vasoconstriction in the finger and vasodilation in the head) and eventually it was replaced by the "specific pain reaction" (i.e. contractions of both types of blood-vessels which characterize the defensive reaction - see section 2). Subsequently it was found that nonreinforced words but with a direct close semantic link with the key word "skripka" evoked "exactly the same reaction as the basic stimulus, that is the specific pain reaction ..." (p. 99). These words included: "skripach" (violinist), "smychok" (bow), "struna" (string), "mandolina" (mandoline), etc.

Interestingly, there was another group of words which included names of stringless musical instruments (e.g. accordion, clarinet) and words connected with music more generally (sonata, concert); all these words evoked vascular reactions which were orienting in character rather than defensive. In some cases (it is not specified) the same orienting reaction was evoked by acoustically similar words to the key-word as, for example, in the case of "skrepka" (paperclip). On the other hand, words which were neither semantically nor acoustically related to the key-word did not evoke any vascular changes. Further experimentation showed that only the key-word continued to evoke the defensive reaction. Words close to it in meaning began to evoke orienting vascular changes while words which previously had evoked orienting reactions ceased to evoke any vascular changes. During further experimentation only the key-word kept eliciting defensive reactions; the remaining words evoked no response. The above, according to the experimenters, showed the dependence of vascular reactions to a given word on its context.

It should be pointed out that Luria and Vinogradova interviewed the subjects at the termination of the described experiments. It was found that, "as a rule", the subjects "were unable either exactly to formulate the aims of the experiment, or to designate exactly that group of words evoking definite vascular reactions" (p. 103). Also, the semantic system of links which was revealed was "reflected much more fully in the system of vascular reactions than in the conscious account of the subject" (p. 104). Finally, the authors suggested, their method makes possible "to approach, without the active participation of the subject himself, the complexes of consolidated semantic systems which have been formed in the process of social speech experience and which are at the same time peculiar to the individual" (p. 105).

Maltzman, Gould, Pendery and Wolff (1977) reported data similar to Luria and Vinogradova after experimenting with differential semantic conditioning of the EDR with both a noxious (white noise) and an innocuous (mild tone) UCS.

There have been several other investigations in which the effects of changes in verbal stimuli on OR magnitudes were studied. Van Olst (1971) reported that following habituation training of the EDR with a word stimulus, presentation of a word of similar or more contrasting meaning caused its dishabituation. The results did not bear out the hypothesis that words of similar meaning would cause less dishabituation. The latter was based on the supposition that generalization of habituation to stimuli of related meaning to that of the original stimulus would be greater than to stimuli of contrasting meaning.

Grush, Coles, Ferguson and McGee (1973) presented two groups of subjects with 20 either positively evaluated words (E^+ group) or negatively evaluated words (E^- group) consisting of adjectives, nouns and verbs. The words were presented via earphones connected with a tape recorder. On the twenty-first trial, half the subjects in the E^+ group received a negatively evaluated word (E^{+-} subgroup) and the other half received a further positively evaluated word (E^{++} subgroup). The E^- group was similarly divided into E^{-+} and E^{--} subgroups. The dependent variable was EDR. It was found that there were no significant differences between E^+ and E^- groups and between E^{++} and E^{+-} or between E^{-+} and E^{--} subgroups prior to stimulus 21. However, it was found that presentation of a positively evaluated word following habituation training with negatively evaluated words and vice versa resulted in an increase in the frequency of EDRs with 15 of the 18 subjects who were given a shift in meaning on stimulus 21 showing an increase in magnitude of response to this stimulus.

In a paper by Siddle, Kyriacou, Heron and Matthews (1979) three experiments were reported in which the effects of changes in meaning of words on EDR were also studied. In experiments 1 and 2 subjects were presented with a single stimulus word on 12 trials and then a different test stimulus word was given. The words were projected onto a ground glass screen. It was found that a test stimulus which constituted change in meaning and taxonomic category evoked larger EDRs than did a change in meaning alone; the latter also evoked larger EDRs than did a control condition of no stimulus change. Further, the results showed that, unlike acoustic changes, semantic changes in the test stimulus evoked larger EDRs than did a control condition of no change. In the third experiment, there was a habituation training with 4 examples of a word category (car names, plane names, place names). The test trial represented: in group (1), no change; in group (2), change in stimulus and category; in group (3), change in stimulus but not category. The use of a number of examples of a category during habituation training was expected to enhance generalization of habituation and it was predicted that only group (2) would show increased orienting on the test trial. The results confirmed the hypothesis and they were consistent with those of Grush et al. (1973, above) in showing that a change in word category following habituation training produces larger ORs than do either a change within a category or a control condition involving no change. The experimenters concluded that their findings give support to Sokolov's view that during habituation the semantic content of verbal stimuli is encoded in a "neuronal model". They also indicate that the electrodermal OR on a change trial "is a positive function of the amount of semantic change which has occurred" and the implication for encoding processes is "that the semantic aspects of verbal stimuli seem to be of prime importance" (p. 39). It is interesting that although all subjects were able to identify the change trial only a few could specify the exact nature of the change.

There have also been studies in which, instead of words, numbers were presented. Unger (1964), for example, presented numbers seriatim, i.e. 1, 2, 3, 4, etc.. It was assumed that in such a context and on the basis of the subjects pre-experimental experiences, forthcoming elements in the sequence would become "anticipatorily primed or triggered" (p. 12). It was found that 12 out of 20 subjects reached a habituation criterion of 3 successive vasoconstrictive nonreactions to successive numbers but this habituation was followed by immediate reappearance of the response upon presentation of an out-of-sequence number. Unger concluded that "if ... a 'filtering model' of the type described by Sokolov mediates habituation, then under circumstances such as pertained in the present experiment, the 'model' must be capable of successively and appropriately changing from trial to trial, of virtually reconstituting itself after each succeeding stimulus, to reflect a repeated pre-experimental experience of sequential order, of what follows what, in the stimulus world" (p. 17).

In summary, the experimental work above clearly demonstrates that human subjects have the ability to form "neuronal models" for categories far more complex than simple physical identity. Also, the type of selectivity underlying the OR elicitation requires the operation of a considerable amount of information acquired prior to the experimental situation and extracted therefore from long-term memory. The cognitive processes associated with the observed selectivity in the OR evocation are not necessarily conscious. Furthermore, the kind of information extracted reflects evaluations, hypotheses, expectations, etc., in accordance with previous analyses of stimuli within a social context.

6.2 THE AFFECTIVE CONTENT OF STIMULI AND THE OR

It has long been known that there is a positive relationship between the affective content of a stimulus and the magnitude of the EDR to that stimulus. In a review of the subject and on the basis of data published as early as 1911 by Wells and Forbes, McCurdy (1950) estimated a correlation of .93 (corrected C) between the average EDRs to word stimuli and four categories of intensity of experience as judged by two subjects who were "practiced introspectionists". Similarly, and according to McCurdy, a study by Wechsler (1925) reported the correspondence between EDRs and subjective judgements of the emotion-rousing value of a set of stimulus words. Wechsler asked the subjects, after they had been presented with a list of thirteen words, to estimate their emotional value on a five-category scale. The average responses ranked against the average judgements yielded correlations of .59 and .67. Bartlett (1927) also found a correlation (corrected C) of .78 between the degree of hedonic tone experienced by one subject in response to pictures in an art book and his EDRs. McCurdy continued his review by presenting similar findings by Cattell (1929), Patterson (1930) and Dysinger (1931). He referred to the possibility that there could have also been studies with negative correlations between the two dimensions under consideration "but, if so, it has been my misfortune to overlook them" (p. 324). In his study, McCurdy found a correlation of .76 (corrected for attenuation this figure becomes .94) between the rank order of judgements of his subjects on the emotional value of a list of words and their EDRs to these words presented on small cards. The words were adjectives (e.g. cheerful, adventurous, attractive, etc.) and the subjects were instructed to regard these adjectives as completing an implied question of the kind "Are you (whatever the adjective indicated)?" and to respond to this with a "silent yes or no" (p. 324).

More recently, Epstein and Fenz (1962) presented subjects with words using a tape recorder. The experiments consisted of parallel forms of a word association test with four levels of relevance to parachuting and with words related to general anxiety (e.g. fear, injury, anxiety). The subjects were 16 novice parachutists who had made at least one and not more than three parachute jumps and they were matched with a comparable group of control student subjects. It was found that the parachutists on both the day of a jump and a control day (two weeks from jump), and unlike control subjects, produced gradients of EDRs as a function of the stimulus relevance to parachuting and the gradients were higher and steeper on the day of a jump than on a control day. Anxiety words, on the other hand, evoked larger EDRs from both parachutists and control subjects, with parachutists showing greater responding on the day of the jump and followed by parachutists 2 weeks from the jump.

It could be argued that in word association tasks as well as in the task of the experiment by McCurdy (reported above) the EDRs are associated with the verbal responses (Rs) aroused by the stimulus word rather than with the stimulus (S) itself. Gross and Stern (1967), however, pointed out that they have consistently found that in word association tasks the EDR is "tightly time-locked to the presentation of the stimulus word rather than being time-locked either to the cognitive processes intervening between the S and the R or to the response" (p. 24). As such, they argued, the response can be considered as an OR to the stimulus word. Furthermore, the content of the stimulus enters into the electrodermal OR (ED-OR) as "one gets consistently higher amplitude ED-OR's to emotionally meaningful than to bland material" (p. 24). In their free association task experiment, Gross and Stern used as one of the bland stimuli the word "drink". They found that in alcoholics this word elicited larger EDRs than in other psychiatric patients or normal subjects. Thus, the OR in this context "is more than a simple perceptual response; it includes a response to an at-least-rudimentary cognition of the stimulus word" (p. 24). Gross and Stern proposed the OR to an emotional stimulus be called "conditional OR" as "we suspect that potential alcoholics are not born with this discrimination (i.e. to respond relatively vigorously to the word "drink") but that it develops as a function of conditioning" (p. 24).

Geer (1966) carried out an experiment with subjects who were frightened of spiders but not of snakes. After they were presented with pictures of "neutral" animals on the first 7 trials, they were shown pictures of a spider on trials 8, 9 and 10. Another group of subjects who reported no fear of either spiders or snakes were shown on trials 8, 9 and 10 a picture of a snake. It was found that the spider-phobic subjects showed larger EDRs, in 8, 9 and 10 trials than the non-phobic subjects. Two possible explanations for this were put forward by Geer; one was that the spider stimulus evoked an increased OR because spider phobic subjects were responding with increased attention toward what was an important stimulus to them; the second explanation was that the spider stimulus evoked a negative emotion. Geer concluded that his study could not evaluate the relative strengths of these alternative explanations.

In a similar study, Wilson (1967) also found that spider phobic subjects showed much larger EDRs to slides of spiders than subjects who were not afraid of spiders. The two groups did not differ in responses to slides of landscapes.

However, Prigatano and Johnson (1974) found no difference in the magnitudes of the EDRs to spider slides between spider phobics and non-spider phobics. This might have been associated with the methodology used. The subjects were administered three types of stimuli (spider, seascape, surgical pictures) in random order and over an extended period (30 minutes). As a result, the experimenters suggested, the EDR habituated and did not differentiate the spider phobics and non-spider phobics. It should be pointed out that spider phobics did show more frequent EDRs to spider and surgical slides than seascape slides and larger responses to surgical slides than non-spider phobics.

In a study by Geer and Klein (1969), an attempt was made to determine to what extent the earlier result by Geer (1966, above) reflected orienting (attention) or emotion. The non-phobic subjects were shown either photographs of dead bodies, or photographs of live individuals projected upside-down (5 trials), after they had been presented with neutral habituation stimuli (10 trials). It was found that dead bodies elicited larger and more frequent EDRs than the upside-down photographs. The data also indicated that this effect was enhanced by shock threat. It may be added that, apart from electrodermal, heart-rate (HR) changes were also recorded. These were consistent with the electrodermal data but they did not reach acceptable levels of statistical significance. It should be pointed out that the cardiac responses were separated into accelerative and decelerative components and there were no differences between them. (Graham and Clifton (1966) had earlier suggested that the acceleration component is associated with defensive and the deceleration with orienting responses - see section 2, above.) Geer and Klein speculated that the EDRs to the dead bodies were more than simple ORs to stimulus changes. However, they added: "While what this extra something is cannot be stated with assurance, it seems reasonable to infer that it reflects the negative emotion elicited by the aversive stimuli" and "it is clear that the content of the stimulus is an important variable, and the content may elicit more than an OR to stimulus change. Perhaps the effect of certain stimulus content is similar to what occurs when a stimulus change acquires signal properties" (p. 240). Geer and Klein admitted that their data cannot provide exclusive support to either of these alternative explanations.

In a study by Hare, Wood, Britain and Shadman (1971), male subjects were presented with a series of 30 slides of disturbing homicide scenes, nude females, or ordinary everyday objects. Half of the subjects saw the same stimulus 30 times and the other half saw a different picture on each trial. The main finding from this study was that the different physiological responses of all the groups of subjects were consistent with the evocation of the OR and they showed a similar pattern. That is, there was an increase in skin conductance, cardiac deceleration, digital vasoconstriction and a biphasic cephalic vasomotor response which consisted of constriction followed by dilation. Hare et al. remarked: "With the exception of the constrictive component of the cephalic vasomotor response, these physiological changes are those generally considered to be part of the OR" (p. 416). However, subsequent reanalysis of data indicated that at least some of the subjects responded to homicide scenes with cardiac acceleration and vasomotor changes characteristic of the DR (Hare, 1972).

Klorman, Weissberg and Wiesenfeld (1977) rated their subjects as high or low in fear mutilation and presented them with one of three types of slides: (1) mutilated bodies; (2) persons and objects in incongruous or humourous poses; (3) standard photographs of persons, objects and landscapes. It was found that mutilation stimuli evoked greater EDRs than nonaversive slides (2 and 3) but there were no significantly different EDRs as a function of degree of fear. However, the high-fear subjects exposed to mutilation stimuli emitted EDRs of greater amplitude than all other groups combined.

In an earlier study by Klorman, Wiesenfeld and Austin (1975) it was found that subjects rated as high in fear mutilation showed larger EDRs to mutilation slides relative to the remaining categories and they exceeded unafraid persons in this tendency. Also, the high-fear subjects showed slower recovery of their EDRs to mutilation vs neutral slides. The EDRs of unafraid subjects did not differ between those emitted to mutilation and neutral slides. It may be added that in both these studies by Klorman and associates and on the basis of heart-rate measurements it was concluded that responses to mutilation materials indicated reactions of defense in high-gear mutilation subjects and orientation in low-gear persons.

From the above, it appears that as far as the EDR is concerned there is some uncertainty in the literature of whether this response signifies orienting or defensive reflexes (emotion). Raskin (1973) argued for an interpretation of the relationship between the affective quality of a stimulus and the amplitude of the EDR to that stimulus in terms of attention or OR rather than emotionality. He pointed out that research has shown that phasic EDRs accompany a wider range of psychological processes than can be subsumed under the label of anxiety or emotion. According to Raskin, Flanagan (1967) obtained amplitude measures of SCR and ratings of emotional reactions and "attention-getting" value of photographic material. It was found that there were average correlations of +.64 between SCR magnitude and attention scale values while the average correlations between magnitude of SCR and emotion scales were +.32. Since attention correlations were significantly higher, it was concluded that an attention interpretation of SCR is preferable to one based upon emotion (see also Maltzman and Raskin, 1965 and Öhman (1979b), section 8 below).

Finally, in a study more relevant to this thesis, Öhman, Eriksson, Fredrikson, Hugdahl and Olofsson (1974) reported three experiments in which the habituation of the electrodermal ORs of non-phobic subjects to slides of potentially phobic and neutral stimuli was examined. In the first experiment, 10 different pictures of snakes (phobic stimuli) were used and each picture was shown to two of the 20 subjects; that is, there were 10 groups of two subjects being shown different pictures. A control group of 20 subjects was similarly shown 10 different pictures of houses. It was found that there were no significant differences between groups in response magnitude but there were significantly fewer trials to habituation in the group presented with neutral stimuli. In the second experiment, a within-subject design was used, i.e. each subject was given both phobic (snake or spider) and neutral stimuli (houses) in mixed order. It was found that the responses to phobic stimuli were larger than those to neutral ones but the absolute difference between phobic and neutral stimuli was of about the same magnitude as in the previous experiment. However, the responses to phobic stimuli took significantly more trials to habituate than those to neutral stimuli. In the third experiment, a between-subject design was used. Some electric shocks were given prior to the experiment and the subjects were threatened with further shocks during the experiment. It was found that the shock threat potentiated the difference between the responses to phobic and neutral stimuli, with the responses to the phobic becoming about 4 times as large as those to the neutral stimuli. The results clearly indicated that both the content of stimuli and arousal due to threat influence the magnitudes of the ORs. Furthermore, the experimenters concluded (p.93), the more intense ORs to phobic than neutral stimuli point "at the OR as a possible mediating mechanism behind the superior conditioning to phobic stimuli that has been previously reported" (i.e. Öhman, Eriksson and Olofsson, 1975; Öhman, Erixon and Lofberg, 1975).

In summary, research with stimuli of affective content indicates that these stimuli elicit more vigorous EDRs which take longer to habituate than do stimuli of relatively neutral content. This effect seems to be potentiated by arousal due to threat. The nature of these responses has not been established unequivocally, i.e. whether they reflect anxiety and emotion or orienting. On the whole, however, there appears to be a consensus that, at least in non-phobic subjects, these responses are predominantly orienting.

7 THE SIGNIFICANCE HYPOTHESIS

It is widely accepted that "the dominant concern in the OR literature since Sokolov's original formulation has been with the factor of novelty", and "what might be termed the traditional view of the OR is that it is a reaction to stimulus change, triggered by mismatch with a neuronal model" (O'Gorman, 1979, p. 253). This view is also reflected in even stronger statements such as "any mismatch produces orienting" (Pribram and McGuiness, 1975, p. 117).

Some theorists, notably Maltzman and Bernstein, have challenged this view and proposed a different conceptualization of the OR. In several papers, both Maltzman and Bernstein, but separately, suggested that the elicitation of the OR is predominantly determined by appraisals on the part of the subject about what is "significant". The obvious implication of this conceptualization is that it shifts the emphasis from the stimulus characteristics to the decisions of the subject and it has come to be known as the "significance hypothesis" (O'Gorman, 1979, p. 255).

Initially, Maltzman and Mandell (1968) argued: "Stimulus change <u>per se</u> is not the critical factor or sufficient to induce an OR" (p. 99). Similarly, Bernstein (1969) wrote, "mere contact with, or recognition of a stimulus change is not itself a sufficient condition for the appearance of an OR" (p.347), and "an OR will follow only if the novel stimuli are judged to be of some significance, at least potentially" (p. 348). In a series of papers by Maltzman and Bernstein these assertions were elaborated and supported by substantial experimental evidence. It may be pointed out that Luria and Vinogradova's (1959 - see section 6.1) work also provides such evidence since it showed that the OR is dependent on meaning of words and the instructions given to the subjects rather than on change of the stimulus.

In an experiment by Bernstein (1969) the EDR to a visual stimulus was habituated and subsequently the intensity of the stimulus was altered on a test trial; almost all the subjects were able to report they had detected a stimulus change but only 47% responded to the change with an EDR. Other workers in the field (e.g. van Olst, 1971; O'Gorman, 1972, Siddle and Heron, 1975) have confirmed this finding under a variety of experimental conditions.

Bernstein, Taylor and Weinstein (1975) also confirmed a series of predictions regarding the incremental effect of stimulus significance on the EDR - larger EDRs were evoked by signals with relatively high significance induced by instructions, i.e. by asking subjects either to press a pedal on hearing a stimulus, or only when hearing it in a specified ear, or after waiting until when a signal was given, etc. They distinguished between "execute" ORs which are related to motor activity and "alerting" ORs which are elicited by stimuli not requiring motor responding. This distinction, however, reflects peripheral specialization and does not imply differences in the central mechanisms.

Maltzman (1977), on the other hand, made another differentiation between "voluntary" and "involuntary" ORs. This arose from the observations that while task instructions have a profound influence on the habituation process of the EDR they do not affect the response to the first presentation of a stimulus. Maltzman suggested that unlike the first response which is relatively unpredictable and not subject to language and thinking processes, the subsequent responses are influenced by such processes and in this sense they could be said to be voluntary.

Maltzman (1979b) wrote that "given a particular state of the organism, a stimulus change may evoke an OR. In a different state that same stimulus change would not, or would do so to a much smaller degree" (p. 278). Although these views were adopted as a result of observations on people in experimental situations, certain conceptions were independently developed in the Soviet Union regarding the higher nervous activity. These are related to Ukhtomsky's formulation of the "dominant focus" or "dominant" which "refers to a focus of excitation in the CNS that modifies current activity by attracting to itself impulses which would evoke a different response in the absence of the prior existing dominant" (Maltzman, 1979b, p. 280). Reviewing the literature on the dominant focus, Maltzman refers to Rusinov (1973), Bechterev (1933) and others. Rusinov saw the dominant as a temporarily prevailing system which directs the activity of neural centres at any given moment. According to Maltzman, the OR to a stimulus is predetermined by the prevailing dominant focus at a time. Maltzman (1979a) wrote: "A dominant focus established by instructions persists for a time, directs thinking, selectively influences the processing of information, and leads to the occurence of ORs when the significant stimuli exciting the dominant focus are presented. Occurence of ORs reinforce the persistence of the dominant focus. Instructions imparting significance to a stimulus establish a set for that and related stimuli ..." (p. 345). The dominant should not be considered identical to levels of arousal. Aroused subjects, for example, may not respond to a sudden loud noise when it comes from outside the laboratory, i.e. when it is not relevant to the experimental situation.

However, apart from situations in which the significance of stimulus depends on experimentally induced short-lived dispositions, the concept of significance refers also to enduring dispositions, i.e. "predisposing sets, anticipations of what may occur, and various attitudes" (Maltzman, Gould, Pendery and Wolff, 1977, p. 180). That is, the appraisal of attributes even before a stimulus is presented may determine whether a stimulus is "noteworthy" (Pendery and Maltzman, 1977, p. 122). As Maltzman (1979b) put it succinctly: "Responses are always a function of the history of the organism, the state of the organism at the moment as a consequence of its past history", and "the particular state of the CNS ... is a consequence of ontogeny, phylogeny, past learning experiences, sets established by the immediate stimulus context, as well as previous stimulations" (p. 278). Wingard and Maltzman (1980) referred to some studies in which enduring predeterminers of stimulus significance were examined. Such studies include the work of Cooper (1959) in which the magnitude of EDRs was found to be associated with prejudicial attitudes of subjects towards ethnic and national groups. Hess (1965) investigated effects of interests and attitudes on the pupillary OR and in one experiment it was found that men's pupils dilated more at the sight of a female pinup than women's pupils which, in turn, showed greater responses to a picture of a baby, a mother and baby or a male pinup. In their study, Wingard and Maltzman (1980) found that electrodermal ORs to slides depicting subjects' own recreational interests were larger than those to slides depicting others' recreational interests or to filler slides. It may be added that the literature reviewed in section 6.2 (above) is also related to the influences of enduring predispositions and attitudes on the OR.

Maltzman (1979a) assumed that the physiological basis for long-standing attitudes and interests is "the establishment of dominant foci". However, our understanding of brain mechanisms underlying these processes is essentially nil (Thompson, Berry, Rinaldi and Berger, 1979) and, therefore, Maltzman's suggestions, though interesting, are probably premature. This is not to say that we cannot develop physiological explanations for the <u>influences</u> of cognitive variables on OR and habituation of various autonomic components. There is a large literature concerned with the descending influences from the brain on spinal reflex pathways in the intact mammal and with various descending "motor" systems which can influence all the varieties of interneurons (see Thompson et al., 1979).

Bernstein (1979) pointed out the adaptive role of the OR when seen in the context of the significance hypothesis. He suggested that responding to every environmental change, regardless of whether a stimulus has any bearing on the well-being of the organism, would have been unadaptive as ongoing behaviour would have to be disrupted and "precious channel capacity" would be occupied in order to facilitate the input of predominantly useless information (p. 264).

According to Bernstein (1979), there is a two-stage process in which the novelty of a stimulus is first assessed in terms of the degree of match with a neuronal model (novelty) and then in terms of the significance of this mismatch. He also discussed several papers which may be relevant to the neurophysiological basis of the significance hypothesis. Bernstein acknowledged that such a basis has not been established; however, he argued, there is "a considerable convergence of opinion both that attention basically does involve the selective, high-priority input of 'significant' stimuli, and that this depends on the integration of essentially neocortical informational analysis with essentially limbic emotional/motivational assessment of stimulus input" (p. 271). Among others, he referred to works by Nauta (1971) and Douglas (1972). Nauta has summarized evidence for the neocortical frontal lobes receiving afferents from primary visual, auditory and somatic sensory areas. He also described the interconnections of the frontal lobes with the hypothalamus and limbic system. Thus, the frontal lobes receive input regarding both the external and internal environments and in both fronto-sensory and fronto-limbic connections the relationships are reciprocal. It is possible, then, that limbic motivational input to the frontal lobe may start a frontally mediated process as a result of which affectively important sensory input is selected for higher processing.

Douglas (1972), according to Bernstein, described the interacting processes of "analyzing" and "motivational" systems as corresponding to Sokolov's "modeling" and "amplifying" systems. The analyzing system includes the neocortex, nonreticular thalamic nuclei, hippocampus and amygdala whereas the motivational system consists of the brain stem, hypothalamus and reticular thalamus. The analyzing system provides what Douglas calls "intellectual" analysis of sensory detail and pattern and the motivational system "decides" which signals are to be attended to. Furthermore, the analyzing system receives input both from classic sensory pathways and sensory collaterals which have initially synapsed in the motivational system. In this way the OR can reflect both stimulus uncertainty (or novelty) and stimulus significance. It should be noted that within this framework the initial reaction to a stimulus is primarily determined by the motivational system.

However, there appears to be no general acceptance of the significance hypothesis and some workers have presented their findings as being against it. Thus, Barry (1975) studied electrodermal ORs to tones from subjects among whom he attempted to reduce the significance of stimulus by not referring to tones in his instructions. Instead, the subjects were told that the object of the investigation was to intercorrelate physiological measures with the earphones being applied in order to reduce extraneous noises. The same investigator (Barry, 1977) studied ORs from another sample and instructed the subjects that they would be questioned later about the tones, i.e. he rendered the tones "significant". Barry reported that his "nonsignificant" stimuli in the 1975 study elicited larger ORs than his "significant" stimuli in the 1977 study, a finding which appears to be in disagreement with the significance hypothesis. Bernstein (1979) argued that these results cannot be taken at face value as Barry's attempt to render the tones nonsignificant may actually have heightened their significance since "not informing, or misinforming subjects about the tones probably served to draw attention to them" (p. 270).

A common criticism of the significance hypothesis is that it is rooted in subjective appraisals and personal perceptions which can be highly idiosyncratic and as such it may give rise to unsystematic data whereas the tradtional OR theory employs only scientifically acceptable and objective features of stimuli. Furthermore, O'Gorman (1979) stated, the significance of a stimulus is judged on post hoc basis of subjects' responses to that stimulus and Grings (1977) also expressed concern about the apparent absence of an independent criterion of significance. In response to these arguments, Bernstein (1979) asserted that judgemental and selective processes are involved in any stimulus intake and matching functions. This becomes apparent when one considers that in a given stimulus environment only certain stimulus parameters may be absorbed and coded into a neuronal model and it is evident that not all individuals encode identical models determined by an objective reality. On the other hand, in a laboratory situation, significance may be associated with pre-selected features of stimuli by means of experimental manipulation, e.g. by asking subjects to respond to a stimulus in a certain way (e.g. Luria and Vinogradova, 1959) or by asking them to attend or remember some stimulus features (Lynn, 1966). Also, the nonsignificance of a stimulus can be established by e.g. instructing subjects that a stimulus is presented during a "non-experimental" period during, for example, "equipment calibration" (Peavler, 1974).

Maltzman (1979b) also discussed the feasibility of independent specification of significance. Significant stimuli or events, he wrote, are those the organism seeks to approach, retain, avoid, or escape. Such events are attention-getting and evoke ORs. Further, there are procedures which may be used to determine the significance of stimuli with human subjects that is independent of measures of the OR. Evaluative scales of the semantic differential (Osgood, Suci and Tannenbaum, 1957) may, for example, serve this purpose.

More criticism of the significance hypothesis have been put forward by O'Gorman (1979), Siddle (1979) and others. These criticisms are, perhaps, of a lesser importance to those mentioned above and like the latter they, too, were adequately dealt with by Bernstein and Maltzman.

In summary, there appears to be considerable agreement in the literature that the OR reflects a selective process whereby significant stimuli are given priority of processing. This process depends on the confluence of informational analysis from different systems. Thus, Maltzman and Bernstein stress that the OR predominantly depends on internal processes rather than external characteristics of the stimulus and they also discuss the influences of contextual and dispositional factors.

From the above it is apparent that Sokolov's conception of a neuronal model, despite its enormous impact on psychology and the neurosciences in general, is not without limitations. Similarly, the processes of orienting and habituation are far more complex than theories like Thompson's would suggest (see section 4). Therefore, new conceptions are needed and Öhman's model of the OR within an information-processing perspective (see below) goes some way in meeting this challenge.

8 ÖHMAN'S MODEL OF THE OR

Öhman (1979b) made two basic distinctions: One differentiates the relatively automatic preattentive processing associated with the identification of a stimulus from relatively advanced and selective processing of input. The other suggests that only a limited set (the short-term store) of the total memory is available for processing at any particular time. These propositions appear congruent with the relevant literature and provide the basis on which Öhman builds his comprehensive model of the OR.

Borrowing notions from information-processing literature (Posner and Boies, 1971; Kahneman, 1973; Norman, 1976; Shiffrin and Schneidder, 1977), Öhman (1979b, p. 444) made the following proposition: "The autonomic concomitants of an OR denote a call initiating processing in a central channel with limited capacity ... or with limited processing resources ... which carries out flexible and subject controlled processing of the stimulus". This channel can be identified with "focal attention" (Neisser, 1967). Öhman suggested that there are two different routes for a stimulus to activate the common call for central processing. Stimuli are selected to focal attention from previous processing by preattentive mechanisms (Neisser, 1967) which interact with a short-term memory store; the latter, in turn, contains related activated elements from a long-term memory store of stimulus representations; if the preattentive mechanisms fail to identify a stimulus because there is no matching representation in short-term store, an OR is elicited and the stimulus is admitted into the central channel. A stimulus also activates the call for central processing if it matches a "significant" memory representation. When a stimulus enters the central channel because there is no match in short-term memory, a search in the long-term memory for associated memories is initiated and the stimulus is processed for encoding into the long-term store. When the stimulus is assessed as "significant", the central channel is called and retrieves information from the long-term store, "allowing the initiation of plans for actions" (p. 445). Such plans include expectations of forthcoming stimuli the representations of which are transferred to short-term store.

This model suggests that the OR is a prerequisite for learning since only through processing in the central channel, which relates

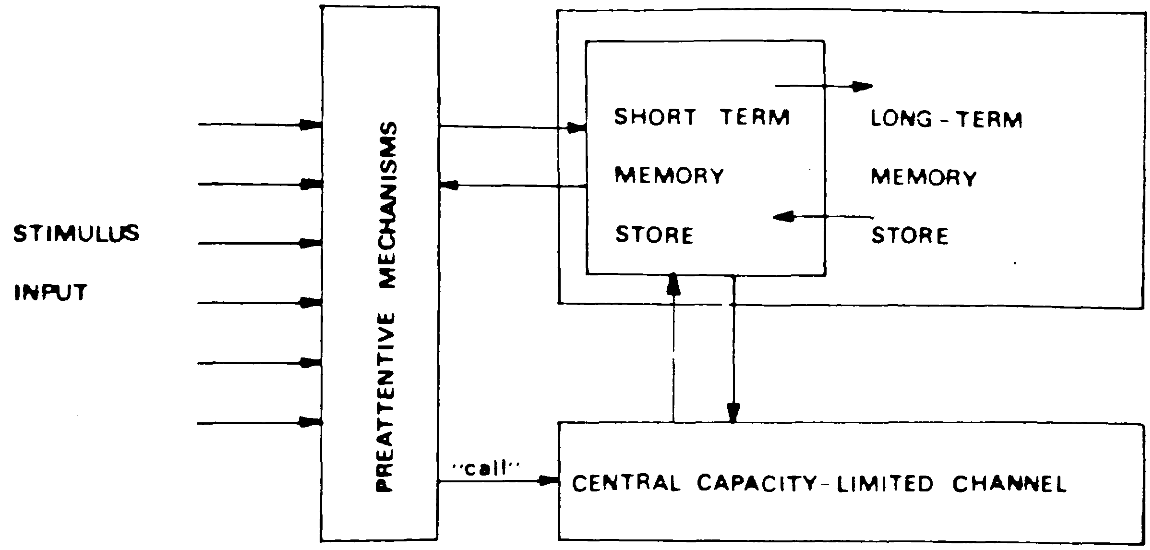

Figure III.2 Öhman's schematic representation of the hypothetical information-processing structures and their interrelations. See text for explanations (Öhman, 1979b).

the stimulus to short-term store, can information be transferred to the long-term memory. Thus, Öhman states, "we learn primarily about unexpected or surprising events ... that by definition evoke intense ORs" and "when a significant or unexpected stimulus has been paired with a preceding stimulus so that the two events are simultaneously active in the short-term store, the contingency is detected and the association (together with the context occupying the STS are) stored in long-term memory. In this way the first stimulus acquires signal value as a reliable predictor of the second stimulus" (p. 445). A schematic representation of the model is seen in Fig. III.2.

A particularly interesting aspect of the model by Öhman is that it raises the possibility that different autonomic responses may code different aspects of the call of the central channel. Thus, he asserted that although EDRs may be identified with the call, they may be also influenced by processing in the central channel since "this measure is regarded as highly sensitive to cognitive effort" and, thus, an electrodermal OR "may reflect not only the call but also part of the answer to the call". He points out, however, that "as long as this central processing does not result in clearly identifiable additional responses, it must be included in the OR" (p. 454). The situation with the heart-rate (HR) is more complicated because this response is a complex, multiphasic event and although the OR has been identified as a deceleration (Graham and Clifton, 1966), cognitive activity, according to Lacey (1967), is related to acceleration. Similarly, Öhman discussed, there is no definite evidence to indicate what exactly electroencephalographic phenomena (evoked potential components) reflect, i.e. whether they reflect preattentive processing, call for central space or processing in the central channel or, indeed, none of these.

Now Öhman's scheme suggests that a "call" for processing space (denoted by the autonomic components of the OR) opens "the gate to the central channel" (p. 453). Öhman adds that although this approach implies a close relation between the OR and attended stimuli, it also allows the possibility of dissociating the OR from conscious perception of the stimulus and therefore the call which the OR represents may not be "answered" because "the central channel is too busy performing other tasks" (p. 453). In support of this notion, Öhman cited the work of Corteen and Dunn (1974) who found that previously acquired signal value of a stimulus was adequate to elicit EDRs despite the fact that the stimulus was not let into the central channel, i.e. the subjects failed to perform an instructed response to the critical stimuli.

A study by Kroese and Siddle (1981) has also given support to Öhman's model. The experimenters reasoned that since the model assumes that habituation depends upon central processing of the eliciting stimulus and on the development of "control elements" (i.e. activated representations in memory which code characteristics of the stimulus) in short-term memory, if processing demands are made by some task during presentation of a task-irrelevant stimulus, habituation to that stimulus will be slower than when there is no central task. In one of their experiments, subjects were required to perform visually-presented arithmetic tasks during administration of auditory habituating stimuli and a control group received the same stimuli. It was found that task subjects showed larger EDRs to auditory stimuli and took longer to habituate than the control subjects. It may be pointed out that the results could not have been due to differences in arousal as the two groups did not differ in mean SCL or SFs (see section 5.1.1). In a further experiment, Kroese and Siddle examined the effects of difficulty of a central task (signal detection). It was found that as demands made by the central task increased, habituation to task-irrelevant habituating stimuli became slower.

In summary, Öhman's information-processing model of the OR accounts for a wide range of data in orienting and habituation including those associated with stimulus significance. It also attempts to integrate findings from related areas of research and, in doing so, Öhman assigns to the OR a central role to "the systems controlling what aspects of the flow of psychological events will receive attention, central processing, and learning" (p. 466).

9 CONCLUSIONS

The OR is of central importance to attention and learning as it heightens sensitivity to stimulation and facilitates processing of information by increasing the discriminatory power of the analyzers.

The habituation of the OR is greatly influenced by the arousal of a person as indexed by non-specific electrodermal activity and/or manipulated by drug administration and instructions.

It is evident from extensive research that quantitative differences in electrodermal ORs in humans reflect qualitative ones of the stimuli and significant, including affective stimuli, are given priority of processing. Thus, humans form "neuronal models" for complex categories, including semantic aspects of words and the OR provides an objective measure of the occurence of higher mental activity.

The selectivity observed in ORs to meaningful stimuli may reflect evaluations, hypotheses and expectations in accordance with previous analyses of stimuli within social contexts.

Sokolov's neuronal model theory is substantially extended by Öhman's model of the OR which seems to provide a comprehensive framework for the OR phenomena while placing this reflex in a central position to the systems controlling attention, central processing and learning.

CHAPTER IV

THE ELECTRODERMAL RESPONSE

1 INTRODUCTION

Two types of electrodermal activity have been recognized since the first observations on electrical changes of the skin by Vigouroux (1879 - cited in Edelberg, 1972a); one of them is the drop in electrical resistance (increase in conductance) of the skin to the passage of an electric current (exosomatic recording) and first observed by Féré (1888); the other is a change in the electrical potential difference between two points of the skin without the imposition of an external current (endosomatic recording) and first reported by Tarchanoff (1890).

The changes in electrical resistance and changes in electrical potential occur together as "both phenomena are manifestations of a single reflex reaction" (Sokolov, 1963, p. 53). However, their quantitative relationship is uncertain (Montagu and Coles, 1966) and, in fact, the two measures may yield different results (Lykken, 1968). While resistance invariably falls in response to stimulation, the skin potential, though usually uniphasic negative, may be biphasic or uniphasic positive and even triphasic (Venables and Christie, 1980). This may sound ambiguous but only reflects the complexities associated with this response. Further, as Montagu and Coles (1966) wrote, the underlying mechanism of the drop in resistance is better understood - it is predominantly due to the secretory activity of sweat glands (see below), while skin potential changes are associated with not well understood reabsorption mechanisms (Venables and Christie, 1973, 1980). It is not surprising therefore that resistance change is regarded as a more satisfactory measure of the electrical activity of the skin (Lykken, 1968; Fowles, Christie, Edelberg, Grings, Lykken and Venables, 1981) and it is frequently encountered in the OR literature. Accordingly, the discussion below will focus on the drop in resistance phenomenon which is also relevant to the experimental part of this thesis.

In the past, electrical changes of the skin were usually referred to as galvanic skin responses (GSRs) or psychogalvanic reflexes (PGRs), terms which are now used infrequently. This is due to a number of attempts in recent years to standardize terminology so that this reflects both the type of measurement used as well as the different aspects (tonic/phasic) of responses (Brown, 1967; Venables and Martin, 1967; Lykken and Venables, 1971, Venables and Christie, 1973, 1980). According to Venables and Christie (1980), the terms electrodermal activity (EDA), electrodermal response (EDR), and electrodermal level (EDL) should be used as general terms of electrodermal activity, irrespective of whether endosomatic or exosomatic methods of measurement are used. (For convenience, however, in this review"EDR(s)" refers only to response(s) measured by the exosomatic method). The Society of Psychophysiological Research (Brown, 1967) has suggested the terms skin conductance response (SCR), skin resistance response (SRR), and skin potential response (SPR) are reserved for phasic changes while SCL, SRL, and SPL for tonic changes. Electrical changes of the skin which occur without identifiable external stimuli are referred to as spontaneous fluctuations (SFs). Venables and Christie (1980) prefer the term "non-specific responses" (NS) as "physiologically a stimulus must have occured at some level" (p. 9).

2 PERIPHERAL MECHANISMS UNDERLYING THE EDR

Historically, and according to Montagu and Coles (1966), there have been three theories accounting for the peripheral mechanism of the EDR: (1) The muscular theory which explained the electrical changes in terms of muscular activity under the skin and at the site of the electrode (Sidis and Nelson, 1910); (2) the vascular theory which attributed the observed electrical activity to changes in the tone of the blood vessels of the skin (Féré, 1888, McDowall, 1933); (3) the secretory theory which explained the electrical changes in terms of the activity of sweat glands of the skin (Darrow, 1927, Peterson and Jung, 1907). For some writers, the controversy "though past its climax, still continues" (Edelberg, 1972a, p. 368). Montagu and Coles (1966) wrote that the muscular theory was discredited at an early time (Waller, 1918). The vascular theory was more "robust" but eventually this too was discarded after Lader and Montagu (1962) demonstrated that if sweat gland activity is suppressed pharmacologically by paralyzing the cholinergic innervation of the glands with iontophoretic introduction of atropine into the finger the skin resistance response disappears; in contrast, a similar blocking of the adrenergically innervated vasomotor tone by bretyllium tosylate results in abolishing vasomotor activity without affecting the EDR. Further, sweat gland activity and EDR may be initiated by intradermal injections of acetylcholine and cholinomimetics (Chalmers and Keele, 1952, Foster, 1971 - both cited in Venables and Christie, 1973).

It is noted that although the sweat glands are "solely" under sympathetic control (Venables and Christie, 1980), they are innervated by acetylcholine (normally the parasympathetic transmitter). Evidence for the sympathetic activation of the sweat glands is presented in Edelberg (1972a). The EDR can be elicited by stimulation of the sympathetic trunk, after the sectioning of the rami (Wang and Lu, 1930) and a unilateral sympathectomy abolishes the response in the ipsilateral foot (Schwartz, 1934). Recently, Lidberg and Wallin (1981) recorded sympathetic skin nerve action potentials in the median nerve of 5 human subjects who were stimulated with touch stimuli and loud sounds. A linear and significant correlation (mean correlation coefficient of .68, $p < 0.05$) was found between amplitude of sympathetic burst and amplitude of SRR. Thus, it was concluded, the SRR is the result of sympathetic outflow to the sweat glands innervated. However, some parasympathetic role in EDA activity has also been suggested in the past (Darrow, 1937, Edelberg, 1972a).

Now there are two types of sweat glands, the apocrine and eccrine. The apocrine glands are mainly found in armpits and genital sites, are not under nervous control (they are stimulated by circulating adrenaline) and not involved in EDA, hence they are not of interest here. The eccrine glands, on the other hand, cover the whole body and there are regional differences in their density with no less than $2000/cm^2$ on palm and sole of feet, 200-$300/cm^2$ in the axillae and only 100-$200/cm^2$ on the trunk (Weiner and Hellman, 1960 - cited in Venables and Christie, 1973, 1980). On the palms the density of active glands is greater on the volar surfaces of the distal phalanges (Kuno, 1956). These glands secrete a NaCl solution and their main function is thermoregulatory but the eccrine glands of the palms and soles of feet adopt such a role only when the ambient temperature exceeds $30^{o}C$. In these sites, eccrine glands are predominantly associated with "psychological excitation" (Lykken, 1968, p. 463), i.e. they are responsive to "psychic stimuli" (Venables and Christie, 1973, p. 19) or "what are possibly best described as orienting or signal stimuli" (Venables and Christie, 1980, p. 22). Further, if stimuli of different "subjective intensities" are administered the amplitudes of the EDRs will tend to vary in proportion to the applied intensities (Hoveland and Riesen, 1940; Kimmel, 1964). However, Lykken (1968, p. 473) observed, since the subjective intensity or "attention-value" of a stimulus depends partly on the subject's expectations (Lykken, 1959a), a novel or unexpected stimulus will commonly evoke "an unusually large GSR or 'orienting reflex'" (p. 464).

The function of the eccrine glands has been subject to speculation. Darrow (1936) thought it to be part of the body's preparation for increasing grip and tactile sensitivity and made the analogy of a labourer spitting on his hands before gripping his tool. On the other hand, Lader (1963, p. 42) remarked, "using the analogy of a tennis-player repeatedly drying his hands, one could argue in antithesis". Edelberg (1967) found that touch sensitivity occurs both when the skin is dry and when it is immersed in water and suggested that some other mechanism to sweat gland activity must be responsible for such effects. Lykken (1968) noted that both Wilcott (1966) and Edelberg and Wright (1962) observed that during sweating palmar skin is toughened and becomes resistant to cutting or abrasion. Hassett (1978) also wrote that wetness of the palms and soles makes them resistant to abrasion and cutting and "all of these changes are helpful in threatening situations ..." (p. 35). These suggest that the sweat gland may have a predominantly protective function.

Details of the anatomical structure of the eccrine sweat glands can be found in Edelberg (1972a), Venables and Christie (1973), Hassett (1978), etc. Here only an outline of its anatomy will be presented. The outer layer of the skin, the stratum corneum, consists of dead cells. Below it, the epidermis made of germinating cells which continually replace the dead cells of the stratum corneum can be found, and below the epidermis is the dermis. The sweat ducts pass through all the layers and their coiled secretory portion lies in the subdermis (below the dermis). The secretory process itself is still not sufficiently elucidated and the purported mechanisms underlying it remain controversial (Venables and Christie, 1973).

A reabsorption process in the eccrine sweat gland is suggested by the fact that sweat at the skin surface is hypotonic while sweat at the point of secretion at the base of the duct is relatively hypertonic with respect to plasma (Venables and Christie, 1980). Two reabsorption systems have been discussed. According to Venables and Christie, Schultz, Ullrich, Frömter, Holzgreve, Frick and Hegel (1965) provided evidence that sodium is actively absorbed in the dermal portion of the eccrine gland and this results in a lumen negative potential relative to interstistial fluid. In the epidermal portion of the gland a similar potential is found. The notion that these systems act as sodium pumps is supported by the fact that injection of a sodium pump inhibitor (g-strophanthin) is accompanied by an increased concentration of NaCl in surface sweat. Fowles (1974 - cited in Venables and Christie, 1980) also wrote that the epidermal portion of the duct is involved in the reabsorption of water and NaCl as a result of which it is likely to be more conductive.

From the above it is apparent that at least three conducting pathways have been suggested in the sweat gland, i.e. the secretory and the dermal and epidermal absorption systems. Thus, as Venables and Christie (1980, p. 23) concluded, "while it may be convenient to think of sweat glands as conducting pathways through relatively nonconducting dermal and epidermal tissue, (see below) these conducting pathways are by no means simple in function or characteristics". It appears then that "the 'simple' sweat gland is an organ of unexpected biological sophistication" (Hassett, 1978, p. 38) and this has led some writers to suggest that different electrodermal measures reflect different underlying processes the precise nature of which is however far from understood (Venables and Christie, 1973). Further, there must be interrelationships between the different aspects of EDA. What follows an SCR, for example, depends on the state of the skin and "in particular the hydration of the stratum corneum and the fullness of the sweat duct at the time of secretion" (Venables and Christie, 1980, p. 24). If the amount of sweat produced initially is small and the duct is empty, only the dermal reabsorption mechanism is brought into play; if there is a large secretory response and the ducts are relatively full, the epidermal reabsorption mechanism is activated and an alternative conducting pathway is being brought into action.

3 CENTRAL INFLUENCES ON THE EDR

The complexities underlying the EDA become even more apparent when central influences on the eccrine sweat glands are considered. As mentioned earlier, these glands are innervated by the sympathetic branch of the autonomic nervous system (ANS). In the past, it was thought that the action of the sympathetic system was gross and nondifferentiated and EDA was often identified with the other functions mediated by the sympathetic ANS. As Venables and Christie (1973) wrote, this interpretation "has been strenuously opposed by Miller (1969), and the independent nature of the electrical activity of the skin is exemplified by, for instance, comparing changes in it and heart rate in orienting and defensive reflexes, and in the low correlations usually reported between electrodermal indices and indices of other autonomic functions" (p. 30).

Major reviews of the central influences on EDA have been made by Darrow (1937) and Wang (1957, 1958, 1964). In the light of these works, and a number of subsequent papers, Edelberg (1972a) and particularly Venables and Christie (1973) presented a comprehensive account of the central mechanisms of EDA. It should be noted most of the relevant research has been carried out in animals (mostly cats) and some of it is summarized below.

Venables and Christie (1973, p. 30) wrote there is "extensive" evidence regarding the inhibitory role of the ventromedial reticular formation on EDA. They referred to work by Wang (1958) which indicated this by an operation which allowed the descending activity of the ventromedial reticular formation to appear unmodified by higher activity. This caused a sharp fall in the intensity of the EDR of the animal (cat) and the response was abolished soon after the operation. A lower transection at the spinal level which eliminated the influence of this structure restored the EDR. In discussing the effects of the reticular activating system on EDA, Venables and Christie mentioned the work of Block and Bonvallet (1960) who stated that EDRs resulting from short, weak, peripheral stimuli are mediated by the brief reticular activation which they provoke. According to Venables and Christie, these workers showed that low-voltage, short-duration stimulation of the brain stem gave the same type of EDR as the one given by peripheral stimulation and the part of the brain stem which initiates these responses is the same part which gives EEG signs of wakefulness, and facilitates motor activity. In this region, which extends between the bulbar area and the posterior hypothalamus, the threshold of EDR is low and uniform while outside it the threshold becomes higher. Bloch and Bonvallet could not evoke EDRs from thalamic regions or the central grey matter. Only a part of the anterior hypothalamus was found to have low threshold for evoking EDRs and this is consistent with earlier reports (Hasama, 1929; Wang and Richter, 1928 - see Edelberg, 1972a). Venables and Christie (1973) suggested that these observations are congruent with the thermoregulatory role of that part of the hypothalamus and the fact that sweat glands of palmar and plantar surface do assume thermoregulatory role within certain temperature ranges (see section 2 above). Further, the authors remarked, although the above may not do justice to the role of the hypothalamus in mediating and coordinating the activities of other centers, they nevertheless imply "a rather secondary role for the hypothalamus in the mediation of non-thermoregulatory electrodermal activity" (p. 34).

Portions of the limbic system have also been implicated in the control of EDA. As limbic areas are closely associated with emotional behaviour (e.g. Papez, 1937), it would be reasonable to expect that such structures may initiate EDA commonly observed in response to emotional stimuli. Sourek (1965) suggested that the limbic system is involved in EDA of man specifically and various other workers have examined the roles of particular limbic structures in EDA of animals. The data "appears to be reasonably consistent" (Venables and Christie, 1973, p. 33). These authors reported, for example, that the amygdalas are found to play a facilitatory role in EDA (Bagshaw, Kimble, and Pribram, 1965; Bagshaw and Benzies, 1968). Also, while strong stimulation of the amygdalas results in facilitation of SPR, stimulation of the hippocampus produces its inhibition and stimulation of the fornix results in even greater inhibition of SPR and depression of SPL (Yokota, Sato, and Fujimori, 1963). It may be noted that the experiments by Bagshaw and his associates were carried out on monkeys while the experiments by Yokota et al. on cats. For further data on facilitatory or inhibitory roles of limbic structures see Edelberg (1972a).

More important, however, is the regulation of EDA by the highest centres. Venables and Christie (1973, p. 35) wrote: "It is perhaps worthwhile to view electrodermal activity in this context as a component of the orienting reflex , and following this to cite Luria and Homskaya

(1970, pp. 304, 305) who say, 'the efferent apparatus of the orienting reflex is located at the level of the reticular formation of the brain stem and of the nonspecific thalamic system, while the afferent link of the orienting reflex is located at the level of the cortex of the large hemispheres', and later, 'undoubtedly, the neo-cortex of the cerebral hemispheres and, above all, the cortex of the frontal lobes of the brain take part in the regulation of the orienting reflex'". Sokolov (1963) also wrote that the OR is a highly selective functional system and includes a cortical apparatus which influences the course of reactions at the subcortical level and in referring to the electrodermal component of the OR he commented: "Musyashchikova's investigation of the process of extinction of this reaction has shown beyond any doubt the cortical nature of its inhibition" (p. 53).

In the light of the relevant evidence, Venables and Christie (1973) concluded that a picture emerges which supports Wang's general thesis of "a hierarchy of suprasegmental controls" which, the authors add, "are in the reverse order to that in which they have been presented" (p. 36). This also applies to the brief and selective presentation here. On the other hand, the involvement of neocortical and limbic structures in EDR regulation is broadly in agreement with Bernstein's (1979) attempt to argue for a neurophysiological basis of the significance hypothesis regarding the elicitation of the OR (see chapter III, section 7).

Additional factors which may influence EDA include age, sex, hormones (with both central and peripheral effects), race, physical condition, personality traits, etc. (see Montagu and Coles, 1966, Edelberg, 1972a, Venables and Christie, 1973).

Before closing this section, it should perhaps be reiterated that the EDR has extensively been used as an index of the OR. Indeed, it is the most commonly studied OR component (chapter III, section 2). In introducing the EDR as an OR component, Sokolov (1963) wrote: "The main laws governing the galvanic skin reactions are identical with those described in connexion with the orientation reflex" (p. 56). It may also be added that despite the complexities and our poor understanding of the underlying peripheral and central mechanisms of the EDR, this response can nevertheless furnish "dependable information" about sympathetic activity "provided the various factors outside the nervous system which affect them are adequately controlled" (Edelberg and Burch, 1962, p. 25). These factors include skin temperature (see above), current density, electrode composition and size, electrolytic medium, etc. (see next section and "General methodology" in chapter V).

4 ELECTRICAL MODELS OF THE SKIN AND UNITS OF MEASUREMENT OF THE EDR

Montagu and Coles (1966) wrote that when two electrodes are placed on the surface of the body, the resistance between them is virtually the sum of the skin resistances at the sites of the electrodes while the resistance of the body interior is negligible; also, that the sweat ducts act as parallel conducting pathways and increase in their activity results in decrease of the skin resistance (i.e. increase in conductance). The sweat duct pathways are represented by the resistors $r_1 - r_n$ (Figure IV.1 - model by Venables and Christie (1973) after Montagu and Coles (1966)). These resistors may switch in or out depending on whether the sweat ducts are active or inactive. The R_P represents residual resistance of the skin when the sweat glands are inactive. The R_S stands for a three-part pathway lying in the stratum corneum, the lower epidermis and body core. The C represents an additional pathway, i.e. the capacitance of the skin which provides a conducting pathway only when alternating current (AC) is used (see below).

There is some empirical evidence in support of such a model, i.e. that the sweat glands act as conducting pathways in parallel. Conductances in parallel are additive and it would appear that, according to the model, an increasing conductance should be proportional to the number of sweat glands being activated. Darrow (1934, 1964) showed that SC is linearly related to the amount of perspiration (while SR is not). Thomas and Korr (1957) found that the relation of SC to the number of active sweat glands is "very nearly linear" and "a given increment in conduction thus reflects essentially the same increment in sudomotor activity" (p. 510). Given that sweat gland activity is the primary source of electrodermal changes, the above also suggest that the measurement of EDRs should be made in conductance rather than resistance units. Apart from the mentioned linear relationship between SC and number of active sweat glands which suggests that SC measures are biologically meaningful, Lykken and Venables (1971) pointed out that "the overall

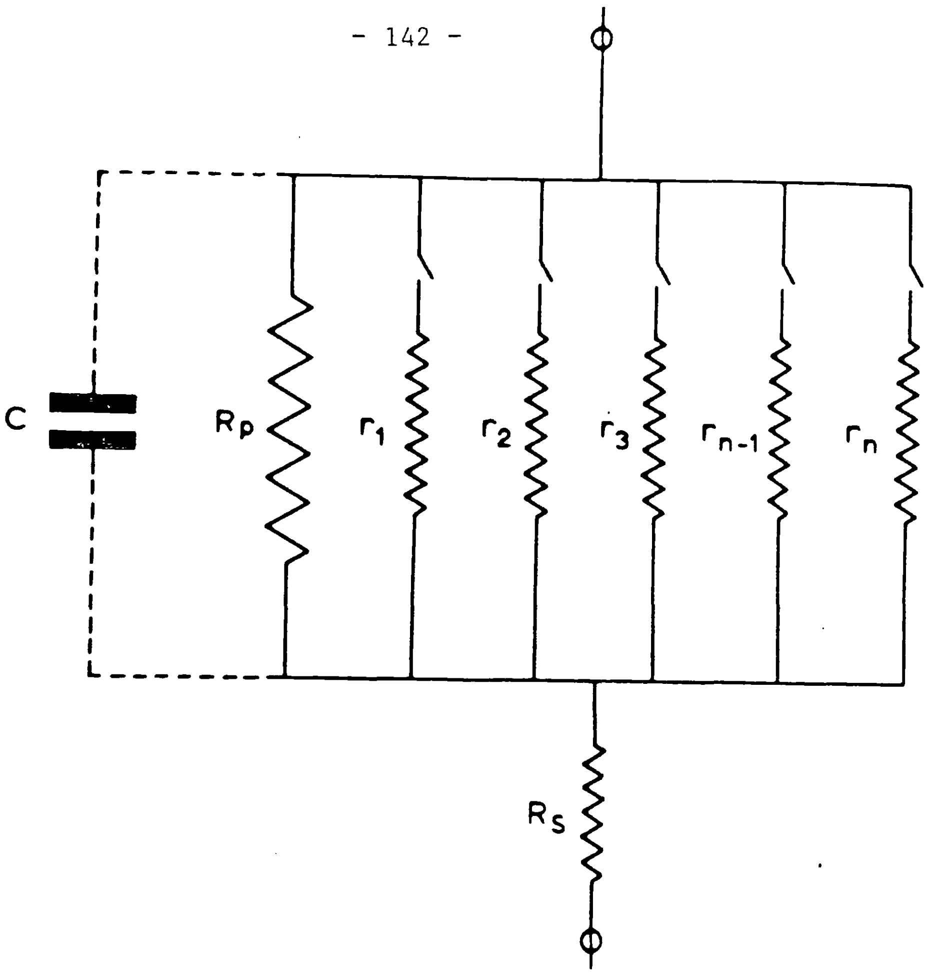

Figure IV.1 Electrical model of the skin; after Montagu and Coles (1966) (Venables and Christie, 1973)

resistance of a parallel circuit is a complex function of the individual resistances and the change produced by a change in one branch depends upon the resistances of all the other branches. In contrast, the <u>conductance</u> of a parallel circuit is a simple sum of the conductances-in-parallel and a change in one of these produces simply an equivalent change in the total, independently of the values of the others". In other words, they added, "the structure of the skin as an electrical conductor motivates the use of SC rather than SR" (p. 658). These also imply that while the SCR is potentially independent from base conductance the SRR would correlate with base resistance. This is generally found to be the case, i.e. "correlations of SRR with SRL tend to be high in comparison with the correlations of SCR with SCL" (Lykken and Venables, 1971, p. 659). It may be argued that it is not always desirable to eliminate correlations of phasic responses with background levels (e.g. Montagu and Coles, 1966) but as Lykken and Venables (1971) wrote, "a correlation which results directly from the mathematical properties of the measuring units employed is obviously to be avoided" (p. 659).

Further, Lader (1970) reported that SCRs decline in an orderly manner and gradually subside to zero while SRRs fluctuate more randomly after atropinization of the palmar surface. (Both SCRs and SRRs were proportions of simultaneous SCRs and SRRs respectively recorded from control sites). It should perhaps be added that SC data are more normally distributed than those of SR and this is another reason for employing conductance units as statistical considerations may warrant normality in the distribution of scores (e.g. Hassett, 1978).

However, as discussed earlier (section 2), the skin cannot be viewed as a simple system and "inevitably there will be interrelationships between all aspects of electrodermal activity" (Venables and Christie, 1980, p. 24). Some models of the skin attempted to describe possible interrelationships between different aspects of EDA. Fowles (1974) presented such a model which is an elaboration of an earlier one by Edelberg (1968). Fowles' circuit provides for conducting pathways for the secretory activity of sweat glands as well as for their dermal and epidermal absorption systems (see section 2). However, our knowledge of the electrical activity of the skin remains inadequate and "it should ... be emphasized that it (Fowles' model) is at this stage little more than a description of aspects of electrodermal mechanisms which may, with differing degrees of certainty be known to exist" and "only suggestions can be made about the values of the elements and only guesses can be made about the dynamic relations between them" (Venables and Christie, 1980, p. 27). The same may be said for other models presented in Edelberg (1972a), Venables and Christie (1973) etc., and in this sense <u>any</u> electrical model of the skin is perhaps premature. Nevertheless, some model is needed to guide one's measurements and the relatively simple circuit by Montagu and Coles could be said to serve this purpose since it appears to be empirically supported, for example, by the work of Thomas and Korr (1957).

Now the findings of Thomas and Korr suggest that sweat gland units have fixed values and are capable of switching in or out in an all-or-none fashion. However, there is evidence that sweat glands may act as <u>variable</u> resistors, i.e. in a graded form (Venables and Christie, 1973). As Edelberg (1972a) also wrote, even Wang who showed an apparent all-or-none behaviour in the sweat glands has argued for temporal summation effects. Further, there is evidence that the activity of the sweat glands depends upon the frequency of neural impulses (Fujimori, 1955; Adams, 1966 - both cited in Edelberg, 1972a). Thus, Edelberg reasoned, if sweat glands show graded activity to neural impulses of different frequencies, their resistance is determined primarily by the height of the column of sweat in their ducts, with additional increments of sweat causing a linear decrease in resistance and a reciprocal increase in conductance which now would appear to correlate with the conductance level. Edelberg (1972a) observed that, in their experiments, Thomas and Korr (1957) pressed an electrode to the paste-free skin surface which may be expected to be dry and under these conditions only the ducts which were full would make contact with the electrode. As a result, he argued, it would be surprising if the relation between the number of these parallel units making contact with the electrode and the sum of their conductances were "anything <u>but</u> linear" (p. 396), as the partially filled units were excluded from the measurement and thus the linearity was preserved.

On the basis of the above, Edelberg concluded: "It appears that, for a system consisting of sweat gland activity only, in which all units operate and each varies its resistance in equal increments for each neural impulse, skin <u>resistance</u> changes should be the linear measure of choice. The response amplitude would be independent of base <u>resistance</u>. If the situation is one in which individual units are being recruited in an all-or-none fashion, <u>conductance</u> values become a linear measure of activity. The response amplitude is then independent of the base <u>conductance</u> level". Further, "at times, one or the other of these conditions may prevail, but in practice both types of activation are probably involved" (p. 397).

From the above it appears that, despite the extensive literature advocating the use of conductance rather than resistance units, no general acceptance of the situation has been reached and the investigator, as Edelberg (1972a) pointed out, "faces several decisions when he considers how to treat electrodermal data", one of them being whether "amplitudes (should) be expressed in resistance or conductance units" (p. 395). On the whole, however, it seems that given the evidence todate, conductance should be the units of choice. Further, when conductance cannot be measured directly (see below), resistance units should be converted into conductance by taking their reciprocals as advocated by Lader (1970).

These conclusions, on the other hand, do not necessarily imply that studies reporting resistance measures should be regarded as invalid or unreliable and some empirical findings will illustrate the point. In comparing raw resistance measures (ohms) with 5 other methods of scoring EDRs, including conductance units (to which the resistance scores were converted), Hunt and Hunt (1935) concluded that "the absolute number of ohms deflection ... offers a simple and adequate method of scoring the galvanic skin response" (p. 387); interestingly, they found that for normal subjects the correlation of number of ohms with corresponding conductance units was: +.97 ± .01 (they used the rank-difference correlation formula for ρ). In a study by Epstein and Fenz (1962 - see chapter III, section 6.2) the EDRs to emotional and neutral words were measured in three different ways, i.e. as changes in resistance (ohms), changes in conductance (mhos) and in log conductance changes (log mhos). The results obtained from each measure were plotted for each experimental subject. It was found that "on all three measures 16 of the 16 subjects showed a gradient of response corresponding to the dimension of stimulus relevance" and "analysis of variance for each separate transformation yielded parallel results" (p. 102). More recently, Boucsein and Hoffman (1979) recorded simultaneously EDRs in both conductance and resistance units (see below methods of measurement) and from both hands of subjects who were administered white noise stimuli. No differences between conductance and resistance measures in raw amplitudes of responses were found and the two measures were seen as equivalent in their reliability and behavioural concordance. However, reliable differences between SC and SR methods in the measurement of recovery time (i.e. the time taken for the post peak amplitude of the EDR to recover to 63% of its peak value - Edelberg, 1970) were observed, with shorter recovery times found with the SC units. Thus, at least when only amplitudes of responses are studied, resistance units can be adequate measures in describing the relative strength of responses (see also treatment of raw data below). To reiterate, however, the weight of evidence todate and the need of standardization suggest the use of conductance units.

5 METHODS OF MEASUREMENT OF THE EDR

There are two techniques of exosomatic measurement of the EDR. One is as originally described by Féré (1888) and involves the passage of a direct current (DC) through the skin; the other is carried out by use of alternating current (AC). The latter method was used inthe past for two reasons which have now become of "doubtful relevance" (Venables and Christie, 1973, p. 4). The first reason was related to the possible polarization of electrodes with the use of a direct current when employed for more than a very short time. Such polarization was caused by the development of an artifactual apparent resistance due to an electromotive force (EMF) in the opposite direction to that of the applied current. However, the use of silver-silver chloride electrodes and appropriate electrolytic media (see chapter 5) have minimized polarization effects. An additional reason for using the AC method was that it made possible to measure the capacitative component of the skin (Figure IV.1, section 4, above). However, Venables and Christie wrote, there is controversy about the nature of this component and, in any case, it has not been demonstrated to be an independent factor having psychological relevance. Moreover, as Montagu and Coles (1966) commented, there is a near unity correlation (.99) between AC and DC methods of measurement at low frequencies such as 60 cps (frequency of current is an additional factor to be considered with the AC method as the ability of a capacitor to conduct AC varies directly with the frequency of the current). For all these reasons, the AC method is now regarded as an unnecessary complication (Venables and Christie, 1973).

According to Ohm's Law, the resistance R in a circuit is given by the equation $R = V/I$, where V stands for the voltage and I the current. From this it becomes apparent that skin resistance may be measured in either of two different methods: (a) the constant-current one, in which a constant current is passed through the skin and the voltage developed across it measured; this voltage is directly proportional to the resistance of the skin which can thus be recorded directly; (b) the constant-voltage method, in which a constant voltage is applied across the skin and the current which flows measured; this current is inversely proportional to the resistance, i.e. it varies directly with the conductance which can thus be obtained directly.

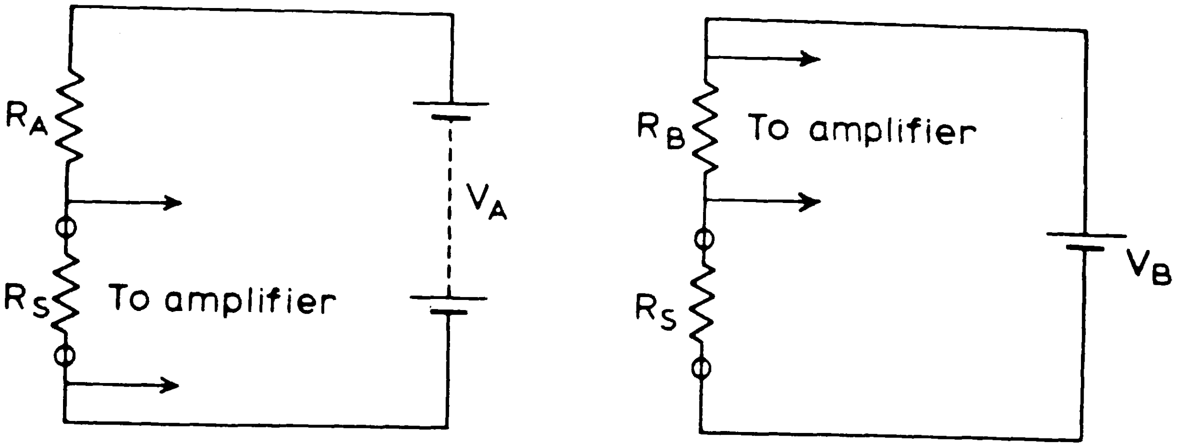

Figure IV.2. Schematic circuits to illustrate: (a) constant current; and (b) constant voltage methods of measuring SC (Venables and Christie, 1973).

It should be pointed out that Ohm's Law holds in as much as it holds for the physiological electrochemical circuit involved in ED phenomena (Venables and Christie, 1973). In a study by Edelberg, Greiner and Burch (1960), for example, it was suggested that when using a constant current type of circuit Ohm's Law is valid as long as the current density is below $10\,\mu A/cm^2$; outside this limit SRL and SRR decrease as the current density increases. Later, Edelberg (1967) showed that the limiting current density was influenced by the individual subject's resistance. That is, if subjects had a low SR value, they could tolerate much higher current densities, i.e. up to $75\,\mu A/cm^2$ before non-linearity was observed; in contrast, in subjects with high SR value non-linearity became apparent with as low current densities as $4\,\mu A/cm^2$. The current density can, of course, be reduced by using large electrodes (see below). Similarly, Edelberg (1967) reported that voltage/current curves are linear below a voltage of 0.8 V across a single active site and suggested the use of 0.5 V across a single site to avoid non-linearity.

In more detail, the principle of the constant-current method is shown in Figure IV.2(a) (Venables and Christie, 1973). The electrodes are connected in series with a resistor R_A the resistance value of which is large as compared to that of the subject's R_s (R_A should be at least 10 times greater than the highest value of R_s). Thus, regardless of fluctuations in R_s, the current remains relatively constant. However, as Montagu and Coles (1966) wrote,'the current density per unit area of electrode is stable but the effective density per physiological unit must vary inversely with the number of active sweat glands as, by definition, with this method the same current will flow regardless of the state of the sweat glands. The greater the number of sweat glands are activated, the greater is the number of pathways which share the current. It is apparent that the maximum current which may pass through the skin without causing injury is determined by the minimum number of active units. This depends not only upon the electrode area but also upon the density of sweat glands as well as their functional state.

The principle of the constant voltage is illustrated in Figure IV.2 (b). With this method, a source of low voltage is connected across the electrodes and the current is measured by introducing a small resistance R_B in the circuit and recording the voltage drop across it. The latter is proportional to the current. Since the subject's resistance fluctuates, in order to ensure that the voltage across the electrodes remains stable, the value R_B must be at least 10 times smaller than the lowest R_S. As the sweat glands are in parallel, the voltage across each physiological unit is constant and equal to the voltage of the source. Thus, while the total current varies with the number of sweat glands being activated, the current density per active unit remains the same regardless of their number. This depends only upon the applied voltage (Montagu and Coles, 1966).

A number of writers have concluded that the constant-voltage method is preferable to that of the constant current on various grounds. Constant voltage, of course, gives a direct measure in conductance which, as seen in the previous section, should be preferred to resistance. Also, with the constant voltage method the current flow through each sweat gland seems to be independent of the activity or inactivity of the other glands and although the constant-current method has been employed on the grounds that the current density through the skin remains constant, it was pointed out above that this is not the case. However, for lack of differences in the measurement of amplitudes of responses with constant-current and -voltage methods see Bouscein and Hoffman (1979, section 4, above).

CHAPTER V

GENERAL INTRODUCTION TO THE EXPERIMENTS

1 RATIONALE

Seligman (1971) proposed phobias be viewed as instances of biologically prepared learning. In chapter I it was argued that this theory is, if anything, of limited usefulness and that the notion of phylogenetic preparedness for certain associations, while possibly valid for lower organisms, is of doubtful relevance to humans. As Razram (1971) wrote, the ratio of ontogenetic learning plasticity to phyletic unlearned relative fixity is a growing function of evolution and in man is very large and overriding. Similarly and specifically in the context of emotions, Averill (1976, p. 107) stated: "As we ascend the phylogenetic scale, biological systems become increasingly segregated on a genetic level and individual experience assumes a greater importance as a systematizing factor". Man, Averill argued, is "world-open", i.e. the human nervous system is largely undifferentiated at birth and behaviour patterns are not "wired in" as they are in lower organisms (p. 122).

On the other hand, the most striking evolutionary advance at the human level is the drastic increase in the degree to which behaviour is determined through the operation of complex cognitive processes (McReynolds, P., 1976). Such processes became evident in the discussion of the content of fears in chapter II. It was seen that their content is frequently determined by cognitive development, shared knowledge and beliefs in the community as well as various social parameters including sex and socioeconomic status. However, the data presented in chapter II was not based on experimental work and therefore there is a need of a systematic research on these influences upon the observed selectivity in phobias (e.g. Marks, 1969). As seen, at best, research todate gives support to the evolutionary explanation for the content of only a few of them.

It should be pointed out that there is no intention to enter a nature vs. nurture argument regarding the apparent selectivity in phobic objects. In this problem, as in any other study of behaviour, what is important is not whether this is innate or acquired but how we go about understanding it best. Phobias may be better understood by considering the active part played by cognizant human subjects in determining their behaviour rather than by viewing them as passive organisms in which responses are acquired more or less "automatically" by prepared associations through evolution or, for that matter, by the simple interplay of temporal contiguities and occurences of rewards and punishments (traditional learning theory view). Such an approach is congruent with ample evidence on the operation of complex cognitive factors in human conditioning. Working, for example, within a cognitive-verbal framework and a differential classical conditioning paradigm Bunde, Grant and Frost (1970) found greater differentiation between reinforced and unreinforced CS when the word/command "blink" was the positive and "don't blink" the negative cue than when the reverse contingencies were applied.

It is apparent that the "active" processes of cognizant human subjects referred to above are influenced by past experiences. That is, individuals bring into a situation tendencies to perceive stimuli in certain ways and their responses are a function of their histories (Maltzman, 1979b). Further, in the context of the OR, Luria and Vinogradova (1959) and many other workers (see chapter III) found that the information extracted during the elicitation of the OR may reflect evaluations, hypotheses, expectations, etc. in accordance with previous analyses of stimuli within a social context. The evolution of man clearly suggests that human beings are first and foremost organisms who utilize knowledge (Russell, 1980). Knowledge may be acquired directly or indirectly through communication. The latter may involve the transfer of information from one person to the other and enable them to learn about situations with which they had not had direct (personal) contact (Manis, Cornell and Moore, 1974).

Now one way of investigating the potential of stimuli to become involved in phobias (and assuming that phobias are learned responses) is to examine the ORs evoked by these stimuli. This is justified by the fact that the OR is central to the systems controlling the flow of psychological events, their processing and learning and, as Öhman (1979b) wrote, we tend to learn more of things to which we orient vigorously. It has been found, for example, that subjects with relatively large ORs (EDRs) as compared with those with relatively small ORs showed better semantic conditioning of autonomic responses (Maltzman and Raskin, 1965). Earlier, Winokur, Guze, Stewart, Pfeiffer, Stern and Hornung (1959) had found a correlation of 0.65 between the number of ORs and the number of electrodermal CRs in extinction of a psychiatric patient sample (Dykman, 1967). In chapter III the functional importance of the OR in the elaboration of classically conditioned responses was specifically discussed. Classical conditioning, of course, is the most typical objective manifestation of simple associative learning. However, there are other forms of learning through which fear responses may be established (vicarious conditioning, sensory conditioning, etc., see e.g. Marks, 1969; Rachman, 1977) and this issue is not contested here. Nevertheless, it is assumed that in all these types of learning the OR is of central importance since, as stated, it determines what is attended to, processed and ultimately learned.

However, the magnitude of the OR is not the only variable associated with efficiency in learning. Indeed, Öhman and Bohlin (1973) found that while OR magnitude had no predictive value for subsequent conditioning the rate of habituation of the OR did so. They argued that this latter variable derives from several encounters between the organism and discrete aspects of the environment and therefore it should be more reliable than the OR magnitude. Also, the authors continued, habituation is a more complex measure, reflecting the organism's ability to deal with and adapt to its environment and consequently its relationship to other aspects of adaptive behaviour, including conditioning, is of special importance.

The present research investigates the ORs and their habituation to stimuli of basically two categories: (a) stimuli of which subjects report moderate, "normal" fears; (b) stimuli commonly associated with fears in one's culture but of which the individuals selected as subjects report no fear. The study of moderate rather than intense fears was dictated by the focus of this research on the potential of stimuli to become phobic, i.e. the interest is in the ORs to such stimuli rather than DRs (emotional responses) which are probably elicited from phobic subjects (see chapter III). It may be added that phobias are not but accentuated fears experienced by numerous "normal" people in the population at large (Snaith, 1968) and the former may derive from the latter (see also chapter II).

The OR has a number of components (see chapter III) and in principle it makes no difference which component is chosen to be studied. In practice, however, the EDR is most commonly used because of its high sensitivity (van Olst, 1971). Sokolov (1963) wrote that the EDR "exemplifies the phasic orientation reflex" (p. 116). In chapter III a number of studies were reported in which the sensitivity of the EDR was indeed amply demonstrated. Lykken (1968) also wrote that the electrodermal phenomena "comprise the most important psychophysiological variables currently available for use in general psychological research" (p. 473), in the sense that they are more accessible to and interpretable by the psychologist than other psychophysiological indices For all these reasons, the present research employs the electrodermal component of the OR. The inclusion of additional OR components would not perhaps serve any useful purpose due to lack of correlation between the various components (see chapter III). After reviewing the relevant literature and referring specifically to indices of "arousal", Lader (1963, p. 77) concluded that "if only one measure is used ... in a simple experiment, then meaningful results will be obtained ... (but) if more than one measure is employed, the problems of experimentation and interpretation multiply alarmingly". Numerous problems are associated with the measurement of each OR component and some pertinent to the EDR were discussed in chapter IV (see also below). It should be also pointed out, that the attachment of many electrodes on the subjects for different measurements is hardly conducive to "simple" experimentation. Apart from causing physical discomfort they may multiply internal questions in the subjects about the purpose of measurement of their responses and probably on how they can influence some of them. The EDR measurement, on the other hand, is unobtrusive and can hardly give them the impression they can influence it. Of course, a number of writers have noted what Lacey and Lacey (1958) described as "response specificity" (i.e. the tendencies of individual persons to respond to stimulation mostly with a particular physiological system) but this problem could be minimised by using relatively large samples and equal number of subjects in experimental and control groups.

It was earlier seen that the OR to a stimulus is not only determined by its content but it is also amplified or attenuated by its context and the state of arousal of the person (chapter III, section 5.1). The state of arousal associated with threat has been found to be particularly effective in influencing EDRs to potentially threatening stimuli (see, for example, Epstein and Fenz, 1962; Geer and Klein, 1969; Öhman et al., 1974, in chapter III, section 6.2). Thus, in this research the ORs to potentially phobic stimuli will also be examined in the context of different psychological states.

Öhman and his colleagues characteristically used pictorial representations of stimuli (chapter I) but it is known that the EDR is also sensitive to word stimulation and the meaning of words is encoded in habituation experiments (chapter III). Furthermore, words may be preferred as stimuli because they are abstract, nonspecific and impersonal. The way a corpse, for example, is conceived pictorially may considerably vary from person to person but the word "corpse" may effectively substitute for a dead person as conceived by the individual subject.

In summary, this research is based on the hypothesis that fear content is influenced by life experience, both direct and indirect, and the selectivity in phobias will be investigated in this context. The potential of moderate fears to become elaborated in intense ones will be examined by studying the ORs to stimuli denoting moderate subjective fears. Then, the ORs to stimuli of which subjects report no fear but which nevertheless are commonly feared in the culture will also be examined. These investigations will be carried out in different conditions, i.e. states of the subjects, since responses to stimuli may depend on past experiences but they are also influenced by a person's present state. The stimuli are in verbal form and the dependent variables are magnitude of the electrodermal ORs and their habituation.

2 GENERAL METHODOLOGY

2.1 RECORDING OF ELECTRODERMAL RESPONSES

The technique for measuring physiological responses should be based on sound criteria. That is, the up-to-date knowledge in the field should be carefully considered and the appropriate instrumentation should be chosen accordingly. To paraphrase Venables and

Christie (1973), however, "perfection" is "for those who have facilities, time, opportunity, and finances" (p. 3). On the other hand, the object of a research is defeated if its method is not carefully thought out as the validity and reliability of the experimental findings may remain questionable. Thus, though necessary, compromises should be "acceptable falls from grace" (Venables and Christie, 1973, p. 3). Of course, much depends upon the nature of the investigation to be carried out as while a certain experimental set up is adequate for a particular type of measurement, it may not be so for another (see, for example, Bouscein and Hoffman's study in chapter IV, section 4).

With such considerations in mind, the following general method was adopted.

The measurement of the EDRs was made with a George Washington oscillograph 400 MD/Z using an FC-141 coupler. The method of measurement was constant current. The density of the current was 5.8 $\mu A/cm^2$ (current 5.51 μA divided by the area 0.95 cm^2 of one of the electrodes - Edelberg, 1972a.) The coupler was operated in the DC mode giving an output calibrated in ohms. The output from the amplifier was taken to a PDP Lab 8/E computer and displayed on an oscilloscope screen. The sampling rate was 10 per second. The computer screen informed the experimenter about the range of fluctuations of SR and an attenuator setting, appropriate for the subject, was chosen during the settling-in period at the beginning of the experiment. If, for example, it was apparent that a subject's response magnitudes would be high a less sensitive attenuator setting was chosen. This was entered into the computer just before the experiment started and the program took into account the amplification chosen. The computer's A/D conversion was calibrated for each gain likely to be used. In order to achieve maximum precision the calibration was carried out with the use of a resistance decade box. Subsequent investigation confirmed that the computer's estimations of responses were identical to those described by the manufacturer of the oscillograph in terms of pen deflections on the recording paper. Each computer unit (i.e. each "bit" on the A/D converter) represented a change of 20A ohms where A represented attenuator setting and the figure 20 was an approximate average from readings taken at various attenuator settings. More specifically, the PDP computer recorded resistance values arranged on 1024 points (range of the oscilloscope). For each point on the screen the SR value corresponded to the product of the figure representing this point multiplied by 20 A. For example, for point 100 the resistance value was: 20 A x 100; if attenuator setting was, for example, 5 this means: 20 x 5 x 100 = 10000 ohms. Responses were computed as the differences between the peak values of SR following stimuli and preceding baseline mean values (see below). The averaging of the baseline, identification of the peak magnitude and subtraction to give the response magnitude for each stimulus were carried out by the computer using a different program to the one employed for recording the responses. Given the limited range of measurable values and in order to keep the pen output and PDP oscilloscope traces within their available ranges, the SR scale had occasionally to be brought manually to subjects' approximate "baseline" levels. All such resettings were made outside the sampling times which were from 11s before to 10s after the stimulus. Thus, the net effect of a resetting on the calculation of responses was either to add or subtract a constant value both from the prestimulus and poststimulus SR values. The need for resettings influenced the decision for a discontinuous computer sampling; if the sampling were continuous, the experimenter would not know whether a trace on the oscilloscope was "critical" or not, i.e. whether a stimulus presentation would occur during a particular period and thus resetting could not be done without the risk of confounding tonic levels and responses. (It should be pointed out that the interstimulus intervals were randomly decided by a PET-computer - see below). With this method of recording,each SRR represented a deflection in absolute number of ohms and it was not necessarily derived by subtracting real ohmic SR values. Despite its limitations, however, this method was thought adequate for the purposes of the present investigation in which the focus of interest was in the relative magnitudes of responses.

2.1.1. ELECTRODES

The literature on the subject suggests that both bias and polarization potentials are lowest when "reversible" electrodes are used (e.g. Lykken, 1959b,Montagu and Coles, 1966, Edelberg, 1967). Such electrodes consist of a metal "disk" in contact with a solution of its own ions. Accordingly, the electrodes used were silver-silver chloride (Ag/Ag Cl) of 11 mm in diameter, i.e. 0.95 cm^2, embedded in plastic cups. The size of the electrodes in the measurement of the EDR is relevant since resistance varies inversely with the area of skin from which recordings are made and this results from the parallel arrangement of the physiological units (chapter IV, section 5). It is thus important to standardize the area as well as site of measurement (see below) because of the regional differences in sweat-gland density (chapter IV, section 2). The plastic cups when filled with electrolyte are effective in maintaining the electrode size constant across the subjects (e.g. Lykken and Venables, 1971). The electrodes were prepared in the department's psychological laboratory workshop and in accordance with Venables and Sayer (1963) and Venables and Christie (1973). The criterion of using Ag/Ag Cl electrodes is the potential difference between a pair is not greater than 100 μV after being open circuited for 1 hour. This criterion was observed throughout the present research by checking the electrodes with a "Farnell TM2" AC-DC Microvolt meter at regular intervals (2/3 days). Before usage the electrodes were soaked for at least 24 hours in a solution of the electrolyte with which they were to be used (see below). According to Venables and Christie (1980), the soaking allows "adequate time for the electrolyte to penetrate into the interstices of the porous electrode surface and for local reaction to take place which might otherwise cause instability" (p. 32). After each experiment the electrodes were cleaned by a jet of distilled water using a polythene wash bottle. When not in use they were stored in dry conditions (Venables and Christie, 1973).

2.1.1 ELECTRODE SITES

The electrodes were attached to the palmar surfaces of the medial phalanxes of the first and second fingers of the right hand. The medial phalanxes rather than the distal ones were chosen (see chapter IV, section 2) because they are less prone to cuts and other damages (Edelberg, 1967) and also less influenced by movement of fingers (Venables and Christie, 1980).

2.1.2 PREPARATION OF SITES

Skin hydration and electrolyte concentration of the skin surface influence EDA (e.g. Montagu and Coles, 1966). As it is likely that subjects would come to the laboratory having washed their hands at variable times there was a need for a standardizing procedure to ensure that in all subjects hydration and electrolyte concentration of the skin were similar. Therefore, the electrode sites were wiped dry with alcohol using cotton wool (e.g. Boucsein and Hoffman, 1979). Alcohol was used for practical reasons (no sink in or near the laboratory was available), despite the superiority of washing hands with soap and water over ether and acetone (Venables and Martin, 1967) and presumably alcohol in reducing SC.

2.1.3 ELECTROLYTIC MEDIUM

The electrolytic medium should be isotonic, i.e it should have equivalent concentration to the sweat with which it comes into contact as the resistance of the skin is affected by its water content. As seen in chapter IV, sweat contains mainly NaCl and its concentration varies widely due to reabsorption processes in the sweat ducts. According to Rothman (1954 - cited in Venables and Christie, 1980), the NaCl concentration in human sweat varies from 0.015 to 0.06 M. In agreement with this, Edelberg (1967) recommended an electrolytic solution of 0.05 M NaCl. Edelberg suggested that the electrolyte concentration is not greatly affected by the sweat under the electrodes and the resistance of such a substance is too low to influence the actual measurements. However, Venables and Sayer (1963), following a recommendation by Rein (1929) advocated the use of potassium chloride (KCl) for SPL measurement and Venables and Christie (1980) wrote that 0.05 M KCl has been used by both authors and for both SP and SC measurements satisfactorily for many years.

Accordingly, for this research the electrolyte was made as prescribed by Venables and Sayer (1963) and Venables and Martin (1967). That is, an agar jelly was prepared by heating 2 grams of agar-agar in 100 ml of 0.5 percent KCl almost to boiling and then stirring until it became cool. When not used, the electrolyte was stored in a refrigerator to prevent it from rapid deterioration and fresh supplies were made 3-weekly or at shorter intervals.

2.2 SCREEN FOR THE PRESENTATION OF STIMULI AND EXPERIMENTAL SET UP

The PDP computer was connected with a Commodore PET computer, series 2001, on the screen of which the verbal stimuli were presented at approximately 70 cm distance from the subjects' heads. The PET was programmed so that, apart from presenting stimuli, it initiated the sampling period on the PDP, prior to each stimulus presentation. The PET computer and the subjects were separated from the rest of the experimental room, including the experimenter, by a black screen of 1.8 m height (see diagram of the experimental set up in Appendix 20).

2.3 QUESTIONNAIRES

The most commonplace of the usages of the word "fear" refers to a personal, phenomenally experienced feeling of distress, i.e. for most people, if not all, fear is something they feel (McReynolds, P., 1976). The assessment of fears therefore is commonly carried out by asking people about their fears. Such an assessment is particularly appropriate for this research which examines ORs of "cognizant" human subjects (section 1, above) to stimuli they either fear (moderately) or they know that these stimuli are feared by other people. One method of obtaining self-report data on the content of fears is the behavioural interview, another is the employment of written surveys which are more objective and standardized than interviews and they are also quick, inexpensive and easy to administer (Ciminero, 1977).

At least 10 self-report fear questionnaires have emerged in recent years (McReynolds, W. 1976). One of the most frequently used fear questionnaires, both in the clinic and research, is the Fear Survey Schedule III (FSS-III) by Wolpe and Lang (1964) which consists of items denoting "frequent neurotic anxiety stimuli" (p. 27). Since the interest in the present research is also centred around stimuli which may become implicated in neurotic fears, this FSS was employed to assess the fears of all the subjects except those in experiments 6 and 7 (in which no fear-relevant stimuli were presented). The questionnaires were given with assurances of confidentiality and the subjects were asked to write their names (unless they opted otherwise) on a blank paper slip attached to each questionnaire. They were asked to hand back the questionnaires to the experimenter personally or to leave them (inside envelopes) in a specified pigeon-hole at the entrance of the college. When the experimenter collected them he detached the paper slips from the questionnaires and thus kept the names of the subjects and their responses to the FSSs separately. The written instructions on the FSS explained that the items were commonly associated with fear or other unpleasant feelings and that subjects should rate them according to their current reactions to the objects or situations denoted by the items. The scale was a five-point Likert-type one, ranging from "Not at all" (1) to "Very much" (5).*

Following the experiments, subjects were administered additional questionnaires including one which asked them to rate the stimuli they were presented with and another which asked them about their subjective experiences during the experiments (see individual chapters below).

2.4 SUBJECTS

All volunteer subjects were students of Bedford College, University of London. They were recruited individually by the experimenter within the premises of the college. During their recruitment they were asked to fill in the FSS-III (except subjects in experiments 6 and 7) and appointments for the experiments were made. No information about the nature of the experiments was given at this stage. However, all subjects were told that each experiment involved a "very simple procedure" and approximately lasted half an hour. It was added that after the experiment information on the experimental procedure would be given and any queries would be answered. (For more details on the subjects see experiments in the following chapters.)

3. GENERAL EXPERIMENTAL PROCEDURE

The apparatus was prepared before the subject arrived at the laboratory the temperature of which ranged from 19°C to 26°C. The testing was carried out between 10.00 a.m. and 4.30 p. m. (see section 5.1.1, chapter III, about diurnal variations on EDA). A constant background noise of about 68 dB (arising from the PDP computer and measured by a DAWE sound level meter, type No. 1400F, Ser. No. 3856) masked effectively almost all extraneous noises.

Initially, the subjects were reassured about the nature of the experiment and were allowed to familiarize themselves with their surroundings for 5 minutes while the experimenter carried out (or pretended to be occupied with) some clerical work. Subsequently, the electrodes for recording the SRRs were attached to the subjects' hands

* In agreement with other workers in the field (e.g. Manosevitz and Lanyon (1965), a rating above 3 was considered as indicating a degree of "significant disturbance". Ratings 1 and 2 were thought as indicating lack of substantial fear.'

using plastic adhesive strappings and after filling them with electrolyte. The instructions which followed were given orally (see individual experiments). The main light of the room was then switched off leaving the laboratory illuminated by a shaded 60-watt lamp in a corner. In other words, the experiment was carried out in semi-dark conditions to enable the subjects to relax (Venables and Christie, 1973) and not to be distracted by stimuli non-relevant to the experiment. The semi-dark were preferred to all-dark conditions because, under the former, the subject could easily read the stimuli on the PET screen without being "startled" by the sudden appearance of "bright stimuli" and, as compared to the all-dark conditions, the risk of the subject falling asleep was minimized.

The George Washington oscillograph was switched on and calibrated with the pen zero volt control brought to the appropriate level of the chart. After the electrode wires were plugged in, polarity was chosen so that decreases in resistance were recorded as deflections upward. While the subject continued relaxing an attenuator position, appropriate for the subject, was chosen. The experimenter waited (no less than 3 minutes) until the subjects' skin resistance levels reached relatively stable baseline values (i.e. straight or slowly declining lines). Twenty-five seconds prior to the first presentation of the stimulus the subjects were told that the experiment was about to start and the experimenter pressed a key on the PET computer to start the program. The stimulus then appeared on the PET screen for 12 trials and for 2 s on each trial. (During preliminary studies, stimuli were presented for a larger number of trials, e.g. 30 trials, but it became apparent that the subjects found the experiments far too long and monotonous. This suggested that they could experience the latter parts of the experiments as aversive and as a result they could respond to stimuli vigorously irrespective of their content. It was thought that 10 to 12 trials, though relatively few so as to obtain complete habituation in most subjects, were nevertheless adequate for observing the magnitudes of SRRs and the way and the rate with which different groups of subjects approached their asymptotic levels during habituation training.) The inter-stimulus intervals ranged from 20 s to 35 s (offset to onset) with a mean interval of 27.5 s. The choice of variable rather than identical intervals was made to avoid possible effects of "temporal" conditioning (e.g. Dember and Jenkins, 1970).

Following the experiment, subjects were asked to fill in the questionnaires (see above). Finally, information about the purpose and the method of the experiment was given to the subjects and any queries were answered. They were also asked not to talk about the experimental procedure with other students particularly those who had not yet taken part in the experiments.

4 PROBLEMS WITH THE APPARATUS, REPLACEMENT OF SUBJECTS

One of the most common problems was the breaking down of the PDP computer during experimentation. This meant that the participating subjects had to be replaced by new ones. On different occasions replacement of subjects was required on account of electrode polarization (as indicated on the PDP screen by a typical pattern of a straight line with small identical gaps at regular intervals), though this was a less frequent cause for interrupting experiments. Several subjects were also replaced because their responses exceeded the anticipated available range of SR values (on the basis of the selected attenuator setting) and because either excessive or no electrodermal activity was detected in the pre-experimental settling-in period. It may be added that very few subjects were further excluded from participating in experiments as they became very apprehensive when brought into the laboratory (see individual experiments). No record of these replaced subjects was kept but their total number must be well over 50.

Apart from these problems which were encountered throughout the research there was a period in which computer failures were combined with human error to result in both replacement of subjects and destruction of data from successfully carried out experiments. (See Appendix 22) for details on a period of "acute" technical problems.)

5 DEFINITION OF A RESPONSE AND MEASUREMENT OF HABITUATION

The criterion of a response was decided after examination of traces of responses of subjects to word stimuli in preliminary studies. Some of these subjects were threatened by electric shock (see experiment 2, chapter VI). Detailed traces of representative responses appear in Appendix 21. Each dot on these traces represents an SR value at 0.2 s intervals and was drawn on the basis of recorded numbers by the PDP computer. The onsets of stimuli are indicated by arrows above the time axis. In these studies, the stimuli were presented on either 14th or 11th seconds of the sampling period as the experimental manipulations had not yet been standardized.

A response is an amplitude that occurs within a time interval and exceeds a certain value. On the basis of this definition and observations on the extracted response traces the following decisions were made: Some pre-stimulus SR values should enter the estimation of responses as despite the presentation of stimuli at variable interstimulus intervals anticipatory and/or non-specific responses (NS) were commonly observed and it was upon them that responses to stimuli were superimposed. It was thought that the mean SR value during the 5 s pre-stimulus interval could represent the non-stimulus related EDA reasonably adequately (cf. Edelberg, 1972a). An EDR may take about 0.5-5 s to reach its peak (Edelberg, 1972a) and therefore the estimation of each response was made by subtracting from the maximum value of the SR in the 5 s post-stimulus interval the mean SR value during the 5 s before stimulus onset. The minimum amplitude tolerance was decided to be 500 ohms, i.e. resistance changes of less than 500 ohms were taken as zero responses. This criterion was thought to distinguish the responses to stimuli from other aspects of EDA relatively satisfactorily after the experimenter and two experienced workers in the field compared a number of traces of responses like those appearing in Appendix 21.

It may be pointed out that SRRs were calculated in terms of magnitudes rather than amplitudes. The term "magnitude" was used in accordance with the distinction made by Venables and Christie (1980) between amplitude and magnitude: "In the former case the average size of response is calculated as the mean of all non-zero values. In the case of magnitude all occasions in which a response might be given, that is on which stimuli are presented, are used and consequently zeros may enter the calculation" (p. 53).

There is no general agreement on how habituation should be measured and each method in use has been considered as inadequate in some way or another (e.g. Thompson, Groves, Teyler and Roemer, 1973). Of course, the problem of measurement is related to the fact that a precise theory of habituation is still lacking (Koriat, Averill and Malmstrom, 1973; Graham, 1973). Theoretical problems which have not yet been resolved include whether the absolute decrease in response strength within a certain time or number of trials should be measured or the decrease in response strength relative to its initial value (see Hinde, 1970 for an illustration) and related to this is the problem of whether the initial level of responding should be controlled for (e.g. Koepke and Pribram, 1966 vs. Rather, 1970). Other still unresolved issues are whether a measure should reflect an orderly process of modification of response and in a fixed period of time or whether a change in latency of response should be used as an index of habituation, and so on.

At least five indices have commonly been employed for quantifying habituation (O'Gorman, 1977). Often, these indices do not lead to the same conclusions (e.g. Siddle and Heron, 1967) and thus "generalizations about rate of habituation depend on the manner in which it is assessed" (Hinde, 1970, p. 6). Some of the indices have been mentioned in chapter III when reviewing various studies and they include: "Response frequency", i.e. number of criterion responses to a habituating stimulus; "regression measures" including "H-scores" (see section 5.1.1, chapter III); "amplitude measures", i.e. amplitude of response at a particular time during habituation training or the mean amplitude during a certain time/number of trials.

In the present research the habituation of SRRs was measured by two indices: (a) the decrease in response strength over trials; (b) the number of stimulus presentations before a criterion of three successive zero (i.e. below criterion) responses was reached (e.g. Sokolov, 1963, Hinde, 1970). The choice of these indices was influenced by their common use in the relevant literature (e.g. Bohlin, 1971; Öhman, Eriksson, Fredriksson, Hugdahl and Olofsson, 1974). Index (a) has been the most widely used measure for comparison of group differences in response habituation (O'Gorman, 1977). This method involves an analysis of variance on magnitudes of responses over trials and considers a significant groups x trials interaction as evidence of a difference in habituation of the groups compared. As O'Gorman wrote, this measure reflects change in response over trials (time) and therefore is "particularly sensitive to differences in initial level" (p. 275). Index (b) is the most widely used individual-subject measure in human response habituation and "it is most appropriate where a complete failure of response occurs in the course of habituation such as with EDR" (O'Gorman, 1977, p. 272). This index implies that habituation is a state which is attained and does not include information on responses before or after attainment of criterion (Cook, 1970 - cited in O'Gorman, 1977). Also, decrements in responsiveness from different initial levels cannot be ascertained with this measure but initial level and criterion index have been found to correlate. O'Gorman, for example, cited Nebylitsyn (1973) who found a correlation of 0.68 between these two variables. It may be added that Siddle and Heron (1976) found correlations of -0.77 and -0.84 between index (b) and regression index (H-scores) for two samples. In short, the two indices of habituation employed in this research are not only the most commonly used in related literature but one of them (criterion b) is closely correlated with another relatively frequently used index of habituation (H-scores) while the other (criterion a) reflects the change (i.e. decrement) in response strength which is the operational definition of any habituation process.

6 TRANSFORMATION OF RAW DATA

The raw data were converted (with certain exceptions - see below) to range-corrected values as suggested by Lykken and Venables (1971), Lykken (1972), etc.

Lykken and Venables (1971) pointed out that amplitudes of SCRs (and presumably SRRs) cannot be explained in terms of psychological variability alone and "a substantial proportion of the variance in any distribution across Ss of SCL or SCR values must be attributable to physiological differences which are essentially unrelated to the psychological processes in which we are primarily interested", and which vary considerably from one individual to another (p. 666). They argued that range correction partials out these extraneous sources and produces "a variable determined mainly by psychological factors ..." (p. 667). Further, range correction is found to succeed in reducing error variance and this increases the magnitudes of correlations and treatment effects (e.g. Lykken, 1972). Lykken and Venables (1971) wrote that "whenever one is comparing SCRs across individuals, as in habituation studies or experiments relating SCR amplitudes to types or intensities of stimuli, one can obtain the range-correction effect and scale one's data in a form suitable for inter-individual comparison simply by dividing each SCR by the largest SCR elicited from that individual in the session" (p. 668). Thus, for each subject each response (ix) is calculated according to the formula: $\Delta\phi$ ix = SCR ix/SCR imax, where imax is the subject's largest response during the experimental session.'

A similar treatment of electrodermal measures had been earlier advocated by other workers. The so-called Paintal index involves a similar conversion of GSRs (Paintal, 1951). According to Paintal, a maximal response (MGSR) is assumed to be elicited by an electric shock and is considered as characteristic of the individual subject's electrodermal capability and each GSR response is evaluated in terms of this response ($\frac{GSR}{MGSR} \times 100$). It is interesting to note that Paintal found a close similarity between ratios obtained in ohms calculated as above and measures in log conductance units (Paintal, 1949 - cited in Paintal, 1951). After experimenting with 450 psychotics and 450 normals, Paintal (1951) also reported that this percentage index bore no relationship to the subjects' tonic resistance levels. This was confirmed in a different study by Elliot and Singer (1953) who found that while there was a close correlation between GSRs and baseline skin resistance (r = .412), the correlation of the baseline skin resistance with the Paintal index was virtually zero (r = .061). In other words, the Paintal index and with the same token range correction do not reflect individual differences in tonic SR levels and as such they make inter-subject and intra-subject comparisons more meaningful than the use of absolute measures of skin resistance change (Hunt and Hunt, 1935, see above). It may be recalled that one of the arguments against measuring EDRs in resistance units is that they correlate with SRLs and to a greater extent than SCRs with SCLs (chapter IV, section 4).

The effectiveness of range correction in normalizing the data and reducing the differences in variances between the groups to be compared can be seen in Appendix 25.

7 PILOT STUDIES

Before the experiments proper were conducted, several pilot studies were carried out to test the adequacy of the method of measurement, to determine the criterion of response (section 5, above), the optimal interstimulus intervals, number of trials, etc., as well as to investigate whether a within - or between - subjects design would be more appropriate for the research which was to follow. The type of design was thought to be relevant in the light of the findings by Öhman, Eriksson, Fredrikson, Hugdahl and Olofsson (1974 - see chapter III, section 6.2). A brief presentation of three pilot studies is given below and they are particularly concerned with the question of the type of design which ought to be used. Since in the present research both stimulus type and state of arousal of the subject were to be manipulated, some subjects were threatened by electric shock. Statistical analyses and transformations of the data were not attempted as the samples were small and the sole purpose of this preliminary work was to observe trends of responses to fear-relevant (phobic) and fear-irrelevant (neutral) stimuli. The raw data are shown in Appendix 23 (It may be noted that the data of the pilot study 3 were incorporated with those of experiment 2.)

7.1 PILOT STUDIES 1 AND 2 USING A WITHIN-SUBJECTS DESIGN

A number of subjects of both sexes were asked to fill in the FSS-III. On the basis of their answers, 4 subjects (2 males and 2 females) who indicated they feared a particular stimulus "much" (column 4 of the inventory) were presented with a* of neutral content (see type and selection of stimuli in experiment 1, next chapter). The stimuli were presented randomly with the restriction that no stimulus was given in more than two consecutive trials. Each stimulus was presented 10 times, (i.e. each subject was administered 20 trials altogether). The method and procedure were as outlined in section 3. The mean SRRs to stimuli of phobic and neutral content as a function of trials appear in Figure V.1.

In a similar study (pilot study 2), 8 subjects (2 males and 6 females) were presented with phobic and neutral stimuli also in a within-subjects design. The phobic stimuli were randomly chosen among those the subjects indicated they feared "fair amount" (column 3 of the FSS-III). The mean SRRs to the two types of stimuli appear in Figure V.2.

The trends in these two pilot studies seem to be similar and their combined data appear in Figure V.3. This figure suggests that while the responses to one type of stimulus are initially independent they later become related to the responses to the other type of stimulus. That is, it seems that the relatively enhanced initial responding to phobic stimuli has a sensitizing effect on responses to neutral stimuli as indicated by an upward trend of the responses to the neutral material after trial 4.

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* word or phrase denoting this stimulus as well as with an equivalent word or phrase

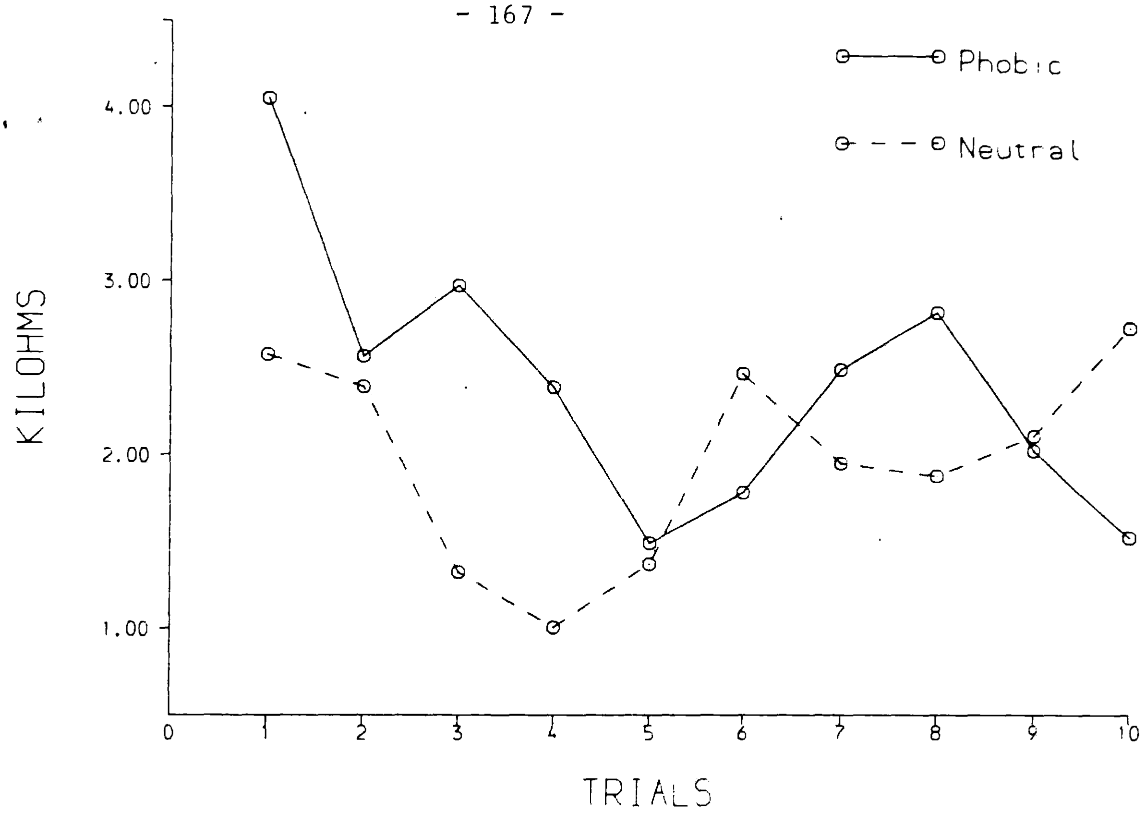

Figure V.1. Pilot study 1: Mean habituation curves for the subjects presented with both phobic and neutral stimuli (N=4)

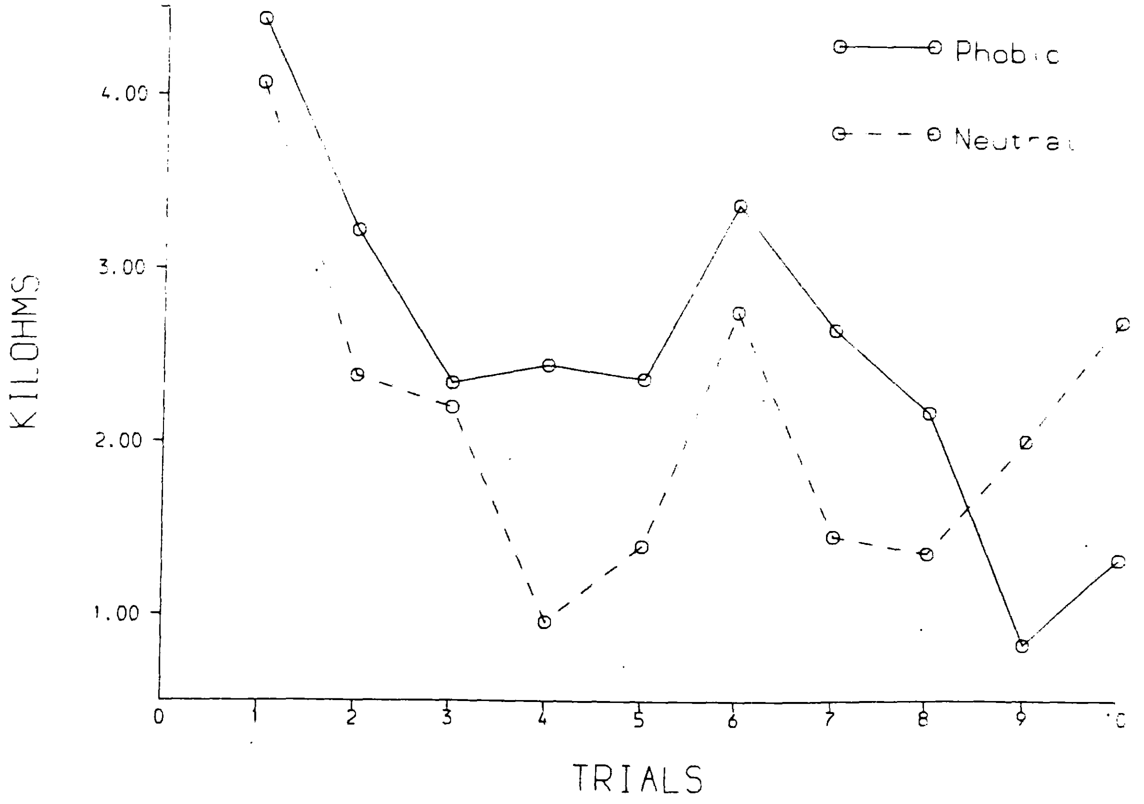

Figure V.2. Pilot study 2: Mean habituation curves for the subjects presented with both phobic and neutral stimuli (N=8)

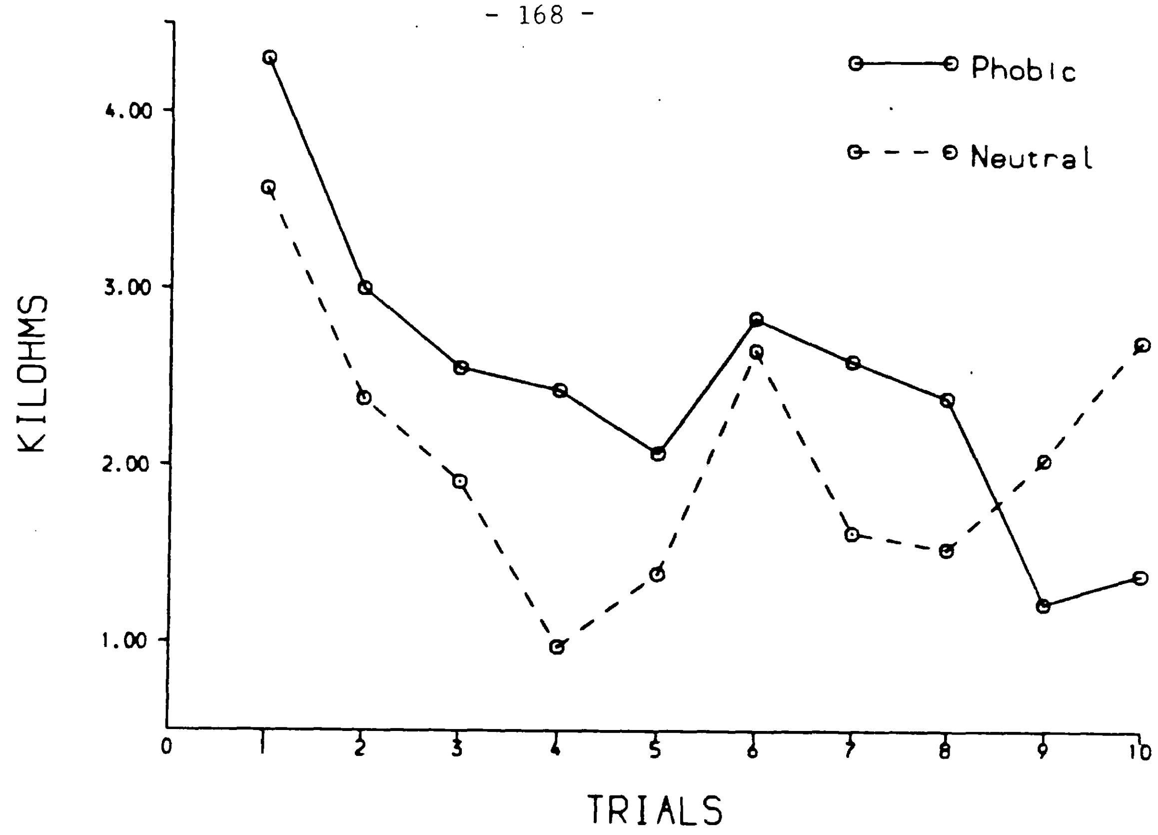

Figure V.3. Pilot studies 1 and 2 combined: Mean habituation curves for the subjects presented with both phobic and neutral stimuli (N=12)

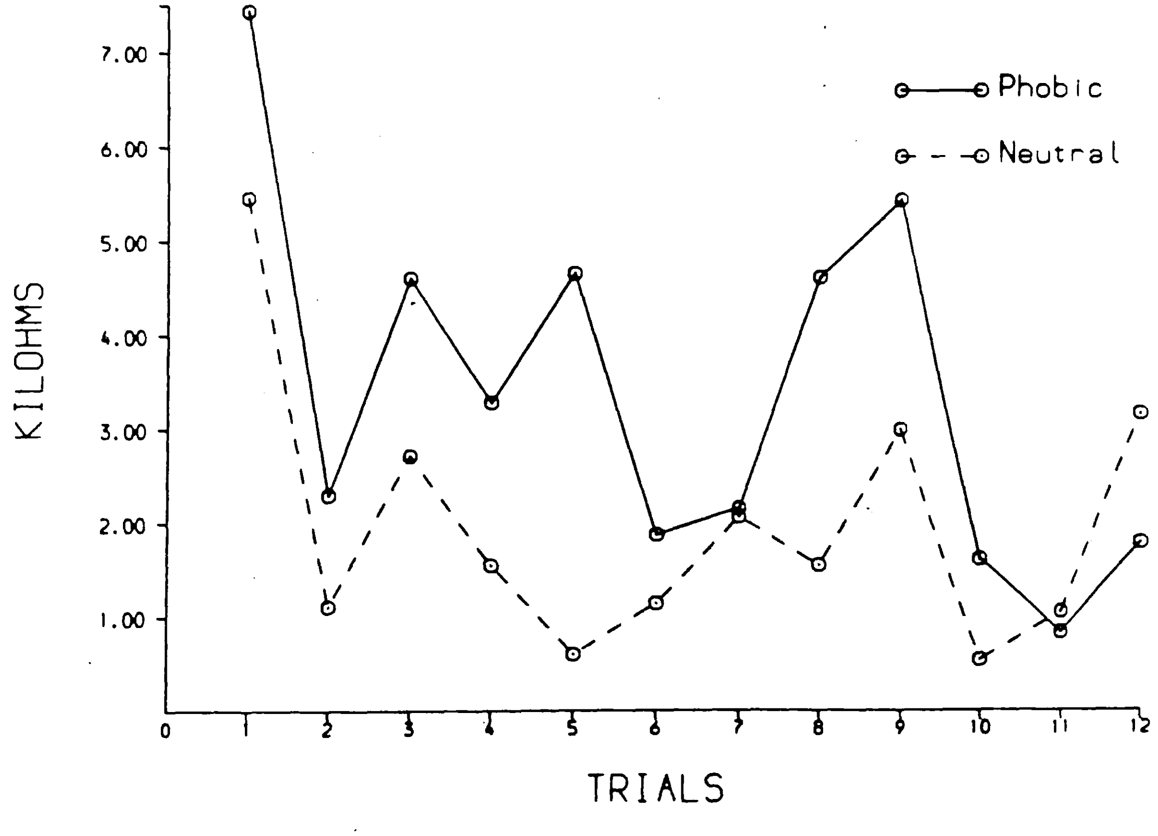

Figure V.4. Pilot study 3: Mean habituation curves for the subjects presented with either phobic or neutral stimuli (N=9)

It may therefore, be concluded that while the study of the ORs and their habituation to phobic and neutral stimuli is feasible under the conditions employed in these studies and that responses to stimuli reported as feared "much" and "fair amount" are similar, a within-subjects design results in a complex outcome and renders the evaluation of the habituation processes to the two types of stimuli difficult or even impossible to make. For the purposes of this research a between-subjects would probably be more appropriate than a within subjects design and this was confirmed in other pilot studies, including pilot study 3 (see below) in which, however, the state of the subjects was also manipulated.

7.2 PILOT STUDY 3 USING A BETWEEN-SUBJECTS DESIGN

In this study, 9 subjects (5 males and 4 females) were presented with either a word or phrase denoting a stimulus they reported they feared "much" or "fair amount" (5 subjects) or with an equivalent neutral one (4 subjects). Each subject was administered 12 trials and the experimental procedure was as described in section 3. However, the subjects were also under threat of electric shock (see experiment 2, next chapter). The mean SRRs to stimuli in the two groups as a function of trials appear in Figure V.4. The two groups appear to be relatively clearly differentiated and data seem to lend themselves more readily to interpretation than those in the previous pilot studies. It may be pointed out that in an additional pilot study in which subjects were also under threat of shock but a within-subjects design was used, the outcome was akin to the findings of the pilot studies 1 and 2, i.e. it posed serious problems of interpretation. It was therefore concluded that in the experiments which were to follow a between- rather than a within-subjects design would be more appropriate.

CHAPTER VI

ORIENTING RESPONSES TO MODERATELY FEARED STIMULI

EXPERIMENT 1: Presentation of stimuli without manipulation of the state of the subjects

In examining the ontogenetic, i.e. experiential influences on the content of phobias, it is reasonable to begin the investigation by focussing on objects or situations of which subjects report moderate degrees of fear. It may be assumed that for such persons fear responses to these stimuli have already been learned though, perhaps, in a rudimentary form. Past learning influences future and accepting the notion that phobias are learned they may develop on the basis of earlier, "normal" fears. Ordinary fears of childhood, for example, may persist well into adulthood and develop into phobias; also, common fears within a particular society may become exaggerated and show neurotic features (see chapter II).

Experiments by Geer (1966) and Wilson (1967) demonstrated that phobic subjects show larger electrodermal ORs to stimuli they fear (slides depicting the phobic objects) than to relatively neutral or not feared stimuli. Similar results were recorded by other workers, e.g. Hare and Blevings (1975) and Klorman, Wiesenfeld and Austin (1975). However, Prigatano and Johnson (1974) found more frequent but not larger EDRs to spider slides among spider-phobic subjects while Klorman, Weissberg and Wiesenfeld (1977) found greater EDRs to mutilation slides than nonaversive slides but both in subjects with high and low fear of mutilation. Öhman, Eriksson, Fredrikson, Hugdahl and Olofsson (1974), on the other hand, found differential effects on magnitudes and habituation of ORs to slides of "potentially phobic" and "supposedly neutral" stimuli in non-phobic subjects, i.e. subjects who were described, rather ambiguously, as reporting not "excessive fear" of the phobic stimuli (snakes and spiders). Their results were interpreted in terms of "biological significance" of the phobic stimuli, an interpretation which was challenged in chapter I. Moreover, since the actual degree of fear of the subjects of the phobic stimuli was not specified, the nature of the ORs and their habituation to stimuli subjects report as moderately feared has not been adequately assessed.

The present experiment examines the magnitudes and habituation rates of electrodermal ORs to stimuli subjects report as moderately feared on the basis of their responses to the FSS-III. Since the OR and its habituation is related to the significance of the stimulus for a particular subject (chapter III), it is predicted that subjects will show larger and more slowly habituating ORs to verbal stimuli denoting objects or situations they moderately fear than to stimuli of relatively neutral content.

METHOD

Design

Two groups of subjects were each presented with a different kind of word. The phobic words denoted moderate fears of the subjects while the neutral denoted relatively innocuous objects or situations and they matched the phobic ones as well as possible in frequency of occurence, length, imagery, meaningfulness and concreteness. The subjects in the two groups were matched in pairs for reporting the same degree of fear of the phobic stimulus in each pair of words and they were randomly assigned to phobic or neutral conditions by tossing a coin. They were also matched for sex since there are significant sex differences in reporting the intensity and content of fears (e.g. Geer, 1965) and in electrodermal activity (Montagu, 1963).

Subjects

Forty volunteers took part in the experiment, 22 males and 18 females. They were students from different departments of Bedford College, University of London. Their ages ranged between 18 and 30 with the great majority of them in their early twenties. The subjects were tested individually.

Selection of stimuli

The phobic stimuli were words or phrases denoting objects or situations which are frequently associated with neurotic anxiety and are listed in an 88-item version* of the Fear Survey Schedule (FSS-III) by Wolpe and Lang (1964 - see Appendix 1). To facilitate matching

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* This was the version by Wolpe (1973) except that item "Receiving injections" was not included

phobic with neutral stimuli (see below), some items of the fear questionnaire were used in abbreviated forms, e.g. instead of "Open wounds" and "Being alone" the words "Wounds" and "Loneliness" were adopted. When two items were conveying similar meanings, they were replaced by a single one, e.g. "Flying insects" and "Crawling insects" were replaced by the single word "Insects", "Witnessing surgical operations" and "Prospect of a surgical operation" were replaced by "Surgery" and so on. The item "Lull in conversation" was not considered since in the pilot studies it became apparent that some subjects had difficulty in comprehending its meaning. There were similar difficulties with the item "Premature heart beats" and this was replaced by "Heart problems". Finally, the items "Automobiles" and "Elevators" were replaced by the more familiar ones "Cars" and "Lifts". The items of the FSS-III adopted as phobic stimuli appear in Appendix 1a. It should be noted, however, that the questionnaire was administered in its original form (Appendix 1).

An attempt was made to select neutral stimuli which matched the phobic ones in terms of attributes (other than their affective content) which could influence the magnitude of the OR. The attributes considered were: (1) Frequency of word in language to control for "novelty" effects; (2) Length of word to control for brightness and area of patterning (see General Methodology in chapter V) - control of stimulus size (number of letters) would ensure that there would be equal areas of light and dark (words appeared as white light on the PET's black screen); (3) Meaningfulness; (4) Imagery; and (5) Concreteness (for definitions of these attributes see "Instructions" in Appendix 4). In a word-association task, Berlyne (1961) found that words with a high information value elicited larger EDRs than words with a low information value and the information value of the words was determined by the number of associations (meaningfulness) evoked by the words (Laffal, 1955). Luria and Vinogradova (1959) had earlier stated that "in evoking an orientation reaction to one word, we bring about, at the same time, a whole system of meanings" (p. 93). Imagery and concreteness were thought to be relevant because the subjects were to attend to the stimuli and a vivid image and sensory experience brought about by a word of high imagery and concreteness could have a different effect on the OR to that of an abstract word of complex meaning as, for example, Berlyne and Bosra (1968) found that blurred pictures intensified the EEG component of the OR (prolonged blocking of the a-rhythm) and Fredrikson and Öhman (1979) showed that EDRs to complex visual stimuli (abstract drawing superimposed on a green and yellow filter of a projector) took more trials than simple stimuli (projector light projected through the filters) to reach habituation. An additional comparison was made so that words or phrases of phobic and neutral content were of similar parts of speech. This was done to facilitate selection of stimuli (by limiting the area of searching) rather than control influences on the OR.

A perfect matching of words for all these attributes is a formidable task and compromises had to be made. This is reflected in the not entirely satisfactory outcome of the selection of stimuli (see Appendices 2 and 3). Luckily, however, not all the stimuli appearing in these lists had to be used. (See below for the stimuli which were actually used.) The selection of the neutral stimuli was made as follows:

Firstly, the frequencies of all phobic words were found in the <u>List of Comparative Analysis of American English</u> (Kučera and Francis, 1967) and a number of words of relatively neutral content (in the opinion of the experimenter) with similar frequencies to each of the phobic ones were drawn from the same list. Then, using the <u>Concreteness, imagery and meaningfulness values for 925 nouns</u> by Paivio, Yuille and Madigan (1968), the concreteness, imagery and meaningfulness of 14 single-word phobic stimuli and their corresponding neutral ones were found and the neutral word which optimally matched each of the phobic ones was selected. These 14 phobic and their corresponding neutral stimuli appear in Appendix 2. Whenever more than one neutral word qualified for selection both were included in the list and before an experiment started one of them was chosen randomly by the experimenter.

For the phobic words and phrases which are not included in the normative data by Paivio et al. (1968), the following procedure was followed: If the phobic stimuli were phrases, the experimenter and two other postgraduates prepared a list of corresponding neutral phrases using only words which qualified for their frequency. For the remaining single-word phobic stimuli a list of neutral words was prepared by using again only words of similar frequencies to those of the phobic stimuli. The lists of words and phrases, i.e. the phobic with their corresponding neutral stimuli (for each phobic there were 3 to 5 neutral) were given to undergraduate judges who were asked to select one from the alternative neutral stimuli which they thought had the most similar imagery (17 judges), concreteness (20 judges) and meaningfulness (18 judges) to each of the corresponding phobic stimuli. The lists of these words and the written instructions to the judges appear in Appendix 4. On the basis of the judges' answers, the list of the most appropriate neutral stimuli (i.e. those which satisfied optimally the attributes under consideration) was drawn (Appendix 3). A summary of the judges' assessments appears in Appendix 5.

During pilot studies and discussions with subjects and other undergraduates it became apparent that some of the selected stimuli were not sufficiently neutral in content and these were replaced by the experimenter using mostly words originally given to the judges for assessment. Similarly, stimuli which were found not to convey their phobic content were replaced by more appropriate ones. The lists of stimuli before and after modifications appear in appendices 2 and 3 with the additions in parentheses. Table VI.1 presents the stimuli used in the present experiment.

Table VI.1 Experiment 1: Stimulus words and phrases

PHOBIC	NEUTRAL	Number of times used
Being ignored	Being impressed	1
Surgery	Booking	2
Blood	Coffee	1
Failure	Regard	3
Parting from friends	Favouring a picture	1
Bullying	Enrolling	3
Dentists	Carpets	1
Fights	Walks	1
Corpses	Apples	1
Dogs	Walls	1
Speaking in public	Copying a text	1
Criticisms	Deductions	1
Feeling rejected	Seeing films	2
Worms	Flags	1

Apparatus

This was as discussed in chapter V.

Procedure

Generally, this was as discussed in chapter V. It should be added that the definition of fears as "moderate" was dependent upon each subject's responses to the FSS-III. That is, only fears scored "a fair amount" (column 3) or "much" (column 4) were considered, and were regarded "moderate" in the sense that they were less intense than other fears of the subjects concerned. Thus, the criterion for accepting a stimulus as denoting a moderate fear while being scored as feared "much" by a subject was that the same subject reported 3 or more other stimuli as feared "very much" (column 5); if a subject did not report fears of "very much" intensity, then only fears reported as feared "a fair amount" were considered.

The oral instructions were as follows:

"I am interested in the changes of the autonomic nervous system following verbal stimulation. The electrodes on your fingers give a measure of such changes. I should like you to look at the screen in front of you on which some words will appear from time to time. You are not required to make any response. Please try to relax as much as possible and avoid moving, particularly your hands, during the experiment. However, make sure you do not fall asleep. I shall now turn the main light off and there will be a period of a few minutes during which you must keep relaxing. When the time for the experiment to start approaches, I shall let you know by saying that 'the experiment is about to start shortly' and I shall press a key on the computer in front of you. Please make sure you see all the words all the time".

Questionnaires

Following the experiment, each subject was given two questionnaires to fill in. First, questionnaire "A" (Appendix 12) asked the subjects to indicate on a 5-point scale (from "Not at all" to "Very much") the degree of their fear of the stimuli they were administered as well as of their matched stimuli. This was done to confirm the initial scaling of the fear- and neutral-items post-experimentally. Then, questionnaire

"D" (Appendix 15) asked subjects whether they had seen the stimuli in all trials and to describe their feelings about the experiment. This questionnaire was primarily administered for giving some feedback to the experimenter about the experimental conditions.

RESULTS

In chapter V the reasons for range correction of raw responses were given. However, Öhman, Fredrikson, Hugdahl and Rimmo (1976) pointed out that to justify range correction of data one should demonstrate that the groups to be compared do not differ in maximal responses. This presumably is related to the fact that larger maximal responses in one group would mean larger denominators by which the responses of the subjects of that group would have to be divided; this, in turn, would result in the reduction of the sizes of the range-corrected responses of such a group relatively to the responses of a group with smaller maximal responses.

Following Öhman et al. (1976), therefore, an initial group x sex (2 x 2) analysis of variance (ANOVA) was carried out on raw maximal responses. It was found that there were no differences either for the phobic-neutral or the male-female comparisons. A summary of the ANOVA appears in Table VI.2.

Table VI.2 Experiment 1: Analysis of variance of maximal responses*

Source	SS	d.f.	Mean square	F	P
Groups	226	1	226	0.000	n.s.
Sex	12 212 780	1	12 212 780	0.836	n.s.
Groups x sex	8 790 462	1	8 790 462	0.602	n.s.
Subjects within groups	526 071 973	36	14 613 110		

*All figures, except the F-values, are rounded-up by computer

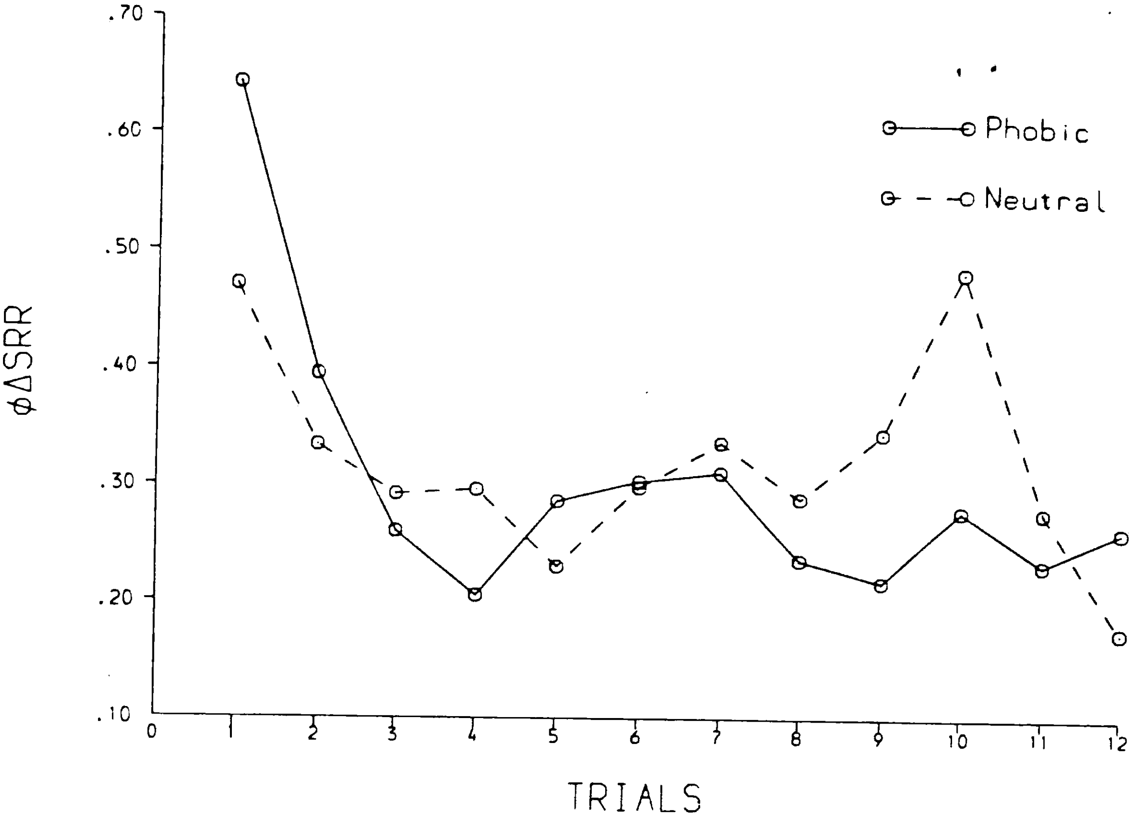

Figure VI.1. Experiment 1: Mean habituation curves for the groups presented with phobic and neutral stimuli (N = 40).

Table VI.3. Experiment 1: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	0.033	1	0.033	0.108	n.s.
Sex	1.130	1	1.130	3.675	n.s.
Groups x sex	0.105	1	0.105	0.340	n.s.
Subjects within groups	11.072	36	0.308		
Trials	3.644	11	0.331	3.727	<0.01
Linear trend	1.006	1	1.006	11.316	<0.01
Quadratic trend	0.541	1	0.541	6.082	<0.05
Trials x groups	1.137	11	0.103	1.163	n.s.
Linear trend	0.235	1	0.235	2.638	n.s.
Quadratic trend	0.294	1	0.294	3.302	n.s.
Trials x sex	0.551	11	0.050	0.564	n.s.
Linear trend	0.020	1	0.020	0.228	n.s.
Quadratic trend	0.000	1	0.000	0.004	n.s.
Trials x groups x sex	0.390	11	0.035	0.399	n.s.
Linear trend	0.005	1	0.005	0.060	n.s.
Quadratic trend	0.056	1	0.056	0.635	n.s.
Trials x subjects within groups	35.204	396	0.089		

The mean range-corrected SRRs to stimuli in the two groups as a function of trials appear in Figure VI.1. A group x sex x trials (2 x 2 x 12) split-plot ANOVA was carried out on the response magnitudes (as defined in chapter V) to test the hypotheses that the phobic stimuli would elicit larger and more slowly habituating ORs than the neutral stimuli. The two groups were not found to be significantly different in magnitudes of responses. There was also no significant sex effect. However, there was a significant trials effect ($F = 3.73$, d.f. = 11,396, $p < 0.01$). Both groups showed a reliable habituation effect as indicated by the linear ($F = 11.32$, d.f. = 1,396, $p < 0.01$) and quadratic ($F = 6.08$, d.f. = 1,396, $p < 0.05$) components of the trials effect but they did not differ in terms of habituation as measured by decrease in responses over trials as shown by the lack of significance of the groups x trials interaction. A summary of the ANOVA appears in Table VI.3.

The habituations of responses of the two groups as measured by the number of trials to reach three successive zero (i.e. below criterion) responses, did not differ significantly as assessed by a Wilcoxon matched-pairs signed-ranks test. With this criterion, the mean habituation rates of the phobic and neutral groups were 8.00 (S.D. = 5.28) and 7.30 (S.D. = 5.25) trials respectively. To test for potential sex differences on habituation with this criterion, a Mann-Whitney test on the differences in the number of trials to the habituation criterion of the matched subjects and between males and females was carried out. The test, corrected for ties (Spiegel, 1956), showed no significant differences between the sexes ($z = -1.22$).

The answers to the questionnaires given post-experimentally were also examined. In questionnaire "A" the subjects were asked to rate both the stimuli they were presented with as well as the corresponding stimuli in the complementary conditions. Table VI.4 presents the ratings of both groups. It appears that both groups showed considerable consistency in their pre-and post-experimental ratings of the phobic stimuli while reporting the neutral stimuli as not feared. In summary, it appears that 17 subjects (85%) in the phobic group seem to have been tested with stimuli they reported both pre- and post-experimentally as feared while 18 subjects (90%) in the neutral group reported they did not fear the neutral stimuli.

Table VI.4. Experiment 1: Ratings of stimuli post-experimentally

Groups of subjects and type of stimulus	Not at all	A Little	A fair amount	Much	Very Much
PHOBIC group					
Phobic stimulus	2	1	14	2	1
Neutral stimulus	18	2	0	0	0
NEUTRAL group					
Phobic stimulus	0	2	14	1	3
Neutral stimulus	15	3	1	1	0

From responses to questionnaire "D" it was indicated that all subjects saw all the stimuli in all trials. Also, the experiment was mostly described either as "boring" or "puzzling" by subjects of both groups. Summary of the subjective reports regarding the experiment appears in Table VI.5.

Table VI.5. Experiment 1: Summary of the frequencies of descriptions of the experiment by the subjects

Descriptions	Number of subjects in phobic group	Number of subjects in neutral group
Anxiety provoking	1	0
Interesting	6*	4*
Boring	5*	10*
Puzzling	15*	12*
Descriptions generated by subjects:		
"Amusing"	1	0
"Thought provoking"	1	1
"Conscious of my reactions being awaited"	1	0

*Included are subjects who gave more than one description

Assuming that the description of the experiment as "boring" is independent of all the other descriptions, a 2 x 2 chi-squared test was carried out to investigate whether there was any relationship between the type of stimulus and the way the experiment was experienced. No statistically significant evidence for an association between boredom and type of stimulus administered to the two groups was found ($x^2 = 1.706$).

DISCUSSION

The results do not support the hypothesis that the phobic words would elicit larger and more slowly habituating electrodermal ORs than neutral ones.

However, the phobic words denoted stimuli the subjects rated as only moderately feared and it may be that differences between responses to stimuli of phobic and neutral content can be more readily observed when the phobic stimuli denote intense fears, as for example, in the experiments by Geer (1966) and Wilson (1967). It could also be argued that the stimuli used as neutral were not sufficiently neutral as, although both groups rated them as not feared, these stimuli could have been significant to the subjects in other ways. On the other hand, in Figure VI.1 it appears that the neutral group showed substantially larger responses on the 10th trial than the phobic group. Inspection of the raw data indicates that, as compared to other trials, many (5) subjects in the neutral group showed their maximal responses and a few more produced responses approximating in strength their maximal responses on the 10th trial (Appendix 24a). It is possible that large responses at that stage of the experiment were due to some boredom effects, i.e. as subjects were repeatedly presented with "uninteresting" stimuli they became bored and consequently experienced the experimental situation as aversive which resulted in relatively large responses. This interpretation is supported by the fact that there was a tendency of more subjects in the neutral group (10 Ss) to report the experiment as "boring" than in the phobic group (5 Ss). It may also be noted that most subjects in both groups described the experiment as "puzzling". Informal discussions with them revealed that this description expressed their inability to guess what the experiment was about without this, however, implying any failure on their part to comply with the experimental instructions.

Finally, it could be argued that subjects will show larger ORs to moderately feared than neutral stimuli when they are somehow aroused since responses are generally state dependent (chapter III, section 5) and there is also an interaction effect between state of the subject and content of stimulus (e.g. Öhman, Eriksson, Fredrikson, Hugdahl, and Olofsson, 1974). This possibility will be pursued in the second experiment.

EXPERIMENT 2: Effects of threat on orienting responses to moderately feared stimuli

In the past, research has frequently focussed on ORs and their habituation to stimuli of various content. Independently, the effects of arousal on ORs to "neutral" stimuli (tones) have been extensively studied (chapter III, sections 5 and 6). However, in research like the present, it would be more appropriate to manipulate both the content of stimulus and the state of the subject since there is evidence that these two variables may interact. Öhman, Eriksson, Fredrikson, Hugdahl and Olofsson (1974) found sharp differences on the magnitudes of electrodermal ORs to slides of phobic vs. neutral stimuli only when their subjects were under threat of an electric shock. It is also a well documented fact that "diffuse anxiety" is usually present before the manifestation of phobic symptoms. In other words, anxiety is prevalent both in the overt manifestations and in the genesis of the phobic reaction (Frazier and Carr, 1967) and, therefore, presentation of stimuli in the context of threat may provide an analogue situation to real life conditions associated with the origin of phobias.

In this experiment, it is predicted that subjects under threat would show larger and more slowly habituating ORs to stimuli they report as moderately feared than to stimuli of neutral content.

METHOD

Design

This was as in experiment 1 but all subjects were threatened by an electric shock.

Subjects

Forty students of Bedford College took part in the experiment, 28 males and 12 females. They consisted of 12 persons (6 in each condition) who were hired and paid by the psychology department in order to participate in various experiments, and 28 volunteers. The subjects' ages ranged between 18-35 years with the large majority of them being in their early twenties and in their first year at the university.

Selection of stimuli

The stimuli were drawn from the list prepared for experiment 1. They appear in Table VI.6.

Table VI.6. Experiment 2: Stimulus words and phrases

"PHOBIC"	"NEUTRAL"	Number of times used
Taking written tests	Having country walks	3
Dogs	Walls	1
Dead animals	Young plants	1
Speaking in public	Copying a text	3
Losing control	Making sound	1
Corpses	Apples	1
Dentists	Carpets	1
Surgery	Painting	2
Blood	Coffee	1
Feeling rejected	Seeing films	1
Fights	Walks	1
Making mistakes	Having soup	1
Booking*	Cooking	1
Having ideas*	Having food	1
Having ideals*	Having soup	1

*These stimuli were initially given to subjects as "neutral" stimuli. During post-experimental interviews and responses to questionnaire "A", it was disclosed that the situations denoted by the stimuli were substantially aversive to the subjects concerned (for idiosyncratic reasons). It was thought appropriate to include these subjects in the phobic group and consequently three additional subjects were given other neutral stimuli. (This may not be a wholly acceptable arrangement but since the experiment tested effects of subjective fears it would have been wrong to include in the neutral group subjects tested with stimuli they reported as arousing considerable fears).

Apparatus

This was as in experiment 1. Additionally, a device for* through a pair of electrodes made of brass and 7 mm in diameter. The electrodes were connected to a capacitor charged by a manipulable DC current generated from a 9v battery. Each shock lasted 0.5 s. A diagram of the circuit of the shock device appears in Appendix 19. The device was constructed at the technicians' workshop of the psychology department.

*delivering electric shocks was employed. Shocks were given

Procedure

In the most part, this was as in experiment 1. However, after the subjects had been reassured about the nature of the experiment, the shock electrodes were applied to the first phalanx of the first and second fingers of the left hand with adhesive electrode collars. Then, the subjects were orally instructed as follows:

"Here is a safe device by which some stimulation on the fingers can be given. Through this switch on the right side (pointed at) the stimulation can be manipulated and it can be arranged to be from below the level of sensation to the level of a mild shock; its duration is always of a fraction of a second and it comes about only when I press this switch in the middle (pointed at). I shall start stimulating you as I said from below the level of feeling and I shall increase the stimulation, step by step, by the switch on the right side, always asking you about your experience. I shall stop to increase the stimulation when you tell me that this starts to become 'unpleasant but not painful'". Subsequently the subjects were told that this was the intensity to be used during the experiment and the right to withdraw at any stage was stressed. Then, the electrodes for the measurement of the EDRs were attached to the subjects' fingers and the same instructions as in experiment 1 were given adding to all subjects: "Occasionally, during the experiment you will receive shocks of the same magnitude and duration as the one you defined as 'unpleasant but not painful'". No shocks were subsequently delivered.

Two subjects were not allowed to take part in the experiment despite their consent to do so. This was decided after they showed intense apprehension when seeing the electric shock device. Two further subjects, one from each condition, did not cooperate with the experimental procedure fully, i.e. they talked anxiously during the experiments which had to be interrupted. These four subjects were over and above the 40 subjects referred to in the "subjects" subsection above.

Questionnaires

Following the experiment, the subjects were given to fill in questionnaires as in experiment 1. However, questionnaire "D" was replaced by questionnaire "E". The latter was identical to the former apart from the fact that there was an additional question asking the subjects to describe their anticipation of shock (see Appendix 16).

RESULTS

A group x sex (2 x 2) ANOVA on raw maximal responses (see experiment 1) showed that there was a significant group effect ($F = 6.230$, d.f. = 1,36, $p < 0.05$) with mean responses of 7669 and 3993 for the phobic and neutral groups respectively. The sex factor was not statistically significant. A summary of the ANOVA appears in Table VI.7.

Table VI.7. Experiment 2: Analysis of variance of maximal responses*

Source	SS	d.f.	Mean square	F	P
Groups	135159170	1	135159170	6.230	<0.05
Sex	41037933	1	41037933	1.892	n.s.
Groups x sex	17298638	1	17298638	0.797	n.s.
Subjects within groups	780992573	36	21694238		

*All figures, except the F-values, were rounded-up by computer.

With significant differences in maximal responses between the two groups range correction of data is not justified (Öhman, Fredrikson, Hugdahl and Rimmo, 1976). A square-root transformation of responses was carried out to reduce the skewness of the raw data (see Appendix 25). The mean square roots of the SRRs as a function of trials appear in Figure VI.2. A group x sex x trials (2x2x12) split-plot ANOVA was carried out on the response magnitudes to test the hypotheses that the phobic group would show larger and more slowly habituating ORs than the neutral group. The two groups were significantly different ($F = 7.34$, d.f. = 1,36, $p<0.01$). There was no significant sex effect. However, there was a significant trials effect ($F = 5.28$, d.f. = 11,396, $p < 0.01$). Both groups showed a reliable habituation effect as indicated by the linear component of the trials effect ($F = 28.14$, d.f. = 1,396, $p < 0.01$) but as their quadratic component was not significant it seems that the responses of the two groups showed a downward trend

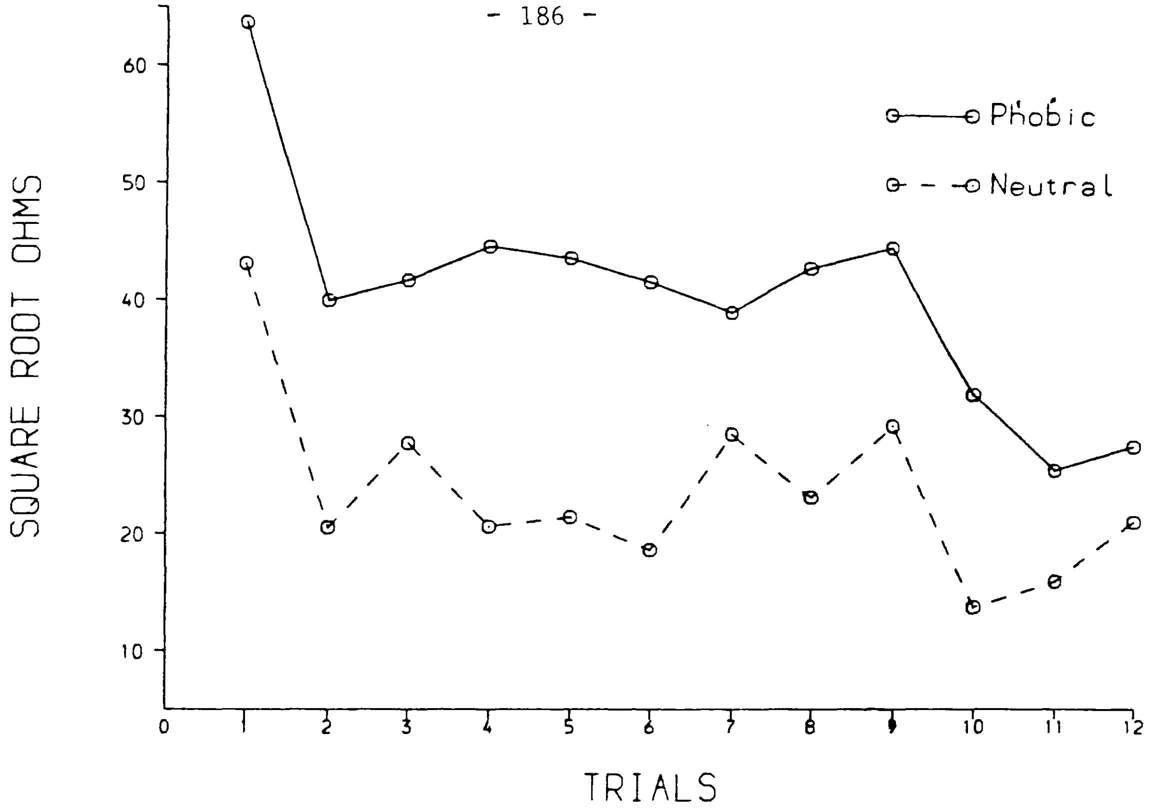

Figure VI.2. Experiment 2: Mean habituation curves for the phobic and neutral groups (N = 40).

Table VI.8. Experiment 2: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	34229.0	1	34229.0	7.342	<0.01
Sex	1212.2	1	1212.2	0.260	n.s.
Groups x sex	8426.4	1	8426.4	1.807	n.s.
Subjects within groups	167828.7	36	4661.9		
Trials	30885.7	11	2807.8	5.276	<0.01
Linear trend	14974.3	1	14974.3	28.139	<0.01
Quadratic trend	285.5	1	285.5	0.536	n.s.
Trials x groups	3580.3	11	325.5	0.612	n.s.
Linear trend	1349.6	1	1349.6	2.536	n.s.
Quadratic trend	529.3	1	529.3	0.995	n.s.
Trials x sex	2496.4	11	226.9	0.426	n.s.
Linear trend	260.5	1	260.5	0.489	n.s.
Quadratic trend	183.2	1	183.2	0.344	n.s.
Trials x groups x sex	5153.9	11	468.5	0.880	n.s.
Linear trend	346.4	1	346.4	0.651	n.s.
Quadratic trend	48.6	1	48.6	0.091	n.s.
Trials x subjects with groups	210730.6	396	532.1		

without approaching asymptotic levels. The two groups did not differ in terms of habituation when measured by the rate of decrease of responses, as indicated by the lack of significance of the groups x trials interaction. A summary of the ANOVA appears in Table VI.8.

The habituations of responses of the two groups as measured by the number of trials to reach three successive below the criterion responses were found to be significantly different and in the predicted direction by a Wilcoxon matched-pairs signed-ranks test ($T = 25.5$, $p < 0.05$, one-tailed test). The mean numbers of trials to habituation for the phobic and neutral groups were 9.60 (S.D. = 4.01) and 6.20 (S.D. = 5.48) respectively. A Mann-Whitney test on the differences in the number of trials to the habituation criterion of the matched subjects and between males and females was carried out to test for potential sex differences on habituation with this criterion. The test, corrected for ties (Spiegel, 1956), showed no significant differences between the sexes ($z = -0.54$).

A summary of the responses to questionnaire "A" which asked the subjects to rate both the stimuli they were presented with and their equivalent in the complementary conditions in terms of the fear they elicit appear in Table VI.9.

Table VI.9. Experiment 2: Ratings of stimuli post-experimentally

Groups of subjects and type of stimulus	Not at all	A little	A fair amount	Much	Very much
PHOBIC group					
Phobic stimulus	0	3	9	7	1
Neutral stimulus	15	4	1	0	0
NEUTRAL group					
Phobic stimulus	0	3	12	4	1
Neutral stimulus	18	2	0	0	0

It appears that both groups show considerable consistency in their pre- and post-experimental ratings of the phobic stimuli. They also report that they do not fear the neutral stimuli. In summary, 17 subjects (85%) in the phobic group were administered stimuli they reported both pre- and post-experimentally as feared substantially. Conversely, 20 subjects (100%) in the neutral group were tested with stimuli they reported as not feared.

Responses to questionnaire "E" indicated that all subjects saw all the stimuli they were administered in all trials. In both groups the large majority of subjects did anticipate shock during the experiment since only 4 subjects in the phobic and 5 subjects in the neutral group reported no-anticipation of shock. About equal number of subjects in the two groups anticipated shock, more or less, throughout the experiment (i.e. they described their anticipation as "continuous" or "intermittent"). The remaining subjects of both groups reported they anticipated shock only at particular stages of the experiment. Interestingly, 6 subjects (3 from each group) reported they <u>did</u> experience shocks during the experiments. However, as stated above, no shocks were given. Both the kinds of anticipations of shock and the ways the experiments were experienced by the subjects appear in Table VI.10. A 2x2 chi-squared test showed no significant evidence of association between boredom experienced by the subjects in two groups and the types of stimuli they were presented with ($x^2 = 2.02$). This, together with the other descriptions of the experiment (Table VI.10) suggest that the levels of arousal of the two groups were similar, at least as far as this can be deduced from their subjective reports.

Table VI.10. Experiment 2: Summary of reported anticipations of shock and descriptions of experiment

PHOBIC GROUP				NEUTRAL GROUP			
Anticipation of shock		Description of experiment		Anticipation of shock		Description of experiment	
Continuous	2	Anxiety provoking	2	Continuous	2	Anxiety Provoking	5*
Intermittent	10	Interesting	6*	Intermittent	7	Interesting	3*
Only at the beginning	3	Boring	3	Only at the beginning	2	Boring	8*
Only in the middle	1	Puzzling	11*	Only in the middle	3	Puzzling	9*
Only at the end	0	"Attention provoking" (description generated by subject)	1	Only at the end	1		
No anticipation	4			No anticipation	5		
Experienced "shock"	3			Experienced "shock"	3		

*Included are subjects who gave more than one description

GENERAL DISCUSSION OF EXPERIMENTS 1 AND 2

The results of experiment 2 confirmed the prediction that subjects under threat of shock would show larger and more slowly habituating ORs to words denoting stimuli they moderately fear than to words of relatively neutral content. This finding seems to be due to the fact that the phobic stimuli were significant for the subjects as their responses to the FSS-III had earlier suggested. There is considerable evidence indicating vigorous ORs to stimuli of significance for the subject. Phobic stimuli, in particular, have been shown to elicit large EDRs (Geer, 1966; Wilson, 1967, etc.) However, it must be noted that the significance of moderately feared stimuli may not become evident unless the arousal of the subjects, due to threat, lowers the threshold of responding. As seen, in experiment 1, feared stimuli similar to the ones used in experiment 2 did not elicit significantly different ORs to those elicited by neutral stimuli.

The outcome of experiment 2 is consistent with the findings by Öhman, Eriksson, Fredrikson, Hugdahl and Olofsson (1974), albeit the phobic stimuli in the two studies were defined differently. The agreement is both with regard to the magnitudes of ORs and to their habituation in the different groups. That is, the habituation is significantly different in the two groups only when it is measured by the number of trials to reach a criterion of three zero responses and not in terms of decrease of responses over trials. However, as Öhman and Bohlin (1973) demonstrated, the former criterion of habituation is directly related to strong subsequent conditioning and it may be more appropriate in the present context.

It could be argued that the observed responses to feared stimuli reflected earlier conditioning (of emotion) rather than orienting. As such and particularly in the context of increased arousal of the subjects by the threat of shock, the feared stimuli would have been expected to elicit larger EDRs than neutral stimuli due to the multiplicative relationships between "drive" and "habit" discussed by Hull (1943) and his successor Spence (1956). According to these theorists, a distinction should be made between learning and performance and the elicitation of a response is related to the product of the strength of drive (state of organism) multiplied by the strength of habit (the amount of learning). Of course, the data from experiments 1 and 2 cannot differentiate between "attention" (ORs) and "emotion" (CRs). As Katkin and Deitz (1973) commented in discussing comparable studies in the past, one cannot distinguish between the attentional component and the fearful component of a subject's response to a phobic stimulus. Fearful persons attend to the objects they fear and their increased attention is an essential component of the entire fearful response. However, the EDRs of both groups in experiment 2 did habituate and also there were no differences in the rates of habituation between them when this is measured by the decrease of responses over trials. These may suggest that the responses in both groups reflected orienting rather than conditioning as conditioned responses to phobic stimuli are defensive in nature (Öhman, Fredrikson and Hugdahl, 1978c) and defensive responses are normally much more stable than the EDRs seen in this experiment (see chapter III, section 2). On the other hand, it could be argued that the verbal stimuli in experiment 2 were converted into "signal stimuli" (Sokolov, 1963) for shock, and higher associability of the phobic than neutral stimuli with an aversive event (since the subjects reported they feared these stimuli) could have produced the present result. However, as Luria and Vinogradova (1959) commented, if a stimulus is given a signalling meaning the reaction to it becomes stable enough to be maintained "during 25-40 repetitions of the stimulus ..." (p. 91). In this experiment, a number of subjects did habituate fully even though they were administered only 12 trials. Thus, the hypothesis that the stimuli were converted into signals for shock is not well supported. It is now apparent, however, that subjects ought to have been asked whether or not they expected shocks when the words appeared on the PET screen.

In summary, the most plausible explanation of the results is in terms of the significance of the phobic stimuli for the subjects. Further, the data are congruent with the notion that ORs are a function of both the content of stimulus and state of the subject and that these two factors interact and produce large and slowly habituating ORs to phobic stimuli (Maltzman, 1979b, Öhman, et al., 1974).

The implication of the above is that, when under threat, people may show vigorous ORs to stimuli they already know they fear moderately. These responses may be said to reflect sensitization effects or pseudoconditioning (Dykman, 1967) which, unlike true conditioning, is manifested by only a "transitory change in threshold" (p. 237). However, at particular times in life, such responses may become enhanced and acquire pathological features particularly if they become associated with aversive experiences. Also, it is known that after a number of trials ORs to moderately intense stimuli are replaced by defensive reactions (Sokolov, 1963) which are accompanied by a sensation of shock, suffocation, palpitations and fear (Lynn, 1966) and it is thus conceivable that such transformations of ORs may become origins of phobic symptoms.

Now, in order to investigate the importance of prior experience more generally in determining the magnitude of ORs, further experiments are needed, in which the fear aspects of the stimuli for individual subjects are dissociated from their knowledge of what may be fearful to other people. This work will be undertaken in the next chapter.

CHAPTER VII

ORIENTING RESPONSES TO STIMULI OTHERS FEAR

EXPERIMENT 3: Presentation of stimuli without manipulation of the state of the subjects

Extensive literature from different sources clearly suggests that culture influences the content of fears and phobias (chapter II, section 2). However, this widely, albeit unsystematically, reported phenomenon has not been investigated in the laboratory. This is probably because cultural factors would normally have to be tested either by bringing subjects of very different cultural backgrounds in the laboratory or by moving the laboratory to far away countries and using local inhabitants as subjects. Either of these approaches is associated with many problems. For example, the laboratory set up should be made appropriate for testing fearfulness to a particular object and it should also be arranged so as to provide equivalent experimental and control conditions in testing responses to fear relevant/irrelevant stimuli within a culture and between cultures. Even if such experimental rigour were to be applied, in the light of the large number of variables involved in the investigation, the interpretation of the results would be far from straightforward and likely to remain equivocal.

On the other hand, it would be legitimate to approach the investigation of this problem by analogue research as Öhman and his associates have done (chapter I, section 5.2) and by employing the methodology used in experiments 1 and 2 (chapter VI).

It was earlier suggested that the observed selectivity in the content of fears within a culture may be accounted for by the fact that individuals within it share common experiences both by encountering similar objects/situations and through common knowledge (chapters II and V). Since, however, not all aversive stimuli encountered within a culture arise fear or become phobic, the content of many fears may be primarily determined by common knowledge of what is potentially aversive.

In accordance with this assumption, this experiment investigates responses to verbal stimuli which denote objects or situations commonly feared in the culture but not feared by the subjects. This implies that the emotional importance of these stimuli for the subjects is, if anything, minimal but they could nevertheless have attentional value. It is predicted that subjects will show larger and more slowly habituating electrodermal ORs to these stimuli than to neutral content stimuli.

METHOD

Design

Two groups of students were each presented with a different kind of word. The phobic words denoted the most common fears among individuals of the same student population. The neutral words denoted relatively innocuous objects or situations and they matched the phobic ones as well as possible in frequency of occurrence and length. The subjects in the two groups were matched in pairs for reporting no fear of the phobic stimulus in each pair of words. They were also matched for sex (see experiment 1). The dependent variables were magnitude of the skin resistance response (SRR) and its habituation.

Subjects

Forty volunteers took part in the experiment, 26 females and 14 males. They were students from different departments of Bedford College, University of London. Their ages ranged from 18 to 26 years, with the great majority of them in their early twenties.

Selection of stimuli

This was carried out by giving the Fear Survey Schedule (FSS-III) by Wolpe and Lang (1964) to 277 subjects of about equal numbers of males and females. These included subjects who had participated in the pilot studies, in experiments 1 and 2, as well as a number of subjects who had filled the FSS-III before taking part in experiments run by a colleague (John Mervyn-Smith). On the basis of their answers 11 words or phrases were selected whose content evoked fear in the majority of subjects, i.e. where over 50 per cent of subjects filled in the inventory, which was scored from 1 to 5, in the columns "Fair Amount" (3), "Much" (4) or "Very Much" (5). The proportion of subjects who reported each item as feared or not feared appear in Appendix 6. The items "Looking foolish" and "Losing control" were substituted by the latter (see experiment 1). Subsequently, 11 equivalent words or phrases of relatively neutral content were selected by a different procedure to theone adopted in the selection of stimuli for the earlier experiments. This was done in two stages. In the first stage, a list of neutral words and phrases was prepared; for each phobic stimulus five alternative neutral ones were found. In the second stage judges were asked to rate all the neutral stimuli in terms of their affectivity (i.e. how pleasant or unpleasant their content was) so that the most appropriately neutral amongst the alternative stimuli could be chosen. The first stages of the preparations of lists of words and phrases were different. If the phobic stimulus was a single word, five relatively neutral words were chosen from the Computational Analysis of Present-day American English (Kučera and Francis, 1967) for their approximately equal frequency in the language to the phobic one. If the phobic stimulus was a phrase, three psychology graduates were asked to generate 5 neutral phrases with similar frequencies to that of each of the phobic stimuli. The graduates worked collectively and they were asked to aim at reaching a consensus in each case. For the preparation of the lists of both words and phrases the criteria which were used were that the neutral stimuli were of similar parts of speech and comprising about the same number of letters as the phobic match. Additional attributes to which attention was paid were those of imagery and concreteness so that these were similar in neutral and phobic material. However, no formal criteria for the attributes were adopted. In the second stage of the selection of the neutral stimuli, all words and phrases were assessed by 10 judges (undergraduate students of psychology) who were asked to complete two questionnaires. In one, they were asked to choose one of the five alternative neutral phrases with the most similar frequency in the language to the corresponding phobic one. The second questionnaire asked the judges to rate all words and phrases according to their affectivity on a 7-point scale. The words with mean affectivity ratings nearest to 4 were considered as qualifying neutral stimuli. The phrases which were finally chosen were those which satisfied optimally the attributes of both affectivity and frequency, the final arbitrator being the experimenter. The words/phrases which were included in the questionnaires and the relevant instructions given to the judges appear in Appendices 7 (phrases assessed for their frequency) and 8 (words/phrases assessed for their affectivity). It is noted that the phobic stimuli were included in the latter questionnaire so that their aversive content and the relative neutral content of the corresponding words could be confirmed and contrasted. The final list of stimuli adopted for the purposes of the experiment appears in Appendix 9. Whenever two neutral stimuli were equally qualified for selection they were both included in the final list and before an experiment started one of them was chosen by the toss of a coin. Table VII.1 presents the stimuli used in the present experiment.

Table VII.1. Experiment 3: Stimulus words and phrases

Phobic	Neutral	Number of times used
Corpses	Drawers	3
Speaking in public	Talking of weather/ Going to College	5
Parting from friends	Tying things together	1
Bullying	Cleaning/Working	2
Surgery	Shaving	5
Being ignored	Being advised/Being asleep	2
Insanity	Advocacy/Adequacy	2

Apparatus

This was the same as in experiment 1.

Procedure

Before the subjects came to the laboratory they were asked to fill in the FSS-III. Each pair of subjects was chosen for reporting no fear of a particular item which, according to normative data, had been reported as fearful by the majority of their peers, i.e. they responded to the five-point scale of the inventory in the columns "Not at all" (1) or "A little" (2). One of the subjects in the pair was allocated to the group exposed to the potentially phobic stimuli by tossing a coin. The experimental procedure was as in experiment 1.

Questionnaires

These were as in experiment 1 with the addition of questionnaire "B" asking subjects to rate both the stimuli they were administered and their matched pairs in terms of the attitudes of the general population (Appendix 13).

RESULTS

A group x sex (2x2) ANOVA was initially carried out on raw maximal responses (see experiment 1). No significant differences either between groups or sexes were found, hence range correction of responses is justified. A summary of this analysis appears in Table VII.2.

Table VII.2. Experiment 3: Analysis of variance of maximal responses

Source	SS		d.f.	Mean square		F	P
Group	2.595	E5*	1	2.595	E5	0.009	n.s.
Sex	2.658	E7	1	2.658	E7	0.922	n.s.
Group x Sex	3.867	E6	1	3.867	E6	0.134	n.s.
Subjects within groups	1.038	E9	36	2.883	E7		

*Figures produced in abbreviated form by computer (y EX = y (10^x)). F-values are not affected as they are calculated on actual and not on abbreviated numbers.

The mean range-corrected SRRs to stimuli in the two groups as a function of trials appear in Figure VII.1. A group x sex x trials (2x2x12) split-plot ANOVA was carried out on the response magnitudes to test the hypotheses that the phobic group would show larger and more slowly habituating ORs than the neutral group. The two groups were not found to be significantly different in magnitudes of responses. There was also no significant sex effect. However, there was a significant trials effect (F = 5.73, d.f. = 11,396, $p < 0.01$). Both groups showed a reliable habituation effect as indicated by the linear (F = 34.19, d.f. = 1,396, $p < 0.01$) and quadratic (F = 12,287, d.f. = 1,396, $p < 0.01$) components of the trials effect. The two groups did not differ in terms of habituation as measured by decrease in responses over trials as indicated by the lack of significance of the groups x

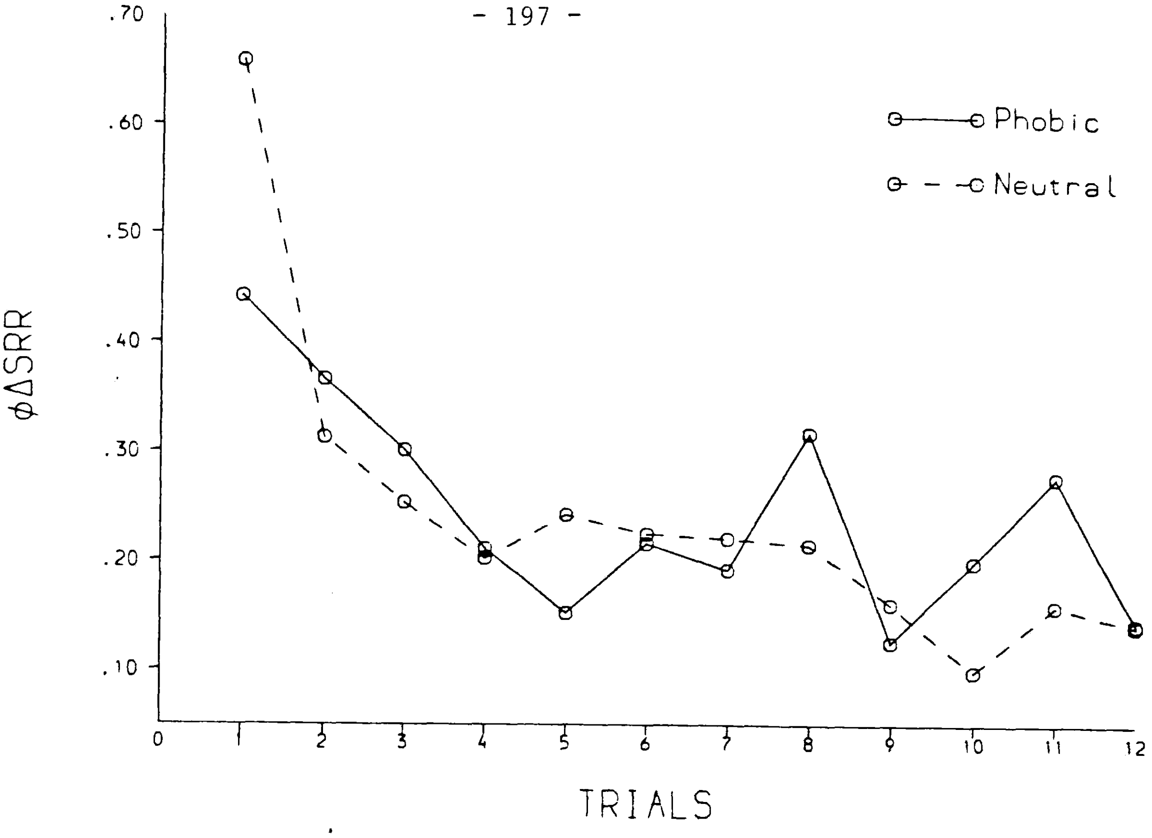

Figure VII.1. Experiment 3: Mean habituation curves for the groups presented with phobic and neutral stimuli (N = 40)

Table VII.3. Experiment 3: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	0.003	1	0.003	0.010	n.s.
Sex	0.247	1	0.247	0.912	n.s.
Groups x Sex	0.681	1	0.681	2.516	n.s.
Subjects within groups	9.747	36	0.271		
Trials	5.606	11	0.510	5.728	<0.01
Linear trend	3.043	1	3.043	34.192	<0.01
Quadratic trend	1.093	1	1.093	12.287	<0.01
Trials x groups	0.969	11	0.088	0.990	n.s.
Linear trend	0.239	1	0.239	2.681	n.s.
Quadratic trend	0.030	1	0.030	0.337	n.s.
Trials x sex	0.240	11	0.022	0.245	n.s.
Linear trend	0.002	1	0.002	0.019	n.s.
Quadratic trend	0.014	1	0.014	0.158	n.s.
Trials x groups x sex	0.577	11	0.052	0.589	n.s.
Linear trend	0.005	1	0.005	0.056	n.s.
Quadratic trend	0.063	1	0.063	0.703	n.s.
Trials x subjects within groups	35.238	396	0.089		

trials interaction. A summary of the ANOVA appears in Table VII.3.

The habituations of responses of the two groups, as measured by the number of trials to reach three successive zero (i.e. below criterion) responses, did not differ significantly as assessed by a Wilcoxon matched-pairs signed-ranks test. With this criterion, the mean habituation rates of the phobic and neutral groups were 5.50 (S.D. = 5.06) and 6.40 (S.D. = 5.25) trials respectively. To test for potential sex differences on habituation with this criterion, a Mann-Whitney test on the differences in the number of trials to the habituation criterion of the matched subjects and between males and females was carried out. The test, corrected for ties, showed no significant differences between the sexes (Z = 0.76).

A summary of responses to questionnaires "A" and "B" regarding the degrees of fears of the various stimuli the subjects reported post-experimentally appear in Table VII.4.

Table VII.4. Experiment 3: Ratings of stimuli post-experimentally

Groups of subjects, type of stimulus, and type of assessment	Not at all	A little	A fair amount	Much	Very much
PHOBIC group					
Phobic stimulus					
Self-assessment	3	13	3	0	1
General population	1	6	9	2	2
Neutral stimulus					
Self-assessment	10	6	4	0	0
General population	6	10	3	1	0
NEUTRAL group					
Phobic stimulus					
Self-assessment	2	11	5	2	0
General population	0	4	6	7	3
Neutral stimulus					
Self-assessment	10	9	0	1	0
General population	8	9	1	2	0

It may be seen that a few subjects who had reported no fear of certain stimuli before the experiment (on the FSS-III), reported fear of them post-experimentally, i.e. 4 subjects in the phobic and 7 subjects in the neutral group. This may not be surprising considering they had to rate the same stimuli in terms of fears of the general population whom on the whole found more fearful than themselves (only 4 out of 20 subjects in the phobic group reported they feared the phobic stimuli substantially, i.e. scored above 2, while, out of the same 20 subjects, 13 felt the general population had a substantial degree of fear of these stimuli). Similar discrepancies were reported between personal and fear of the general population of the phobic stimuli by the neutral group. There was much more agreement between personal and population fears of the neutral stimuli. However, what is important from this table is that 16 subjects (or 80%) of the phobic group were administered stimuli they reported pre- and post-experimentally as not feared though, according to normative data, these stimuli are feared substantially by their own peers and this fact was recognised by 13 (or 65%) of these subjects. On the other hand, 19 subjects (or 95%) of the neutral group reported no fear of the stimuli they were tested with. These suggest the experimental manipulations, at least as far as the stimuli were concerned, were relatively successful.

A summary of the responses to questionnaire "D" appears in Table VII.5. The descriptions and presumably the way the experiment was experienced by the subjects appear almost identical in the two groups suggesting similar psychological states during the experiment. Informal interviews also indicated that the majority of subjects had become progressively more and more relaxed during the experiment. However, they all remained alert and saw all the stimuli in all trials.

Table VII.5. Experiment 3: Summary of the descriptions of the experiment by the subjects

Description	Number of subjects in phobic group	Number of subjects in neutral group
Anxiety provoking	1	1
Interesting	2	3
Boring	6*	8*
Puzzling	14*	13*
Description generated by subject: "Relaxing"	1	0

*Included are subjects who gave more than one description

DISCUSSION

The results do not support the hypothesis that the phobic words elicit larger and more slowly habituating electrodermal ORs than neutral ones, i.e. there would appear to be no general likelihood for generally phobic stimuli to elicit vigorous responses in subjects not personally sensitive to them. Perhaps, no significance should be attached to the much larger initial response by the neutral group. Maltzman (1979b) pointed out, for example, that in habituation experiments the initial response to an unpredictable stimulus may not be influenced by cognitive factors, i.e. it is relatively "involuntary" and distinguished from the subsequent responses which are relatively "voluntary" and influenced by speech and thinking. In other words, the size of the initial response may be largely independent of the stimulus content.

The outcome of this experiment appears to be similar to that of experiment 1 and, as in that study, it may be necessary to qualify the conclusions drawn from the present results. That is, potentially phobic stimuli as defined here may elicit large ORs only when subjects are in some "appropriate" state. As indicated above, most subjects became very relaxed during the experiment thus possibly diminishing any differential effect of the stimuli. In experiment 2, stimuli associated with moderate subjective fears produced much larger and more slowly habituating EDRs while the subjects were under threat of shock. Öhman et al (1974) had earlier showed similar effects when testing subjects who did not report "excessive fear" of the phobic stimuli. It may be therefore that the phobic and neutral stimuli investigated in this experiment will differentiate in their effects if they were administered to threatened subjects.

EXPERIMENT 4: Effects of threat on orienting responses to stimuli others fear

This experiment tests the hypothesis that threat of shock will potentiate electrodermal ORs to stimuli feared by others.

METHOD

Design

This was as in experiment 3 except that the subjects of both groups anticipated an electric shock (as in experiment 2).

Subjects

Forty subjects participated, 20 males and 20 females. They were all volunteers, students from Bedford College. Their ages ranged from 18 to 28 with the great majority in their early twenties.

Selection of stimuli

The stimuli were drawn from the list prepared for experiment 3. Table VII.6 presents the stimuli employed.

Table VII.6. Experiment 4: Stimulus words and phrases

Phobic	Neutral	Number of times used
Corpses	Drawers	3
Speaking in public	Going to College	3
Failure	Analysis	1
Bullying	Working	1
Fights	Regards	3
Surgery	Linking/Shaving	4
Being ignored	Being advised/Being asleep	2
Losing control	Talking aloud	1
Insanity	Advocacy	2

Apparatus

This was as in experiment 2.

Procedure

This was as in experiments 1 and 3 with the modification introduced in experiment 2 regarding the threat of electric shock.

Questionnaires

The questionnaires "A" and "B" were administered as in experiment 3. Apart from these, questionnaire "F" was also given. This was identical to questionnaire "E" with an additional question asking the subjects whether they anticipated shock "only when the words appeared" on the PET screen (Appendix 17).

RESULTS

A group x sex (2x2) ANOVA was initially carried out on raw maximal responses. No significant differences either between groups or sexes were found, hence range correction of responses is justified. A summary of this analysis appears in Table VII.7.

Table VII.7. Experiment 4: Analysis of variance of maximal responses

Source	SS	d.f.	Mean square	F	P
Group	4.713 E7*	1	4.713 E7	1.297	n.s.
Sex	1.897 E7	1	1.897 E7	0.522	n.s.
Group x sex	2.313 E6	1	2.313 E6	0.064	n.s.
Subjects within groups	1.308 E9	36	3.634 E7		

*Figures produced in abbreviated form by computer ($y \text{ E}x = y(10^x)$)

The mean range-corrected SRRs of the two groups as a function of trials appear in Figure VII.2.

A group x sex x trials (2x2x12) split-plot ANOVA on the response magnitudes was carried out and is summarized in Table VII.8. The two groups were found to be significantly different ($F = 6.62$, d.f. = 1,36, $p < 0.05$). There was a significant trials effect ($F = 4.07$, d.f. = 11,396, $p < 0.01$). Both groups showed a reliable habituation effect as indicated by the linear ($F = 22.98$, d.f. = 1,396, $p < 0.01$) and quadratic ($F = 5.164$, d.f. = 1,396, $p < 0.05$) components of the trials effect. The two groups did not differ in terms of habituation when measured by the rate of decrease of responses, as indicated by the lack of significance of the groups x trials interaction. The sex of the subjects as a factor was not statistically significant and the same was true for the group x sex interaction. Although the overall interaction trials x sex was not significant its linear component was so ($F = 6.15$, d.f. = 1,396, $p < 0.05$). Given that the trends of responses are downward, that there is no overall sex effect and that the males showed no significant linear trend over trials while the females showed a highly significant linear trend ($F = 24.17$, d.f. = 1,198, $p < 0.01$ - see separate ANOVAs for each sex in tables VII.9 and VII.10), it seems that the responses of males tended to stabilise at higher levels, i.e. they approached their asymptotic levels more quickly than females. This is also shown in Figure VII.3.

The habituations of responses of the two groups, as measured by the number of trials to reach three successive zero responses, were found to be significantly different in the predicted direction ($T = 21$, $p < 0.05$, one-tailed test) by a Wilcoxon matched-pairs signed-ranks test. The mean numbers of trials to habituation for the phobic and neutral groups were 9.30 (S.D. = 4.14) and 7.15 (S.D. = 4.26) respectively. A Mann-Whitney test on the differences in the number of trials to the habituation criterion of the matched subjects and between males and females was also carried out to test for potential sex differences on habituation with this criterion. The test, corrected for ties, showed no significant sex differences ($Z = -0.12$).

A summary of the responses to questionnaires "A" and "B" regarding the degrees of fear of the various stimuli the subjects reported post-experimentally appear in Table VII.11.

The pattern of the responses is very similar to that produced by the subjects in experiment 3. Generally, there appear to be discrepancies between the stimuli subjects report as feared by themselves vs. the population at large. Again, 16 subjects (80%) in the phobic group were administered stimuli they reported pre- and post-experimentally as not feared though these stimuli, according to normative data and the subjects' own recognition, are feared by others substantially. On the other hand, all subjects in the neutral group were administered stimuli they reported they did not fear. The above suggest that the manipulation of stimuli was relatively successful.

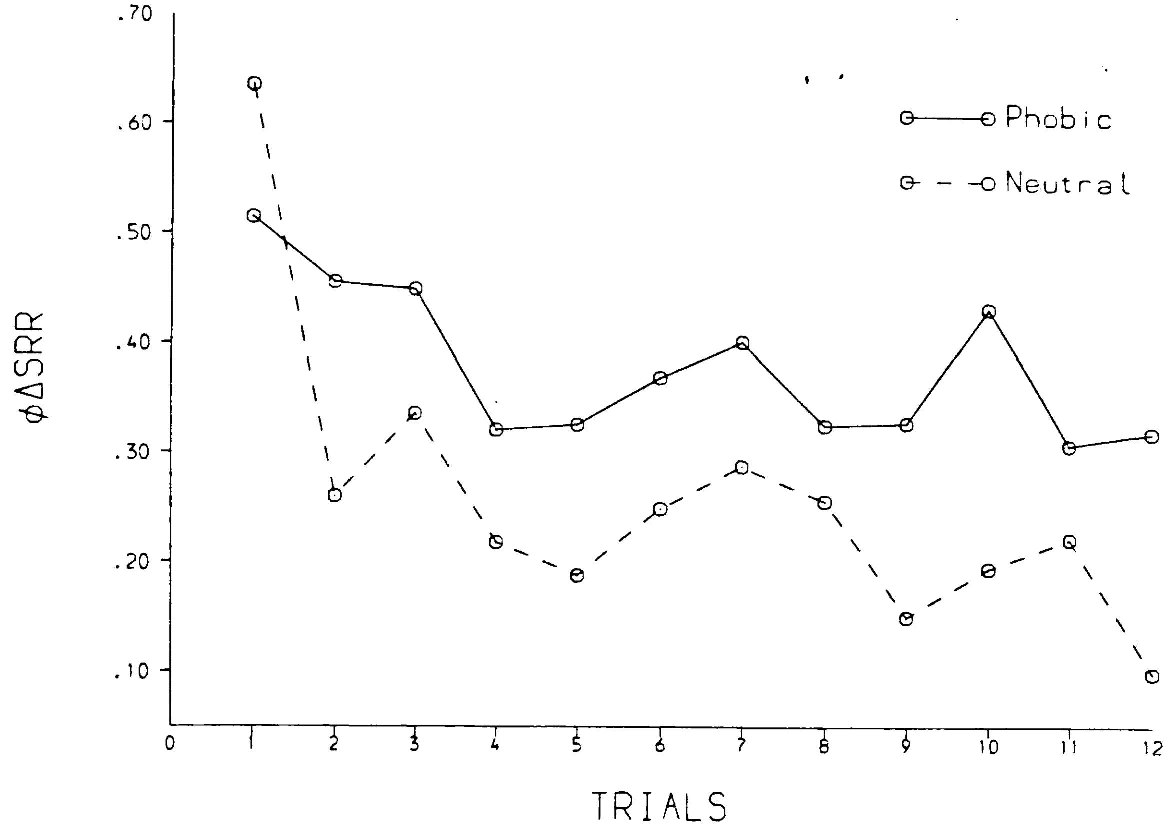

Figure VII.2. Experiment 4: Mean habituation curves for the groups presented with phobic and neutral stimuli (N=40)

Table VII.8. Experiment 4: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	1.786	1	1.786	6.626	<0.05
Sex	0.329	1	0.329	1.220	n.s.
Groups x sex	0.289	1	0.289	1.071	n.s.
Subjects within groups	9.705	36	0.270		
Trials	4.106	11	0.373	4.075	<0.01
Linear trend	2.105	1	2.105	22.982	<0.01
Quadratic trend	0.473	1	0.473	5.164	<0.05
Trials x groups	0.951	11	0.086	0.943	n.s.
Linear trend	0.260	1	0.260	2.841	n.s.
Quadratic trend	0.029	1	0.029	0.316	n.s.
Trials x sex	1.781	11	0.162	1.767	n.s.
Linear trend	0.563	1	0.563	6.151	<0.05
Quadratic trend	0.010	1	0.010	0.112	n.s.
Trials x groups x sex	0.499	11	0.045	0.495	n.s.
Linear trend	0.115	1	0.115	1.259	n.s.
Quadratic trend	0.001	1	0.001	0.013	n.s.
Trials x subjects within groups	36.275	396	0.092		

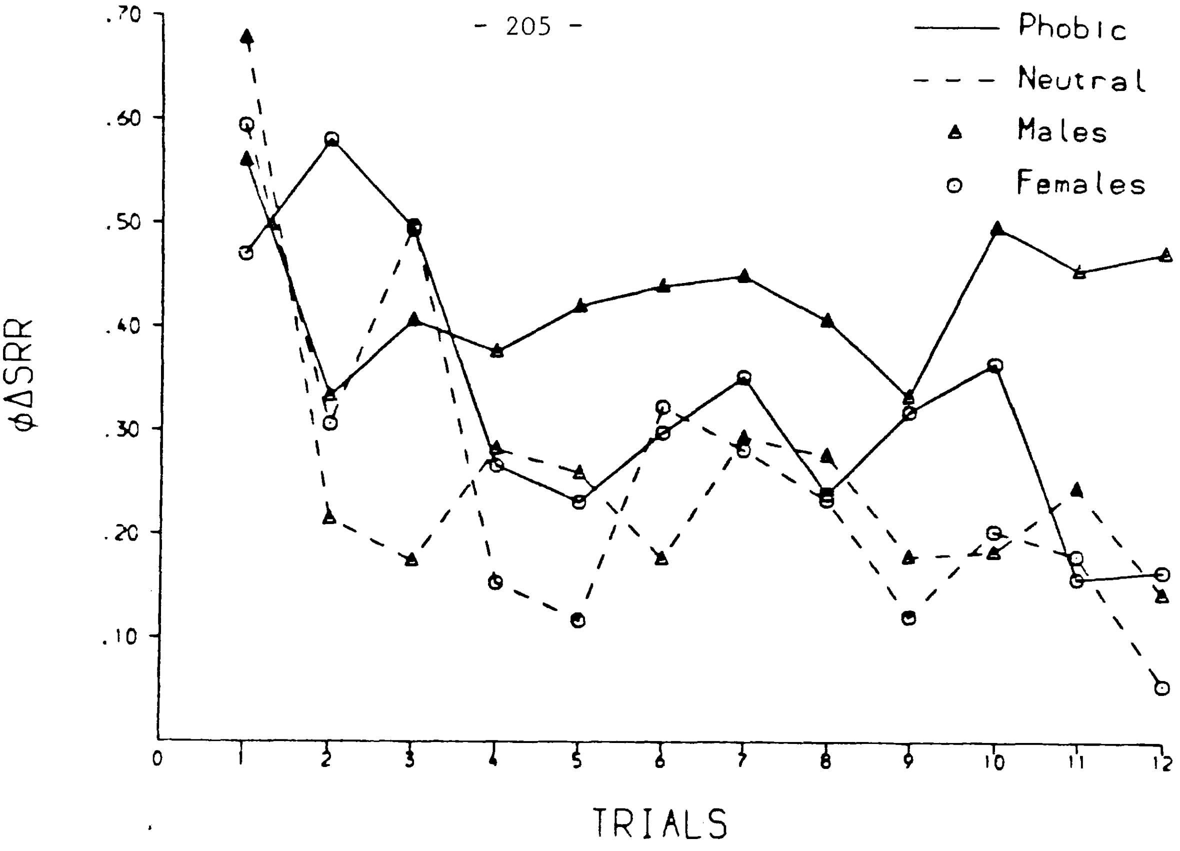

Figure VII.3. Experiment 4: Mean habituation curves for males (N=20) and females (N=20) presented with phobic and neutral stimuli

Table VII.9. Experiment 4: Analysis of variance of response magnitudes for males

Source	SS	d.f.	Mean square	F	P
Groups	1.756	1	1.756	5.801	<0.05
Subjects within groups	5.448	18	0.303		
Trials	1.894	11	0.172	2.075	<0.05
Linear trend	0.245	1	0.245	2.956	n.s.
Quadratic trend	0.311	1	0.311	3.752	n.s.
Trials x groups	0.768	11	0.070	0.842	n.s.
Linear trend	0.361	1	0.361	4.352	<0.05
Quadratic trend	0.021	1	0.021	0.251	n.s.
Trials x subjects within groups	16.426	198	0.083		

Table VII.10. Experiment 4: Analysis of variance of response magnitudes for females

Source	SS	d.f.	Mean square	F	P
Groups	0.319	1	0.319	1.351	n.s.
Subjects within groups	4.258	18	0.236		
Trials	3.993	11	0.363	3.621	<0.01
Linear trend	2.423	1	2.423	24.175	<0.01
Quadratic trend	0.172	1	0.172	1.716	n.s.
Trials x groups	0.681	11	0.062	0.618	n.s.
Linear trend	0.014	1	0.014	0.145	n.s.
Quadratic trend	0.009	1	0.009	0.092	n.s.
Trials x subjects within groups	19.849	198	0.100		

Table VII.11. Experiment 4: Ratings of stimuli post-experimentally

Group of subjects, type of stimulus, and type of assessment	Not at all	A little	A fair amount	Much	Very much
PHOBIC group					
Phobic stimulus					
Self-assessment	4	12	3	1	0
General population	2	2	11	5	0
Neutral stimulus					
Self-assessment	15	4	1	0	0
General population	10	8	2	0	0
NEUTRAL group					
Phobic stimulus					
Self-assessment	1	14	3	1	1
General population	1	1	6	8	4
Neutral stimulus					
Self-assessment	17	3	0	0	0
General population	12	6	2	0	0

Responses to questionnaire "F" indicated that all subjects saw all the stimuli in all trials. Also, all subjects anticipated shock during the experiment. Eleven subjects in the phobic group and 9 subjects in the neutral group reported they anticipated shock, more or less, throughout the experiment (i.e. they described their anticipation of shock as "intermittent" or "continuous"). Only 3 subjects in the phobic group and 2 in the neutral group reported they anticipated shocks only when the stimuli appeared on the PET screen. Two subjects in each group did not respond to the question regarding the anticipation of shock while 1 subject in the phobic and 2 in the neutral groups reported they experienced "shock". In general terms, therefore, it is reasonable to assume that the anticipations of the subjects in the two groups were very similar. Summary of the shock anticipations appear in Table VII.12. In the same table the descriptions of the experiment by the subjects can be seen. Generally, subjects in phobic and neutral groups described the experiment similarly except that 7 subjects in the latter group thought it was "boring" and only 2 subjects from the phobic group did so. A chi-squared test, however, showed no significant evidence of association between the type of stimulus subjects were presented with and their description of the experiment as "boring" ($x^2 = 2.30$). This, together with the similar anticipations of shocks suggest that the levels of arousal of the two groups were not significantly different.

Table VII.12. Experiment 4: Summary of reported anticipations of shock and descriptions of experiment

PHOBIC GROUP				NEUTRAL GROUP			
Anticipation of shock		Descriptions of experiment		Anticipation of shock		Descriptions of experiment	
Continuous	0	Anxiety provoking	4*	Continuous	1	Anxiety provoking	3*
Intermittent	11*	Interesting	4*	Intermittent	8*	Interesting	3*
Only at beginning	4	Boring	2*	Only at beginning	6	Boring	7*
		Puzzling	15*			Puzzling	10*
Only in the middle	0			Only in the middle	0		
Only at the end	0			Only at the end	1*		
Only when the words appeared	3			Only when the words appeared	2		
No anticipation	2			No anticipation	2		
Experienced "Shock"	1*			Experienced "Shock"	2*		

*Included are subjects who gave more than one description

DISCUSSION

With both groups tested under the threat of shock, stimuli fearful to the majority of a student population elicit larger and more slowly habituating ORs than neutral stimuli. The results suggest that the phobic stimuli already had potential significance which was expressed in a response when the arousal of the individual, due to threat, reached a certain threshold as almost identical stimuli in experiment 3 failed to elicit larger responses than neutral stimuli. On the other hand, the apparent significance of the phobic stimuli may be explained by the fact that the subjects know that these stimuli are feared by other people. Thus, stored information about objects and situations may, through manipulation of state, result in differential responding.

The results could also be seen in a different light. It is reasonable to argue that threat of shock and type of stimulus in the two groups meant that their subjects were put into "conflict" situations at different stages of the experiment and conflict is associated with vigorous ORs (Berlyne, 1960; 1961). Thus, for subjects in the neutral group there might have been a discrepancy between expectation of shock and the innocuous stimuli they were presented with at the initial stages of the experiment but as the latter progressed and the shock threat was not to be realized its expectation was diminished and this was congruent with the content of stimuli. As a result, the disparity between threat of shock and neutral stimuli led to an excitation and consequently to large ORs at the beginning of the experiment but the congruence between the lowered expectation of shock and the neutral stimuli later resulted in a state of quiescence and relatively rapid habituation. Conversely, in the phobic group and because the association of threat with phobic stimuli is high, the subjects experienced conflict after the first few trials, as the threat of the expected shock was not to be realized, resulting thus in relatively large ORs in the latter part of the experiment. Figure VII.2 bears this interpretation out as it appears that the initial ORs of the phobic group are at a relatively lower level than those of the neutral group but their strength seems to be sustained throughout the experiment (see experiment 7).

It may also be that, although the subjects were not told that shock and words would follow each other, the instructions converted the words to "signal" stimuli (Sokolov, 1963) for shock, but, again, only a higher associability of the phobic than neutral stimuli with the threat of shock could have produced the present results. However, responses to questionnaire "E" showed that, on the whole, the subjects anticipated shock throughout, i.e. not only when the word appeared on screen. It is apparent also from the graphs that there are raised amplitudes of responding in both groups compared with experiment 3.

It is not clear why the asymptotic levels in males were higher than in females and why males approached these asymptotic levels more quickly. This may, however, reflect a higher degree of arousal of the males. A comparison of responses to questionnaire "F" by sex showed that twelve males anticipated shock throughout the experiment while only eight females did so.

The habituation measures are significantly different in the groups only in terms of number of trials to reach "zero" response and not in terms of decrease of response over the trials. It may be noted that in experiment 2 and the study by Öhman et al. (1974) the same differences between the two measures of habituation were observed.

Öhman and Bohlin (1973) found that slow habituation as measured by number of trials to "zero" response, is related to strong subsequent conditioning. This, taken together with the potentiating effects of threat on ORs to phobic stimuli demonstrated in this experiment, implies that under threat people may develop conditioned fears for phobic stimuli. This is in agreement with clinical evidence suggesting that phobic symptoms are often formed at times of change in life and particularly when the individual perceives the future as threatening and unpredictable (e.g. Rachman, 1974; Arieti, 1979).

EXPERIMENT 5: Effects of anticipation of a pleasant event on orienting responses to stimuli others fear

The previous experiment suggested that words or phrases denoting objects or situations feared by most members of a student population elicit large ORs in subjects who report no fear of these stimuli. However, this was observed only when the subjects were aroused by the threat of shock. A further consideration is whether subjects would behave similarly if they anticipated a different, non-threatening event. It may be that any kind of arousal or anticipation renders the phobic stimuli more potent. Experiment 5 investigates the effects of anticipating a pleasant stimulus. If anticipation as such were the deciding factor, then the phobic stimuli should still elicit larger responses. If, however, the deciding factor were anticipation of aversive stimulation then the two groups should not differ when anticipating music.

METHOD

Design

This was as in experiment 2 but the words were presented while all the subjects were anticipating, instead of a shock, pleasantly arousing music.

Subjects

Forty Bedford College student volunteers took part, 16 males and 24 females. Their ages ranged from 18 to 24 years with the majority of them in their early twenties.

Selection of stimuli

This was as in experiments 3 and 4. Table VII.13 presents the stimuli used in the present experiment.

Table VII.13. Experiment 5: Stimulus words and phrases

Phobic	Neutral	Number of times used
Corpses	Drawers	4
Speaking in public	Talking of weather	4
Failure	Analysis	1
Parting from friends	Tying things together	2
Bullying	Cleaning	1
Fights	Regards	1
Surgery	Shaving	1
Being ignored	Being asleep	3
Losing control	Talking aloud	1
Insanity	Adequacy/Advocacy	2

Apparatus

This was as in the previous experiment but instead of the shock device an ordinary tape recorder with earphones was used. On a loop-like piece of magnetic tape music from Rossini's W. Tell as abridged by W. Carlos for the film "Clockwork Orange" was recorded. The duration of this music was 5s and it was chosen for being "pleasantly arousing and meaningful". These attributes were confirmed by all of 8 judges prior to experimenting.

Procedure

For the most part this was as in experiment 4. After the earphones had been placed on the subjects' heads they were orally instructed as follows:

"On this piece of tape I have recorded a short piece of music. I would like you to listen to it a few times and determine the level of volume which makes the listening pleasantly arousing for you. In the first instance you will hear the music at a low level and subsequently I shall increase the volume, step by step, asking you about your experience. At the end, you will tell me which volume level is most appropriate to the description 'pleasantly arousing music' for you". The subjects were then told that occasionally during the experiment they would hear the same music at the volume of their choice. In reality, no music was presented during the experiment proper.

Questionnaires

These were the same as in experiment 4 but the word "shock" in questionnaire "F" may be substituted by the word "music" (see questionnaire "G", Appendix 18).

RESULTS

A group x sex (2x2) ANOVA on raw maximal responses was first carried out. No significant differences either between groups or sexes were found and therefore range correction of responses is justified. A summary of this analysis appears in Table VII.14.

Table VII.14. Experiment 5: Analysis of variance of maximal responses

Source	SS	d.f.	Mean square	F	P
Groups	18697828*	1	18697828	1.988	n.s.
Sex	1873727	1	1873727	0.199	n.s.
Groups x sex	26755	1	26755	0.003	n.s.
Subjects within groups	338654523	36	9407070		

*Numbers have been rounded up by computer

The mean range-corrected SRRs to stimuli in the two groups as a function of trials appear in Figure VII.4.

A group x sex x trials (2x2x12) split-plot ANOVA was carried out. The two groups were not found to be significantly different. There was also no significant sex effect. However, there was a significant trials effect ($F = 13.75$, d.f. = 11,396, $p < 0.01$). Both groups showed a reliable habituation effect as indicated by the linear ($F = 71.40$, d.f. = 1,396, $p < 0.01$) and quadratic ($F = 38.79$, d.f. =1,396, $p < 0.01$) components of the trials effect. The two groups did not differ in terms of the rates of decrease of responses, indicated by a nonsignificant groups x trials interaction. A summary of the ANOVA appears in Table VII.15. As it appears in the table of raw responses (Appendix 24e), a large number of zeros have entered in the calculations, questioning the reliability of this analysis. However, a post-hoc ANOVA of responses in blocks of 3 trials yielded no different results.

The number of trials to reach the habituation criterion of 3

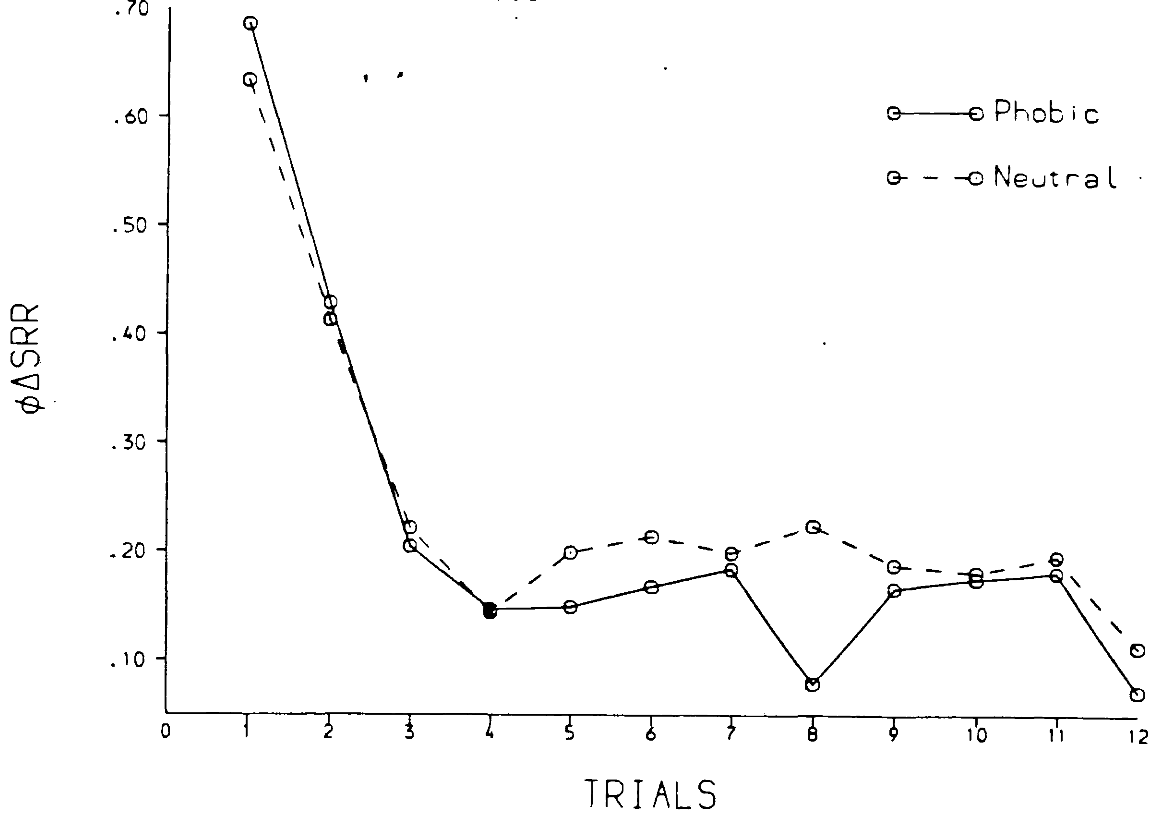

Figure VII.4. Experiment 5: Mean habituation curves of the two groups (N=40)

Table VII.15. Experiment 5: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	0.068	1	0.068	0.216	n.s.
Sex	0.179	1	0.179	0.565	n.s.
Groups x sex	0.000	1	0.000	0.002	n.s.
Subjects within groups	11.387	36	0.316		
Trials	10.688	11	0.972	13.752	<0.01
Linear trend	5.044	1	5.044	71.398	<0.01
Quadratic trend	2.740	1	2.740	38.789	<0.01
Trials x groups	0.248	11	0.023	0.319	n.s.
Linear trend	0.045	1	0.045	0.633	n.s.
Quadratic trend	0.063	1	0.063	0.893	n.s.
Trials x sex	0.843	11	0.077	1.085	n.s.
Linear trend	0.117	1	0.117	1.653	n.s.
Quadratic trend	0.101	1	0.101	1.427	n.s.
Trials x groups x sex	0.703	11	0.064	0.905	n.s.
Linear trend	0.000	1	0.000	0.004	n.s.
Quadratic trend	0.021	1	0.021	0.298	n.s.
Trials x subjects within groups	27.979	396	0.071		

successive zero responses were also compared. A Wilcoxon matched-pairs signed-ranks test showed no significant differences between the groups. With this criterion the mean habituation rates of the phobic and neutral groups were 5.10 (S.D. = 5.31) and 6.50 (S.D. = 5.04) respectively. A Mann-Whitney test on the differences in the number of trials to the habituation criterion of the matched subjects and between males and females was carried out to test for potential sex differences on habituation with this criterion. The test, corrected for ties, showed no significant sex differences (Z = -0.31).

In Table VII.16 the responses to questionnaires "A" and "B" are summarized. As in experiments 3 and 4, there are discrepancies between the stimuli subjects reported as feared personally vs. the general population. The manipulation of stimuli appears to have been successful in the sense that subjects in the phobic group were tested with stimuli they reported pre- and post-experimentally as not feared by themselves though, according to normative data and the subjects' own assessments, these stimuli are feared by others substantially. On the other hand, subjects in the neutral group were tested with stimuli of which they are not afraid.

Table VII.16. Experiment 5: Ratings of stimuli post-experimentally

Group of subjects, type of stimulus, and type of assessment	Not at all	A little	A fair amount	Much	Very much
PHOBIC group					
Phobic stimulus					
Self-assessment	7	11	1	1	0
General population	0	3	12	3	2
Neutral stimulus					
Self-assessment	16	3	1	0	0
General population	12	7	1	0	0
NEUTRAL group					
Phobic stimulus					
Self-assessment	2	11	3	2	2
General population	0	3	10	6	1
Neutral stimulus					
Self-assessment	12	5	3	0	0
General population	12	5	3	0	0

According to the responses to questionnaire "G", all subjects saw all the stimuli in all trials. Except of 3 subjects in the neutral group and 1 in the phobic all subjects did anticipate music during the experiment either throughout or at certain stages of the experiment. Both groups also described the experiment in similar ways. A summary of the responses to questionnaire "G" appears in Table VII.17.

Table VII.17. Experiment 5: Summary of reported anticipations of music and descriptions of experiment

PHOBIC GROUP				NEUTRAL GROUP			
Anticipation of music		Descriptions of experiment		Anticipation of music		Descriptions of experiment	
Continuous	1	Anxiety provoking	1	Continuous	1	Anxiety provoking	0
Intermittent	11	Interesting	6*	Intermittent	9	Interesting	4*
Only at the beginning	3	Boring	8*	Only at the beginning	1	Boring	5*
Only in the middle	0	Puzzling	9*	Only in the middle	3*	Puzzling	12*
Only at the end	4*			Only at the end	3*	"Relaxing" (Description generated by subject)	1
Only when the words appeared	1*			Only when the words appeared	0		
No anticipation	1			No anticipation	3		

*Included are subjects who gave more than one description

DISCUSSION

The results show that the magnitudes of the electrodermal ORs to phobic vs. neutral stimuli do not differ when subjects anticipate pleasantly arousing music. This is also true for the rates of habituation of the responses of the two groups.

These results differ substantially from those in experiment 2. It appears that the significance of all the stimuli in the context of anticipation of music is rather limited, resulting in relatively weak responding. This is shown by the smooth habituation curves at their asymptotic levels in both groups (Figure VII.4.). The reason behind this may be that, despite the intended "arousing" properties of the music, its effect was in fact to reassure the subjects; since their anticipation was of something innocuous, it may have inhibited sources of anxiety including those associated with internalized questions and apprehensions in psychological experiments (Orne, 1962). It should, perhaps, be added that the earphones worn by the subjects reduced the level of the background noise from the PDP computer and might have further contributed to the relaxation of the subjects which was confirmed in informal interviews with them.

GENERAL DISCUSSION OF EXPERIMENTS 3, 4, AND 5

The outcome of the experiments is that words denoting common fears in a student population evoke larger ORs in threatened students who report no such fears than do neutral words; these responses also take longer to habituate.

The results cannot be interpreted in terms of general salience or fear for the phobic stimuli as the salience of the stimuli has been relatively adequately controlled for by the matching of the phobic with the neutral stimuli (see selection of stimuli) and the subjects reported no fear of the phobic stimuli. It could be argued that the subjects were afraid of the phobic stimuli but failed to admit their fears when filling in the FSS. However, it would be reasonable to expect that, were this true, it would have been reflected in the post-experimental self-report data as the subjects were made anxious by the threat of shock and being thus overly alert to stimuli associated with danger (e.g. Aaron Beck, 1976) they would recognize and at least some of them would report their fears. Instead, both pre- and post-experimentally subjects reported no fear of the phobic stimuli.

Larger ORs to words denoting common fears were not found when music was substituted for threat of shock. It is possible that the effects of state of the subject and the stimulus content will only be additive if they are of the same sort, i.e. both pleasant or both aversive. Yet another possibility is that, despite the orienting properties of personally significant pleasant stimuli, potentially threatening stimuli and states have a generally more powerful effect than non-threatening or pleasant ones.

Novelty of stimulus is not the only factor determining strength of OR, though Sokolov saw it as the primary one. In recent years a number of experimental studies and theoretical papers have suggested that stimuli are evaluated mainly for personal significance (e.g. Maltzman, 1979b, Bernstein, 1979). The present findings suggest, however, that when evaluating a stimulus for its phobic or threatening qualities, its potential for others is also taken into account.

The implication of the above is that people tend to orient vigorously to stimuli feared in the culture. These stimuli in turn are primed to be particularly effective CSs since conditioning and learning more generally are associated with vigorous ORs (chapter III). People, therefore, may tend to learn to fear stimuli which are feared in the culture and this may account for the observed convergence, i.e. selectivity in the contents of fears and phobias.

CHAPTER VIII

ORIENTING RESPONSES TO PLEASANT STIMULI

EXPERIMENT 6: Effects of threat on orienting responses to pleasant stimuli

The importance of stimulus significance and state of the subject in the elicitation of the OR were discussed in chapter III. In the preceding experiments only interaction effects of these two factors were shown by the larger and more slowly habituating ORs to phobic than neutral stimuli in threatened subjects (experiments 2 and 4). However, while these results appear amenable to an interpretation in terms of potential significance of the phobic stimuli which is expressed when the subjects' receptivity thresholds, due to threat, are lowered, it is not clear whether *any* significant, e.g. pleasant stimuli, would evoke large ORs in threatened subjects.

According to the review of literature, the term "significance" of stimulus seems to be restricted to what is of personal importance to the subject (e.g. Wingard and Maltzman, 1980). Experiment 4, however, suggested that significance may be extended beyond the personal as far as generally feared stimuli in the culture are concerned. It would be interesting therefore to investigate whether words denoting generally *pleasant* content stimuli would evoke larger ORs than neutral stimuli when subjects are under threat.

METHOD

Design

Two groups of subjects were designated as "pleasant" or "neutral" depending on the kinds of words they were tested with. The pleasant words denoted stimuli eliciting a feeling of pleasantness while the neutral words denoted relatively innocuous objects or situations and they matched the pleasant ones in terms of frequency in language, number of letters, imagery and concreteness. The Ss in the two groups were matched for sex, since there are sex differences in reporting the intensity of pleasant stimuli (Toglia and Batting, 1978) and in electrodermal activity (Montagu, 1963). In both groups the subjects were under threat of electric shock. The dependent variables were magnitude of the SRR and its habituation rate.

Subjects

Forty volunteers took part in the experiment, 22 males and 18 females. They were all first-year students from different departments of Bedford College. Their ages ranged between 18 and 26 (mean age = 19.48 years).

Selection of stimuli

Fifteen words with normative ratings for pleasantness were initially chosen from the Handbook of semantic word norms by Toglia and Batting (1978). The pleasantness ratings for all these words were above 5 (in a 7-point scale). Four of these words were each joined with another word to form phrases so that a consistency in methodologies would be maintained across experiments. Thus, instead of the single word "flowers" the phrase "picking flowers" was adopted. Subsequently an attempt was made to select neutral words which matched the pleasant ones in certain attributes. For each pleasant word one or more neutral (in the opinion of the experimenter) words were chosen from the Computational analysis of present-day American English by Kučera and Francis (1967) for having similar frequencies and consisting of similar numbers of letters as their pleasant match. For each pleasant phrase a few neutral ones were made up by the experimenter with the criteria being that they had similar frequencies in the language, consisted of approximately the same number of letters and of words of similar parts of speech as their pleasant match. In selecting all the relatively neutral stimuli attention was also paid to their imagery and concreteness so that these were similar in the pleasant and their corresponding neutral stimuli. No formal criteria were adopted for the assessment of these attributes but if words were included in the norms by Toglia and Batting their ratings were taken into account. A list of words and phrases including all the pleasant and neutral stimuli were then given to 9 judges, 5 males and 4 females, who were asked to rate them on a 7-point scale in terms of their capacity to elicit a feeling of pleasantness. The list, including the instructions to the judges and their ratings, appears in Appendix 10. Only pleasant words which were given mean pleasantness ratings above 5 with at least one of their corresponding neutral words being given mean rating around 4 were included in the final list (Appendix 11). The stimuli used in this experiment are listed in Table VIII.1.

Table VIII.1. Experiment 6: Stimulus words

Pleasant	Neutral	Number of times used
Beauty	Fashion	3
Garden	Circle	3
Kiss	Graph	5
Prize	Fiber	5
Rejoice	Compile	4

Apparatus

This was as in experiments 2 and 4.

Procedure

Subjects were allocated to pleasant or neutral groups randomly, i.e. as they were approached individually and agreed to participate in the experiment they were assigned to the two groups alternatively after being matched for sex. Basically, the experimental procedure was as in experiments 2 and 4. The stimuli each pair of subjects were presented with were decided by using a table of random numbers. In the instructions it was added: "The computer will decide when you will receive shocks - it could be at any time". This addition to the original instructions was made to ensure that subjects' expectations of shock were more uniform than in experiments 2 and 4.

Questionnaires

Instead of questionnaire "A", questionnaire "C" (Appendix 14) was given and asked subjects to rate stimuli for their pleasantness on a 5-point scale. Questionnaire "F" was also administered.

RESULTS

A group x sex (2x2) ANOVA was carried out on raw maximal responses. No significant differences between groups or sexes were found, hence range correction of the responses is justified. A summary of the analysis on maximal responses appears in Table VIII.2.

Table VIII.2. Experiment 6: Analysis of variance of maximal responses

Source	SS	d.f.	Mean square	F	P
Groups	7460641*	1	7460641	0.671	n.s.
Sex	134365	1	134365	0.012	n.s.
Groups x sex	19004973	1	19004973	1.709	n.s.
Subjects within groups	400235369	36	11117649		

*The figures, except the F-values, have been rounded up by computer

The mean range-corrected SRRs to stimuli in the two groups as a function of trials appear in Figure VIII.1.

A group x sex x trials (2x2x12) split-plot ANOVA was carried out on the response magnitudes (Table VIII.3). There were no significant differences in the ORs between the groups. Although the trials effect was not statistically significant both groups showed a reliable habituation effect as indicated by the linear ($F = 7.09$, d.f. = 1,396, $p < 0.01$) and quadratic ($F = 6.80$, d.f. = 1,396, $p < 0.01$) components of the trials effect. The two groups did not differ in terms of habituation when measured by the rate of decrease of responses, as indicated by the lack of significance of the groups x trials interaction. The sex of the subjects as a factor was not statistically significant and the same was true for the group x sex interaction. Although the overall trials x sex interaction was not statistically significant its quadratic component was so ($F = 5.85$, d.f. = 1.396, $p < 0.05$). Separate ANOVAs for the sexes appear in Tables VIII.4 and VIII.5. Given that the trends of responses are downward, that there is no overall sex effect and that the males showed significant linear trend over trials ($F = 4.92$, d.f. = 1,220, $p < 0.05$) while females did not, it seems that females approached an asymptote at a higher level than males. On the other hand, the significant linear component of the trials x groups x sex interaction in the overall analysis ($F = 7.01$, d.f. = 1,396, $p < 0.01$) is accounted for by the significant linear trend in the trials x groups interaction observed only in males ($F = 6.63$, d.f. = 1,220, $p < 0.05$) and this is due to enhanced responding of males in the pleasant group in the last few trials (Figure VIII.2).

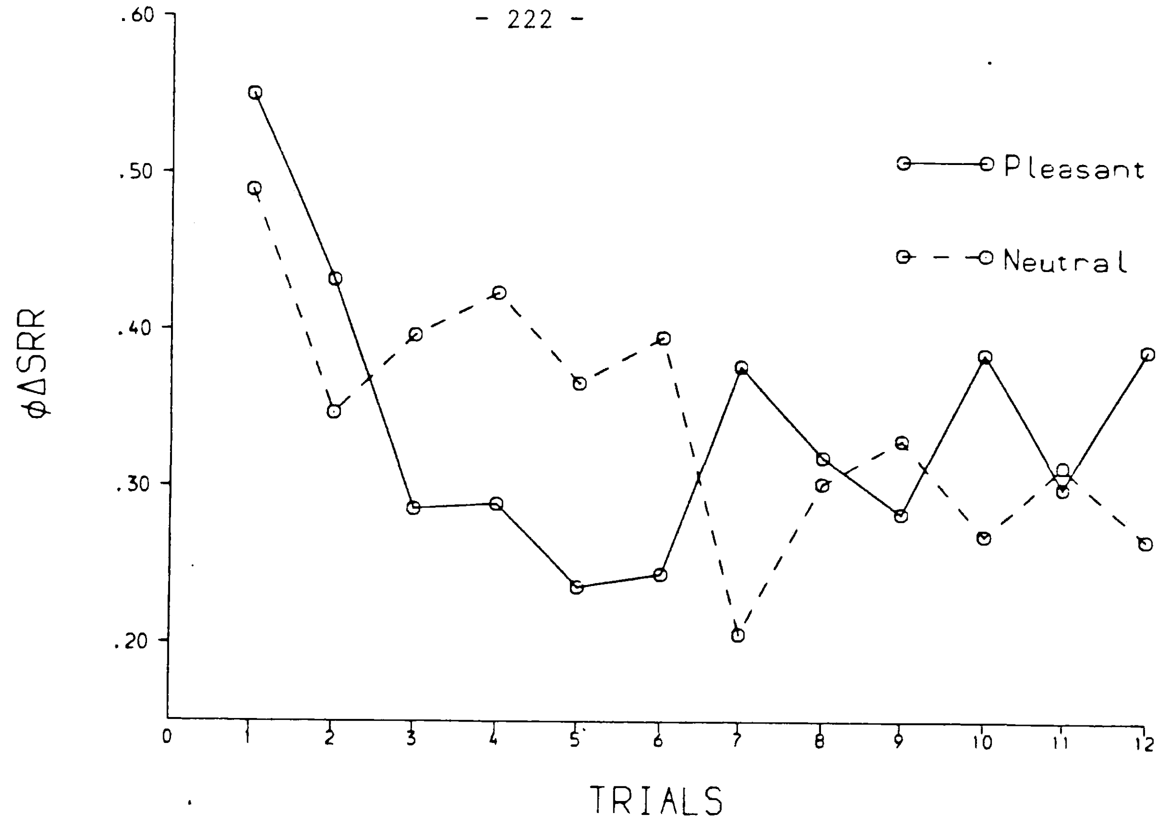

Figure VIII.1. Experiment 6: Mean habituation curves for the groups presented with pleasant and neutral stimuli (N=40)

Table VIII.3. Experiment 6: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	0.000	1	0.000	0.001	n.s.
Sex	0.001	1	0.001	0.004	n.s.
Groups x sex	0.291	1	0.291	1.246	n.s.
Subjects within groups	8.398	36	0.233		
Trials	1.704	11	0.155	1.540	n.s.
Linear trend	0.714	1	0.714	7.093	<0.01
Quadratic trend	0.684	1	0.684	6.797	<0.01
Trials x groups	1.419	11	0.129	1.282	n.s.
Linear trend	0.117	1	0.117	1.162	n.s.
Quadratic trend	0.254	1	0.254	2.530	n.s.
Trials x sex	1.504	11	0.137	1.359	n.s.
Linear trend	0.013	1	0.013	0.132	n.s.
Quadratic trend	0.588	1	0.588	5.846	<0.05
Trials x groups x sex	1.969	11	0.179	1.779	n.s.
Linear trend	0.705	1	0.705	7.006	<0.01
Quadratic trend	0.076	1	0.076	0.755	n.s.
Trials x subjects within groups	39.845	396	0.101		

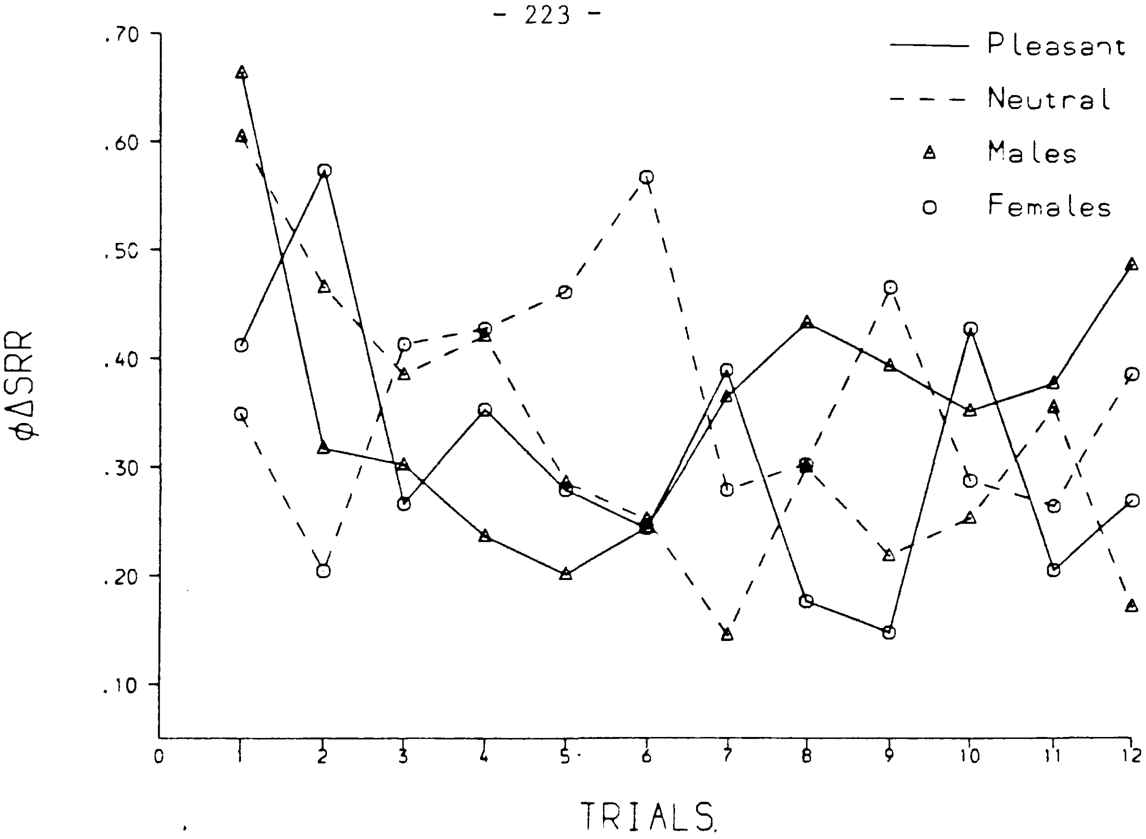

Figure VIII.2. Experiment 6: Mean habituation curves for males (N=22) and females (N=18) presented with pleasant and neutral stimuli

Table VIII.4. Experiment 6: Analysis of variance of response magnitudes for males

Source	SS	d.f.	Mean square	F	P
Groups	0.123	1	0.123	0.617	n.s.
Subjects within groups	3.985	20	0.199		
Trials	2.589	11	0.235	2.340	<0.01
Linear trend	0.495	1	0.495	4.924	<0.05
Quadratic trend	1.272	1	1.272	12.646	<0.01
Trials x groups	1.426	11	0.130	1.289	n.s.
Linear trend	0.667	1	0.667	6.633	<0.05
Quadratic trend	0.036	1	0.036	0.356	n.s.
Trials x subjects within groups	22.128	220	0.101		

Table VIII.5. Experiment 6: Analysis of variance of response magnitudes for females

Source	SS	d.f.	Mean square	F	P
Groups	0.168	1	0.168	0.609	n.s.
Subjects within groups	4.413	16	0.276		
Trials	0.620	11	0.056	0.560	n.s.
Linear trend	0.232	1	0.232	2.301	n.s.
Quadratic trend	0.000	1	0.000	0.002	n.s.
Trials x groups	1.962	11	0.178	1.772	n.s.
Linear trend	0.155	1	0.155	1.537	n.s.
Quadratic trend	0.295	1	0.295	2.927	n.s.
Trials x subjects within groups	17.717	176	0.101		

The habituations of responses of the two groups as measured by the number of trials to reach three successive zero responses were not found to be significantly different as indicated by a Wilcoxon matched-pairs signed-ranks test. With this criterion the mean habituation rates of the pleasant and neutral groups were 8.75 (S.D. = 4.41) and 9.2 (S.D. = 4.12) respectively. A Mann-Whitney test on the differences in the number of trials to the habituation criterion of the matched subjects and between males and females showed no significant differences in habituation between the sexes (Z = 0.76, corrected for ties).

Inspection of the subjects' ratings of stimuli for their pleasantness (Table VIII.6) suggests no differences between the two groups. It also appears that the large majority of subjects were tested with stimuli appropriate to the experimental condition in which they were assigned.

Responses to questionnaire "F" indicated that all subjects saw all the stimuli in all trials. The anticipations of shock in the two groups (Table VIII.7) were very similar and only 2 subjects from each group reported no anticipation of shock at any stage of the experiment. The majority of subjects anticipated shock throughout the experiment, i.e. either "continuously" or "intermittently" rather than only at certain stages of the experiment. The descriptions of the latter were somewhat different in the two groups in the sense that substantially more subjects in the neutral group appear to have experienced the experiment as "anxiety provoking" than subjects in the pleasant group.

A chi-squared test, however, did not produce significant evidence of an association between the type of stimuli with which each group was administered and the experiment being described as "anxiety provoking" ($x^2 = 2.74$).

Table VIII.6. Experiment 6: Ratings of stimuli post-experimentally

Groups of subjects and type of stimulus	Not at all	A little	A fair amount	Much	Very much
PLEASANT group					
Pleasant stimulus	0	3	11	4	2
Neutral stimulus	13	4	1	1	1
NEUTRAL group					
Pleasant stimulus	1	0	8	10	1
Neutral stimulus	14	4	0	1	1

Table VIII.7. Experiment 6: Summary of reported anticipations of shock and descriptions of experiment

PLEASANT group				NEUTRAL group			
Anticipation of shock		Description of experiment		Anticipation of shock		Description of experiment	
Continuous	3	Anxiety provoking	4	Continuous	1	Anxiety provoking	10*
Intermittent	10	Interesting	2	Intermittent	12	Interesting	4*
Only at the beginning	1	Boring	6*	Only at the beginning	2	Boring	2*
Only in the middle	3	Puzzling	8	Only in the middle	1	Puzzling	11*
Only at the end	0	"Tiring" (Description generated by subject)	1*	Only at the end	0		
Only when words appeared	1			Only when words appeared	2		
No anticipation	2			No anticipation	2		
Experienced "shock"	0			Experienced "shock"	0		

*Included are subjects who gave more than one description

DISCUSSION

The results show that the ORs of threatened subjects to pleasant vs. neutral stimuli are not significantly different.

Interestingly, unlike the findings in the previous experiments, no significant trials effect was observed. This suggests there was no substantial reduction in the magnitudes of responses during the habituation training and it may be related to the modified instructions given to the subjects, i.e. that the computer alone would "decide" when shocks would be delivered. That is, the instructions introduced an element of increased unpredictability regarding the occurrence of shock and consequently the arousal of the subjects might have been sustained at high levels throughout the experiment. However, this is not entirely supported by the reported anticipations of shock (Table VIII.7) which, on the whole, were similar to those in experiments 2 and 4. It may also be related to the fact that the subjects were relatively naive as far as psychological experiments are concerned (they were all first year students) and experimental stress due to unfamiliarity with laboratories and experimental procedures (Venables and Christie, 1973) combined with the threat of shock might have kept their arousal at high levels throughout the experiment.

Figure VIII.1 shows some sensitization effects in different parts of the experiment and with respect to different types of stimuli. That is, there is an increase in response magnitude in the first few trials in the neutral group and a similar increase in the last few trials in the pleasant group. The "dual-process" theory of habituation (chapter III) assumes that repeated stimulation results in the development of two independent processes in the nervous system, i.e. habituation and sensitization and it has been shown that an incremental process (sensitization) may appear in habituation training before the onset of habituation when the stimulus is of moderate to strong intensity (e.g. Thompson, Groves, Teyler and Roemer, 1973). The results of the present experiment, however, are not amenable to a "dual-process" interpretation as it cannot be assumed that the neutral stimuli were "intense" and the pleasant stimuli were not so as to result in different patterns of habituation/sensitization processes. Before attempting alternative interpretations it should be pointed out that Figure VIII.2 suggests different effects in females and males in relation to stimulus content and stage of the experiment and indeed these are the effects reflected in the overall differences (Figure VIII.1). However, only the males showed a significant linear component of their trials x group interaction (i.e. produced significantly larger responses to pleasant stimuli in the latter part of the experiment) and therefore this result deserves special attention. It may be argued that the pattern of responding of the male subjects suggests that initially their responses were ORs which subsequently were transformed into defensive responses (DRs). Sokolov (1963) stated that the OR precedes other kinds of responses, i.e. adaptive and DRs, but after a few trials only the "appropriate" responses to the stimuli (adaptive/defensive) remain (see chapter III). It is hard to see, however, how DRs to pleasant stimuli could be observed since such responses are supposed to be elicited by intense stimuli. Nevertheless, the need for other physiological indices, e.g. vasomotor measures, becomes now apparent as on the basis of the available electrodermal data no conclusive statements about the nature of these responses can be made.

The responses of the males may suggest that prolonged administration of pleasant stimuli in the context of threat may, in the end, elicit their significance indicated by normative data and this may be manifested by vigorous ORs. Alternatively, it is possible that such prolonged stimulation results in the realization of the discrepancy of expectations (conflict) in the subject (pleasant stimulus vs. threat of shock) which may be responsible for the elicitation of large ORs. Either of these possibilities is unlikely to facilitate learning and therefore acquisition of phobic responses associated with these stimuli. Indeed, as large responses appeared only after several stimulations were given, they may impede learning. For normal conditioning the appearance of OR is indispensable but it is expected to habituate after it increased the excitation level of the cortex up to an optimal level for the formation of CRs. The appearance of vigorous ORs or, perhaps, DRs in the latter part of this experiment is hardly conducive to creating optimal conditions for learning. Finally, it may be added that it is not at all clear why the discussed differences in the responses to neutral and pleasant stimuli were observed only amongst males and therefore it remains subject to speculation why males should, for example, be more aroused or in conflict than females to produce the results they did. This is particularly so since analysis of responses to questionnaire "F" by sex revealed no substantial differences between males and females.

Recapitulating, the experiment suggests that lowering the receptivity and responsivity threshold by threat does not generally enhance ORs to pleasant stimuli. That is, unlike potentially phobic stimuli, pleasant ones, though apparently significant in the culture, do not evoke significantly different ORs to neutral stimuli. The implication of this is that the potentiating effect of threat of shock on ORs is not non-specific and specifically relates to whether a stimulus is known to the subject, directly or indirectly, to be associated with fear.

EXPERIMENT 7: Effects of anticipation of a pleasant event on orienting responses to pleasant stimuli

Experiments 4 and 6 suggested that, unlike phobic, pleasant stimuli though important in the culture do not generally evoke different ORs in threatened subjects to those elicited by neutral stimuli. A further consideration is whether the state, if it is to act additively with the effects of the stimuli, must be appropriate, i.e. unpleasant with potentially phobic stimuli and pleasant with pleasant stimuli (see General discussion of experiments 3, 4, and 5). There may be a kind of "belongingness" between a subject's state/anticipations and his responses to a particular type of stimulus. Would subjects, for example, behave similarly to those in experiments 2 and 4 were they to anticipate a relatively pleasant event and being presented with pleasant stimulus?

Additionally, it was earlier suggested that the results of experiment 4 could have been due to conflict of expectations at different stages of the experiment. That is, the disparity between threat of shock and neutral stimulus (as the two are presumably not closely associated) resulted in a conflict situation and produced large responses at the beginning of the experiment; no realization of the threat, on the other hand, lowered its expectation which now became congruent with the neutral content of the stimulus and resulted in weak responses. The reverse order of expectations during the experiment, it was suggested, could account for the significantly different responses in the phobic group. Also, in experiment 6 the relatively large responses of the males in the pleasant group could have been related to some conflict of expectations (pleasant stimulus vs. threat of shock) though, perhaps, of a different kind due to the modified instructions given in this experiment.

To elucidate these points, the final experiment was undertaken in which pleasant and neutral stimuli were presented while the subjects anticipated music. If the observed effect in experiment 4 was due to a kind of a general belongingness between the state of the subject and type of stimulus, pleasant stimuli will evoke larger ORs than neutral stimuli when the subjects anticipate music. If the results of experiment 4 were due to some conflict of expectations at different stages of the experiment, the subjects in the pleasant group will show relatively large ORs in the latter part of the experiment.

Since the interpretation of experiment 4 is more important than the equivocal result of experiment 6, the instructions in this experiment were given as in experiment 4, i.e. without telling subjects that the computer would "decide" when they would hear music.

METHOD

Design

This was as in experiment 6 except that the subjects anticipated, instead of shock, pleasantly arousing music.

Subjects

Forty Bedford College student volunteers took part, 20 males and 20 females. They were all first-year students with their ages ranging between 18 and 26 (mean age = 19.42 years).

Selection of stimuli

These were drawn from the list prepared for experiment 6 and appear on Table VIII.8.

Table VIII.8. Experiment 7: Stimulus words

Pleasant	Neutral	Number of times used
Beauty	Fashion	3
Garden	Circle	3
Kiss	Graph	3
Liberty	Safety	1
Prize	Fiber	3
Rejoice	Compile	5
Success	Regard	2

Apparatus

This was as in experiment 5.

Procedure

This was as in experiment 6 with the appropriate modifications regarding the presentation of music as discussed in experiment 5.

Questionnaires

These were as in experiment 6 but instead of questionnaire "F", questionnaire "G" was given.

RESULTS

A group x sex (2x2) ANOVA was carried out on raw maximal responses. No significant differences between groups or sexes were found, hence range correction of the responses is justified. A summary of the analysis on maximal responses appears in Table VIII.9.

Table VIII.9. Experiment 7: Analysis of variance of maximal responses

Source	SS	d.f.	Mean square	F	P
Groups	473498	1	473498	0.035	n.s.
Sex	23110080	1	23110080	1.718	n.s.
Group x sex	3688133	1	3688133	0.274	n.s.
Subjects within groups	484342734	36	13453965		

The mean range-corrected SRRs to stimuli in the two groups, as a function of trials, appear in Figure VIII.3.

A group x sex x trials (2x2x12) split-plot ANOVA was carried out. The two groups were not found to be significantly different. There was also no significant sex effect. There was, however, a significant trials effect ($F = 6.684$, d.f. = 11,396, $p < 0.01$). Both groups showed a reliable habituation effect as indicated by the linear ($F = 13.67$, d.f. = 1,396, $p < 0.01$) and quadratic ($F = 23.51$, d.f. = 1,396, $p < 0.01$) components of the trials effect. The two groups did not differ in terms of the rates of decrease of responses, indicated by a nonsignificant groups x trials interaction. A summary of the ANOVA appears in Table VIII.10.

The habituations of responses of the two groups as measured by the number of trials to reach three successive zero responses were not found to be significantly different, as indicated by a Wilcoxon matched-pairs signed-ranks test. With this criterion the mean habituation rates of the pleasant and neutral groups were 6.35 (S.D. = 5.16) and 7.65 (S.D. = 4.96) trials respectively. A Mann-Whitney test on the

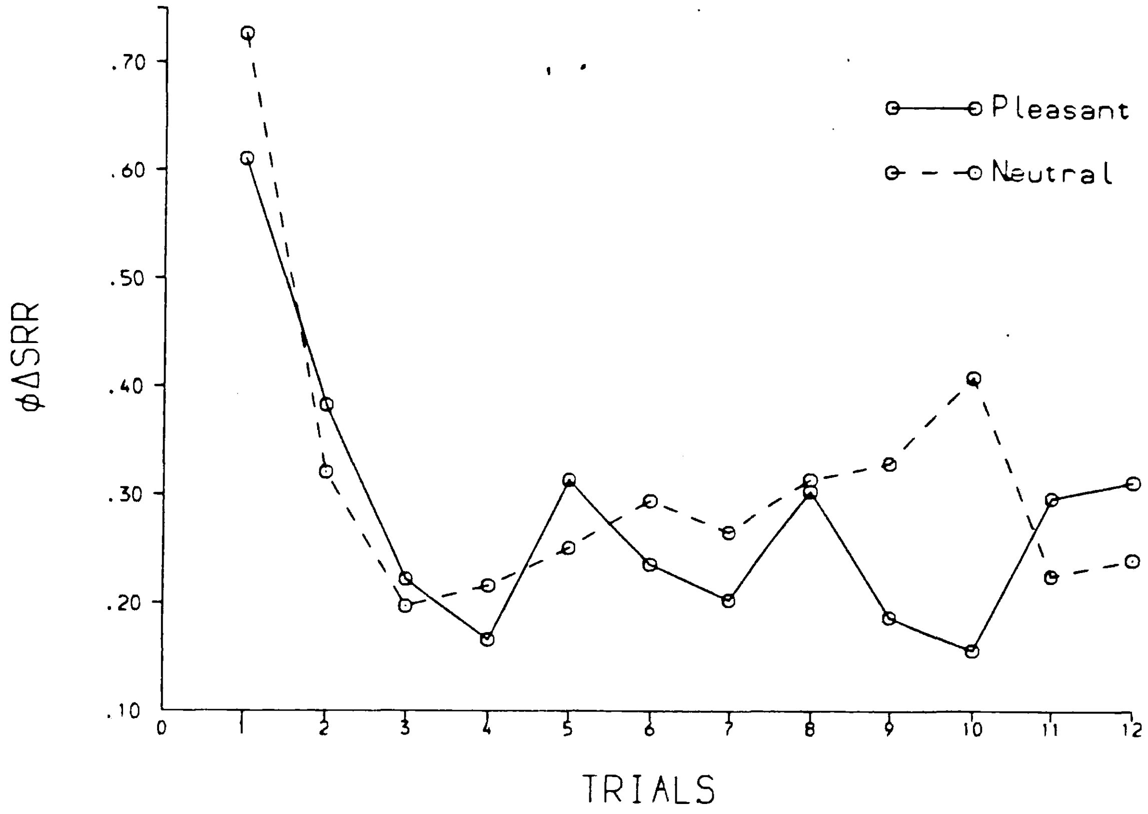

Figure VIII.3. Experiment 7: Mean habituation curves for the groups presented with pleasant and neutral stimuli (N=40)

Table VIII.10. Experiment 7: Analysis of variance of response magnitudes

Source	SS	d.f.	Mean square	F	P
Groups	0.134	1	0.134	0.544	n.s.
Sex	0.263	1	0.263	1.063	n.s.
Groups x sex	0.018	1	0.018	0.073	n.s.
Trials	6.721	11	0.611	6.684	<0.01
Linear trend	1.250	1	1.250	13.675	<0.01
Quadratic trend	2.149	1	2.149	23.510	<0.01
Trials x groups	1.136	11	0.103	1.130	n.s.
Linear trend	0.004	1	0.004	0.045	n.s.
Quadratic trend	0.038	1	0.038	0.411	n.s.
Trials x sex	1.021	11	0.093	1.015	n.s.
Linear trend	0.012	1	0.012	0.134	n.s.
Quadratic trend	0.086	1	0.086	0.943	n.s.
Trials x groups x sex	1.504	11	0.137	1.496	n.s.
Linear trend	0.164	1	0.164	1.797	n.s.
Quadratic trend	0.048	1	0.048	0.526	n.s.
Trials x subjects within groups	36.199	396	0.091		

differences in the number of trials to the habituation criterion of the matched subjects and between males and females showed no significant differences in habituation between the sexes (z = -0.04, corrected for ties). There were also similar ratings of pleasantness of the stimuli in the two groups which were tested with stimuli appropriate to the experimental condition in which they were assigned (Table VIII.11).

Responses to questionnaire "G" indicated all subjects saw all the stimuli in all trials and the anticipations of music were similar in the two groups with the majority of subjects anticipating music throughout the experiment, i.e. either "continuously" or "intermittently" (Table VIII.12). The descriptions of the experiment were also similar in the two groups except that substantially more subjects in the pleasant than neutral groups described it as "puzzling". A chi-squared test indicated no significance should be attached to this apparent difference (x^2 = 1.84).

Table VIII.11. Experiment 7: Ratings of stimuli post-experimentally

Groups of subjects and type of stimulus	Not at all	A little	A fair amount	Much	Very much
PLEASANT group					
Pleasant stimulus	0	2	9	7	2
Neutral stimulus	10	8	1	0	1
NEUTRAL group					
Pleasant stimulus	0	2	5	9	4
Neutral stimulus	11	7	1	0	1

Table VIII.12. Experiment 7: Summary of reported anticipations of music and descriptions of experiment

PLEASANT group				NEUTRAL group			
Anticipation of music		Description of experiment		Anticipation of music		Description of experiment	
Continuous	2	Anxiety provoking	1*	Continuous	4	Anxiety provoking	3
Intermittent	12*	Interesting	3*	Intermittent	10	Interesting	2
Only at the beginning	3	Boring	4*	Only at the beginning	3	Boring	6
Only in the middle	0	Puzzling	16*	Only in the middle	2	Puzzling	11
Only at the end	1			Only at the end	0	"Relaxing" (Description generated by subject)	1
Only when words appeared	1*			Only when words appeared	0		
No anticipation	2			No anticipation	1		

*Included are subjects who gave more than one description

DISCUSSION

The results showed no significant differences between the responses to pleasant and neutral stimuli. It can thus be concluded that there is no general "belongingness" (Thorndike, 1935) between states of subjects and reactivity to stimuli "appropriate" to those states. Rather, it appears that large and slowly habituating ORs are limited to potentially phobic stimuli presented in the context of states associated with anticipated threat. This may indeed be an adaptive way of responding to environmental stimuli, i.e. vigorously orienting only when the subject encounters a potential danger and knows the environment to be hostile and unpredictable and not responding indiscriminately across stimuli and states.

It is also apparent from the present results that it is unlikely that the observed vigorous ORs to phobic stimuli in experiment 4 were due to conflict of expectations of the subjects regarding the occurence of shock. It is reasonable to assume that if the effect was due to such expectations a similar pattern of responding would have been suggested in this experiment with pleasant stimuli evoking larger ORs in the latter part of the experiment, i.e. when music failed to be presented. This is also supported by the subjective reports of subjects in the experiments indicating that anticipation of shock/music was not contingent with the appearance of a stimulus on the computer screen.

CHAPTER IX

GENERAL DISCUSSION OF THE EXPERIMENTS AND CONCLUSIONS

1 THE RESULTS IN THE CONTEXT OF THE OR LITERATURE

The experiments suggest that past experience influences the ORs to stimuli associated with personal and others' fears. While this is an obvious inference to make on the basis of the data, their interpretation within the context of the OR literature is far from straightforward.

Generally, the results supported the "significance hypothesis" (chapter III, section 7) as the magnitudes of the SRRs and their habituation appeared to reflect stimulus significance deduced from self-reports and normative data on contents of fears. If stimulus uncertainty or novelty were the primary factors determining the elicitation of the OR (traditional view) there should have been similar responses to phobic and neutral stimuli as these were matched for novelty and other attributes related to their salience. However, the experiments also suggested that significance of a stimulus should not be taken to be a fixed characteristic of a stimulus which reflexively evokes vigorous responses and that the OR is an even more flexible mechanism than that purported in the most "up-to-date" model of this reflex by Öhman (1979b - see chapter III, section 8).

According to Öhman, preattentive mechanisms carry out automatic and relatively complete identification of the stimulus which is extended beyond its physical characteristics to complex ones, including its meaning. He supported his thesis by citing evidence from shadowing studies which have shown that stimuli arriving at the unattended channel are relatively completely processed; one's name, for example, is easily detected and meaning of words at the unattended channel affects the meaning of those arriving at the attended channel (Moray, 1959; Lewis, 1970; McKay, 1973). Only if preattentive processes fail to handle a stimulus on their own (i.e. if they cannot find a matching representation of a stimulus in the STS (short-term store) or when a stimulus matches a memory representation defined as significant) is the "central channel" called upon, i.e. an OR is elicited. Large and slowly habituating ORs to phobic stimuli seem to have been related to significant memories in the STS retrieved from the LTS (long-term store). However, since only in a state of threat these memories resulted in large ORs (experiments 2 and 4), it may be assumed that either arousal due to threat facilitated the identification and transfer of the significant meanings of the phobic stimuli from the LTS to STS or that significant aspects of the phobic stimui were available in the STS in all experiments using phobic stimuli but only lowering of the threshold of responding by threat could produce large ORs to these stimuli (which were not of great personal significance to the subjects). Apart from the phobic stimuli in experiments 2 and 4, it was shown that in the context of threat pleasant stimuli may also elicit larger responses than neutral stimuli, at least in male subjects and in the latter part of the habituation training (experiment 6). In contrast, the significance of phobic and pleasant stimuli while subjects anticipated music (experiments 5 and 7) was apparently "damped". If the results were to be accounted for by Öhman's model, this should provide ways in which different stimuli interact with different states of subjects but before any such elaboration could take place a great deal of research would be needed in which stimuli and states of subjects are systematically manipulated. It may be pointed out that Öhman (1979b) did refer to the "context" of stimuli as an important variable. He wrote that learning even for a single stimulus is associative and results in propositions of the type "Stimulus A with characteristics Q, R, and S, occurs in context X" (p. 451). That is, during learning, memory representations may be integrated with the content of the STS so that they can later be contextually retrieved from the LTS to the STS. This, however, is a generalization that cannot readily be applied here. One needs to know what constitutes "context" (e.g. physical environment/state of subject) and how it operates in different situations (e.g. pleasant/unpleasant) and with respect to different types of stimuli.

The notion that significant stimuli may be selected for attention and higher processing depending on their meaning in different contexts has been also mentioned by other authors. Bernstein (1979), for example, talked of a biased scanning toward the detection of significant stimuli which varies and interacts with state factors or appreciation of the current field and anticipation of subsequent possible developments within it. The occasional failures to find higher orienting to fear-relevant stimuli (e.g. Hare, 1973; Prigatano and Johnson, 1974) should not therefore be surprising; that is, these stimuli, like the phobic ones in experiments 1, 3 and 5 (above), were probably perceived as insignificant within the experimental conditions in which they were presented and produced no different ORs to those elicited by neutral stimuli.

Perhaps, the results should also be examined in relation to the "dominant focus" or "dominant" concept (Maltzman, 1979a, 1979b). As discussed earlier (chapter III, section 7), Maltzman argued for an intimate relationship between dominant foci and OR, between mental sets and attention. The instructions given to the subjects in experiments 2 and 4 might have established dominant foci for the occurrence of shock and when subjects were presented with phobic words (the content of which is also aversive) large ORs were evoked. Maltzman (1979b) wrote that "a dominant focus established by instructions persists for a time, directs thinking, selectively influences the processing of information and leads to the occurrence of ORs when the significant stimuli exciting the dominant focus are presented" (p. 345). However, there are problems with this interpretation. First, it seems far fetched to assume that a dominant for shock (physical pain) can also serve as focus of excitability for stimuli such as "speaking in public" and "being ignored". Second, if such an interpretation were correct we should have observed analogous results when pleasant stimuli were presented while subjects anticipated pleasant stimulation, i.e. music (experiment 7).

Another question which arises is whether the EDRs to phobic stimuli represented attention or emotional excitement. As discussed earlier (chapter VI), there are grounds for considering the EDR as predominantly reflecting orienting behaviour. However, no unequivocal answer to this problem can be given in the context of the data here (see also section 4 below). It may be pointed out that the two alternative interpretations of the EDR have been given from the very beginning of research with this as well as other autonomic components (e.g. Pillsbury, 1908; Woodworth, 1938). Maltzman (1979b) wrote that "both interpretations are probably correct. Emotional and attentional interpretations are not in conflict. An OR reflected as a GSR is manifested in diverse and widespread central and peripheral somatic and autonomic changes. All of these have been used to designate emotional states (Young, 1973) and in intense form may characterize

Cannon's (1929) emergency reaction. It simply means that orienting or attention, affect, and thinking are intimately related, a situation that Wundt (1897) long ago noted. These are not isolated processes but interact in the subtle and complex ways characteristic of human goal-directed behavior ..." (pp. 332-3).

On the other hand, Öhman's (1979b) model of the OR assumes that this reflex denotes a "call" initiating processing in a central channel. It is pointed out that although the EDR may be identified with the call it may also be affected by processing in the central channel itself (see chapter III, section 8). That is, "it may reflect not only the call but also part of the answer to the call" (Öhman, 1979b, p. 454). It is noted that there were significantly larger maximal ORs to phobic than neutral stimuli only in experiment 1. This finding may reflect what Öhman called "part of the answer to the call" and which (answer) was more unequivocal than in the responses to phobic stimuli in experiment 4 where no difference in maximal responses to phobic and neutral stimuli were found. This becomes intelligible if one considers that in experiment 2 the phobic words denoted stimuli the subjects reported as feared by themselves while in experiment 4 the phobic words denoted fears of others.

Before closing this section, another observation may be made. In experiments 3, 4 and 5 the phobic stimuli had incompatible meanings for the subjects who reported them as feared by the population at large but not by themselves. This was not the case with the pleasant stimuli in experiments 6 and 7. It is arguable that the outcome of experiment 4 was partly due to this conflict in meanings of the stimuli which was manifested when the subjects' responsivity threshold was lowered by the threat of shock. In other words, the large ORs to phobic stimuli were associated with antagonistic kinds of information of the stimuli (Berlyne, 1960, 1961) rather than with their fear-relevance. This can be pursued by experimenting with, for example, stimuli which are not fear-relevant but nevertheless subjects' attitudes towards them are different to those of the population at large. The work on experimental neurosis in conflict situations (e.g. Wolpe, 1958) as well as Freud's (1926) notion that objects which become phobic are stimuli which prior to symptom formation arouse ambivalent feelings may be relevant in this type of investigation. Frazier and Carr (1967) wrote: "... the phobia generally evolves around things or situations that either directly or symbolically represent a source of earlier satisfaction and attraction as well as of threat, in fantasy if not in actuality" (p. 903). It may be, however, that phobias are not based exclusively on ambivalent feelings and they may be more generally formed around objects which are related to discrepant kinds of information.

2 THE MEANING AND IMPLICATIONS OF THE RESULTS

Large and slowly habituating ORs are associated with efficient learning and specifically classical conditioning (e.g. Öhman and Bohlin, 1973; Öhman, 1979b). As the phobic stimuli elicited vigorous responses in experiments 2 and 4, it is reasonable to assume that people under threat may develop fears of these stimuli. This is in accord with clinical evidence suggesting that phobias are formed when the future is perceived as threatening and unpredictable (e.g. Rachman, 1974), a situation that can be clearly observed in phobia acquisition in children. In their immediate premorbid history, there is a period of uncertainty, restlessness, "naughtiness", etc., i.e. a state which could be described as "objectless anxiety" (James Anthony, 1975). Then an incident, i.e. some "conditioning" experience occurs, for example the fall of the horse in the case of Little Hans (Freud, 1909) and the phobia becomes established. However, an important element in this and other cases is that the stimuli involved are not random or "neutral" and they are somehow related to past experiences of the person concerned. Little Hans, for example, (who was "naughty" and anxious prior to the manifestation of his phobia of horses) had been told that horses bite, i.e. an element of fear might have been present before the accident (fall of the horse). It may also be pointed out that the child felt sorry and got upset when he saw horses being beaten and therefore his feelings towards these animals were "ambivalent" (see Frazier and Carr, 1967, above).

On the other hand, the experimental data here suggest that people may show vigorous orienting not only to stimuli they fear but also to stimuli they do not fear and know them to be feared by other people. This suggests a kind of a special "social" or "collective consciousness" postulated by Russian psychologists (Razram, 1961). It is similarly in agreement with Berlyne's (1960) observation that in adult human beings learning (including, presumably, knowledge passed through communication with others) plays a major role in determining which conditions will elicit ORs.

The implication of the above is that selectivity in phobic objects may have a cultural basis and there may be no need to invoke evolutionary notions to explain it. Despite the difficulties in deciding what has/has not evolutionary significance (see chapter I, section 5.3), it may be relatively safely assumed that items such as "being ignored" and "speaking in public" are unlikely to have the evolutionary significance purported for, for example, heights. Nevertheless, it may be argued that these situations do have evolutionary implications since social fears can be seen as leading to social disapproval and social isolation. The latter is probably as effective as, for example, falls from high points in preventing people from passing on their genes. However, it may not be possible to conceive of experiments to determine conclusively "ultimate" (Alcock, 1975) causes of selectivity, i.e. to what extent breeding success has been influenced by behaviour towards commonly feared objects or situations (Kartsounis and Pickersgill, 1981). On the other hand, given the important influences of cognition on human behaviour, (chapter III) the study of "proximate" causes is not only more meaningful but it also relates to the observed differences in fears between cultures (e.g. Wittkower and Dubreuil, 1971), subcultures (e.g. Nalven, 1970) and the flexibility in fear content more generally (see chapter II).

The fact that knowledge of what others fear may influence the responses of (threatened) subjects not personally sensitive to these fears questions the usefulness of the biological preparedness concept more generally. This is because that even fears which may ultimately have an evolutionary basis become, through their manifestation, common knowledge and presumably affect the responses of people sharing this knowledge. Thus, it could be argued that the findings of Öhman and his colleagues (chapter I) may be accounted for by sociocultural (proximate) influences rather than phylogenetic (ultimate) causes and a concept of "experiential" preparedness may be more useful than the concept of biological preparedness as, at least in humans, the "biological" can be subsumed under and greatly modified by the "experiential".

However, further experiments will be needed to confirm whether, like phobias, fear responses to phobic stimuli in the culture are easily acquired, resistant to extinction and not readily modified by instructions. Such an investigation could adopt Öhman's methodology, i.e. a differential classical conditioning of the EDR which can serve as a model of phobias (Öhman, 1979a). This work should be extended to different cultures so that the valencies of stimuli to become associated with phobias in different cultures can be compared and, strictly speaking, only then one could claim determination of the content of phobias by cultural factors. In a similar line of research the habituability and conditionability of children of different ages to potentially phobic stimuli could be investigated. Young children are not readily influenced by socially important stimuli and only gradually they become receptive to sociocultural influences (cf. Campbell and Coulter, 1976 - see chapter II).

Classical conditioning is not the only mechanism through which phobias may be established. It was frequently suggested in the past that observational learning is also a potent mechanism (e.g. Marks, 1969; Rachman, 1977, 1978a). However, both classical and vicarious conditioning are governed by the same principle of associative learning as the observer's emotions may become conditioned through contiguous association to previously "neutral" stimuli (Bandura and Rosenthal, 1966), and the OR may thus be of central importance to vicarious as it is to classical conditioning.

Rachman (1977) wrote of the possibility of fear acquisition through "informational and instructional processes" which, he argued, may provide "the basis for most of our commonly encountered fears of everyday life" (p. 384). Carr (1979) similarly stated: "There is little doubt that the transmission of certain types of information, particularly about pain or harm, can produce persistent fears" but, he continued, "it would be more appropriate to emphasize the subject's acceptance of information ..." (p. 223). It may be added that the "acceptance" of information must be related to attention a stimulus receives by a subject and therefore to the OR it elicits.

The model of phobic reactions proposed by Lader and Mathews (1968) assumes similarity between the physiological components of the OR and phobic responses and suggests that, in individuals with relatively high levels of physiological arousal, stimuli of "low intensity" may not increase their arousal above a "critical level" but stimuli of "moderate arousing properties" would do so and if such stimuli occur frequently "the possibility of positive feed-back taking place may be assumed to be high (level of arousal becomes higher with each successive stimulation) thus producing a panic attack" (p. 414). In such situations the habituation is "slow or non-existent" (p. 413) and takes the features of phobic anxiety. This description may be equally applicable here (threatened subjects are assumed to be highly aroused) but the stimulus content rather than its intensity is the variable which may result in arousal above a critical level.

One may speculate that fears and phobias develop in yet another way. Mandler (1975) suggested that autonomic responses themselves initiate and support further evaluation of a stimulus. Pribram and McGuiness (1975) wrote that the OR components are related to registration of the stimulus in awareness and Öhman (1979b) is in agreement with this, too. Thus, large and sustained ORs to phobic stimuli may result in increased processing of these stimuli and subjects may become aware of their own responses. (This, of course, is a valid assumption only to the extent that the findings on the EDR here can be generalized to other physiological responses which can be registered in consciousness). Schachter and Singer (1962) and a number of subsequent authors (Valins, 1974; Wegner and Giuliano, 1980, etc.) discussed the close relationship of arousal and self-focus. Arousal by its nature is perceptually salient since attention is normally directed to salient stimuli and increase in one's arousal may lead attention to focus on one's-self. Furthermore, if a person is physiologically aroused and the source of arousal is unclear, an active epistemic search begins to identify the stimulus conditions with which the arousal can be explained. This search ranges over a variety of cues which can produce emotion and involves memories of stimuli. Potentially phobic stimuli may thus become linked in peoples' minds with their arousal. Subsequent thoughts generated by such associations may reinforce them and in this way phobias may eventually develop. In other words, phobias may be established on the basis of the propensity of threatened humans to respond vigorously to stimuli feared (moderately) by themselves or by others in their culture, to self-focus when aroused and to think about (reflect/anticipate) these events. These suggest a potentially fruitful line of research in which the state of the subjects is manipulated and some real or false feedback about their responses to phobic stimuli is given. Confirmation of the above could provide explanations not only for the selectivity in phobic objects but also for the non-traumatic origin of many phobias. Further, this approach would be congruent with modern theories of emotion suggesting that a person "not only responds according to his appraisal of a situation, he also monitors his own response and evaluates how it should be interpreted" (Averill, 1976, p. 109) and with the notion that perceived physiological arousal (real or false) determines the intensity with which an emotion is felt and how it is acted out (Valins, 1966; Schachter, 1975).

Now in view of the fact that background arousal/anxiety presupposes large ORs to fear-relevant stimuli and therefore the establishment of phobias, we may consider the possibility that a phobia serves some function in reducing the level of anxiety. Although a phobia is an unpleasant reaction, this may be felt only in the presence of the phobic object (which can be avoided) and, at least according to psychoanalysts, it takes the place of a previously, more or less, ever present "diffuse anxiety". To these speculations the literature relating acquisition of CRs when ACTH (adrenocorticotrophin hormone) levels rise (a situation associated with stress and prolonged anxiety) may be relevant and a paradoxically adaptive role of phobias may be seen in a broader biological perspective. More specifically, ACTH is secreted by the pituitary gland and stimulates the adrenal cortex to release corticosteroids. However, ACTH has also central effects. Hypophysectomy, for example, interferes with the acquisition of shock-motivated active and passive avoidance responses in rats and their behaviour is restored with administration of ACTH or its fragments (de Wied, 1969a; Lissak and Bohus, 1972, etc.). Further, administration of ACTH and its analogs during the period of extinction results in a delay of extinction (de Wied, 1969b; Greven and de Wied, 1973). In human subjects, Endröczi, Lissák, Fekete and de Wied (1970) demonstrated delayed habituation after administration of ACTH analogs and Miller, Kaskin, Sandman, Fink and van Veen (1974) found that ACTH analogs enhance selective attention. All these and other relevant data (see, e.g. Riezen, Rigter and de Wied, 1977) suggest that ACTH may facilitate the learning of responses to selected stimuli and it may therefore be an important variable in a future research studying the content of phobias in the context of arousal associated with threat or stress.

3 SEX AND OTHER VARIABLES

Sex as a factor was not significant in any of the experiments. The same was true for sex with stimulus content interactions, except in experiment 6 in which males showed larger responses to pleasant than neutral stimuli but only in the latter part of the experiment. As there were no significant effects involving phobic stimuli we may conclude that sex may have no influence in the acquisition of fears of these stimuli. This does not seem to be in accord with the preponderance of women amongst phobics (e.g. Gray, 1971b) and the consistent finding in a number of studies that women report more and of higher intensity fears than men (e.g. Geer, 1965; Manosevitz and Lanyon, 1965; Bernstein and Allen, 1969). This discrepancy is not easy to resolve and it is complicated by possible social desirability influences on reporting of fear and to which males are thought to be more susceptible than females (Hersen, 1973 - see chapter II, section 2.4.1). However, it would be instructive to examine sex differences in mean ratings per item of the FSS-III of a large sample of students (Appendix 26) from a study by Kartsounis, Mervyn-Smith and Pickersgill (paper submitted for publication). It seems that the large majority of items in which significant sex differences were observed are not included in the kinds of fears (mainly social) the subjects were tested on in the experiments above. In another table (Appendix 27) percentages of subjects of the same sample responding "Very much" to specific items of the FSS-III are shown and there appears to be a tendency for more women to report such fears than men (e.g. "Being rejected", "Sight of fighting"). Nevertheless, in a number of items the percentages of the two sexes are very similar (e.g."Becoming mentally ill", "One person bullying another" and in a couple of them the percentages of males tend to be larger than those of the females (e.g. "Prospect of surgical operation", "Looking foolish"). All these taken together suggest that only in a small number of the stimuli under consideration female students report more intense fears than males and this is broadly in agreement with the insignificant sex differences in the ORs to phobic stimuli. Although Marks (1969) reported that among phobics with social fears 60% were women, it may be that sex differences in social fears are not as prominent now as they were more than a decade ago, at least among students.

Focussing now on the sex influences on the EDRs more generally, some researchers found greater such responses in the females across different experimental conditions (Berry and Martin, 1957) while others (e.g. Montagu, 1963) found greater variability in EDRs amongst women between tests. Venables and Christie (1973) in discussing possible effects of sex hormones referred to progesterone (the levels of which vary during the menstrual cycle) and wrote that "the findings of MacKinnon and co-workers strongly indicate its ability to decrease palmar eccrine sweat output" (p. 27). The same authors pointed out that the effects of progesterone may be mediated through central nervous mechanisms but local effects on eccrine sweating should not be ignored. Either way, such considerations, among others, dictated the matching of subjects for sex in the experiments above. The results of these experiments are akin to those by Lader and Wing (1966) who found that "between sexes differences were rarely significant" (p. 79). However, the possibility that EDRs amongst women may be affected by the natural fluctuations of sex hormones during the menstrual cycle suggests that subjects should continue to be controlled for their sex and, if possible, inquiries about the menstrual cycle of the female subjects should be made.

It may be added here that apart from sex, there are other organismic variables which should be attended to. One of them is related to race. Johnson and Corah (1963), for example, provided evidence suggesting that Negroes have a higher tonic skin resistance level than Caucasian subjects. However, Thayer and Silber (1971) reported that although Negro and Caucasian subjects may differ in basal skin resitance, they do not differ in phasic responses to stimuli. In any case, in the present experiments a relatively small number of negro subjects were included in the belief that they were likely to be evenly assigned to experimental and control groups. The same consideration was given to other possible influences on the EDR such as drug or alcohol intake which affect the state of arousal.

4 METHODOLOGICAL PROBLEMS AND PERSPECTIVES FOR FUTURE RESEARCH

A question which arises is whether the larger and slower habituating ORs to phobic than neutral stimuli in experiments 2 and 4 were due to a more general autonomic arousal increase or were more specifically related to the processing of these stimuli. The implicit assumption in all the preceding experiments was that the autonomic arousals of the phobic and neutral groups of each experiment were similar. Consequently, wherever intense ORs to phobic stimuli were observed these were thought to be due to the processing of the stimuli rather than to a higher rise in non-specific arousal in phobic than neutral groups. Although the experimental manipulations with either shock or music were applied to both groups in each experiment, one cannot be certain that these induced equivalent levels of arousal. Thus, some index of arousal such as number of non-specific EDRs ought perhaps to have been monitored. It may be noted, however, that subjective reports did not differentiate the groups and this suggests no substantial differences in their arousal. Relevant to a possible variability of groups in arousal is also the size of the samples. As seen, relatively large samples were used (20 subjects in each group) and this should have minimized any variations in background arousal in different groups to which, of course, subjects were randomly allocated. Further, the range correction of responses must have further reduced the dependence of SRRs on SRLs (chapter V, section 6).

It could be argued that, apart from the magnitudes of the SRRs, their recovery times should also have been assessed so that some additional information about their nature could have been obtained. This is particularly important in the light of findings by other workers that although normal controls show a pattern of responding typical of orienting to both neutral and phobic pictures, spider phobics show ORs to neutral stimuli but DRs (i.e. heart rate acceleration and forehead vasoconstriction) to pictures of spiders (Hare, 1973; Hare and Blevings, 1975). Klorman, Wiesenfeld and Austin (1975) found slower recovery of EDRs to phobic stimuli than to control stimuli among mutilation phobics. (See also Öhman, Fredrikson and Hugdahl, 1978c, chapter I, section 5.2.) According to Edelberg (1970, 1972b), fast recovery time of the SCR reflects mobilisation for goal-orientated behaviour whereas slow recovery time signals defensive reaction. Venables (1974 - cited in Venables, Gartshore and O'Riordan, 1980) proposed that recovery time is akin to the notion of "openess" or "closedness" to the environment and associated with heart-rate deceleration and acceleration respectively (Graham and Clifton, 1966). It is arguable therefore that, by studying recovery times, doubts regarding possible qualitative differences in responses (particularly between the two groups in experiment 2) could have been clarified. Also, by this measure an additional to subjective reports index of the processing of stimuli in relation to the anticipation of shock/music could have been obtained. In a workshop on SCR recovery convened by Venables (Conference of the Psychophysiology Society, 1980), Rippon reported that disconfirmation of one's hypothesis led to longer recovery times (more processing of stimulus) though response amplitudes between confirmation and disconfirmation conditions did not differ.

However, assessment of recovery time was not envisaged at the initial stages of this research since the object of the experimentation was to relate the findings to learning (and particularly conditioning) which only in conjunction with response amplitude and habituation has been discussed in the literature. Thus, the sampling period following stimulation was arranged to be only 10 seconds and since half-recovery time (t/2) for SCR ranges from at least 1 to 15 seconds and response latencies range from 1.3 to 2.5 seconds (e.g. Venables and Christie, 1980) a satisfactory estimation of the recovery times of responses was not possible. On the other hand, in the mentioned workshop, Venables suggested the use of t/4 recovery time. However, a great deal of the data (including all data of experiment 2) had been destroyed accidentally by that time by a member of the department and hence no assessment, t/2 or t/4 could be made. Despite strong reservations about the status of the EDR recovery measure by Edelberg and Muller (1977 - they suggested that it reflects hydration of the corneum rather than neural control), no definitive statements can as yet be made and therefore its employment in the future may prove to be relevant in the present type of research. Another useful temporal measure may also be the "rise time", i.e. the time from commencement of the EDR to its peak amplitude. This measure has been found to correlate negatively with cardiac acceleration (Venables et al., 1980).

Sokolov (1963) distinguished the OR to novel stimuli from DR to aversive and painful stimuli by respective vasodilation vs. vasoconstriction in the head (see chapter III, section 2). It could be argued that we, too, should adopt Sokolov's criterion of differentiating the two types of responses. However, this by no means ensures that meaningful results would be obtained. Kahneman (1973) wrote, for example, that although certain workers have confirmed Sokolov's contention that vasoconstriction is part of the response to novel stimuli (e.g. Unger, 1964; Zimny and Miller, 1966), others have failed to do so (e.g. Keefe and Johnson, 1970; Cohen and Johnson, 1971).

In considering the measurement of the magnitudes of the EDRs in the experiments above another criticism which could be made is that there was no control of respiratory irregularities, sighs and coughs which may affect their assessment. It is unlikely however that such factors influenced the experimental outcomes, given the relatively large number of subjects and trials used. It is also noteworthy that certain workers (e.g. Bernstein, Taylor and Weinstein, 1975) found that very few irregularities due to sighs, coughs, etc. occured during critical periods.

Bilateral electrodermal asymmetry has been suggested by a number of writers in the past (e.g. Gruzelier and Venables, 1972, 1973). In one study, schizophrenics were found to be either electrodermal responders (showed slowly habituating ORs) or nonresponders (showed few, if any, ORs) to a habituation series of tones. The responders showed higher background levels and relatively larger EDRs in the right hand while nonresponders had higher levels in the left hand (Gruzelier, 1973). It was suggested that EDA is primarily mediated by ipsilateral mechanisms and that the data could be accounted for by assuming a limbic dysfunction in the left hemisphere of schizophrenics with the result of either an over responsive right hemisphere in responders or bilaterally depressed electrodermal activity in nonresponders. Gruzelier did not find considerable bilateral asymmetries in normal subjects. However, Myslobodsky and Rattok (1975, 1977) did find greater EDA in the right hand during verbal and numerical tasks and greater activity in the left during spatial and emotional tasks in normal subjects. Contrary to Gruzelier, these workers postulated a contralateral hemispheric control of EDA. They suggested that Gruzelier's finding of no asymmetries among normals could have been due to the nonmeaningful stimuli he had used (tones). More recently, Lacroix and Comper (1979) also found electrodermal asymmetries in normals and in relation to type of task. However, contrary to Myslobodsky and Rattok's findings, it was shown that verbal tasks evoked larger EDRs in the left hand and spatial tasks evoked larger EDRs in the right hand. For the interpretation of the results, a contralateral suppression of EDA by the aroused hemisphere was postulated. Although there are inconsistencies in the data above it seems that bilateral electrodermal asymmetries cannot be excluded. Given that asymmetries were found to be particularly sensitive to types of tasks and that the left hemisphere is specialized in verbal while the right hemisphere in spatial and emotional information processing (e.g. Gazzaniga, Bogen and Sperry, 1965; Schwartz, Davidson and Maer, 1975), the possibility of bilateral electrodermal asymmetry should be considered in any future research manipulating meaningful (verbal/pictorial) stimuli in different contexts.

Another methodological consideration is related to the levels of music and shock. That is, as only one subjective level of each was employed, it is not possible to decide whether the reason music in experiment 5 failed to function in the same way as shock in experiment 4 was because pleasure and threat operate differently or because the level of music employed was not analogous to the level of threat. It is arguable that the states induced in the subjects in the two experiments were not equivalent and consequently the experiments may not be comparable. This could be pursued by attempting to identify and compare different levels in the arousing conditions.

A similar argument could be staged with respect to the intensities of phobic and pleasant stimuli which may not be "equivalent" and the experiments, as a result, not comparable. However, as Bernstein (1979) wrote: "Only if there were something of potential significance to the subject associated with intensity ... would (the subject's) judgements ... be expected to produce ORs" (p. 268). Relevant evidence for this assertion was given by Fisher and Fisher (1969) who investigated ED ORs to "hedonically positive" (sucrose), "hedonically negative" (quinine), and "neutral" (water) solutions. Although the subjects considered the sucrose as "pleasant", no significant differences between the responses to sucrose and water were observed. On the other hand, quinine elicited more prolonged responses than either of the other stimuli and the effect was increasing with increased concentrations. Fisher and Fisher explained their results in terms of an "innate process" which alerts organisms to aversive substances. As in the study by Fisher and Fisher, in the present experiments pleasant stimuli did not, on the whole, elicit intense ORs. However, this is not thought to be due to innateness of specific fears but it is possibly related to the innate basis of fear more generally. Stimuli associated with fear, that is, have greater value for survival than pleasant stimuli and as a result they trigger intense ORs to "call up" (Öhman, 1979b) additional processing capacity.

Finally, a central criticism of the experiments is related to the fact that the subjects used in the different experiments were not equally naive as far as the laboratory and psychological experiments more generally are concerned. In some cases, subjects had never had prior experience with psychology experiments. This is particularly true for experiment 2 in which most of the subjects were first-year students and for experiments 6 and 7 in which all subjects were first-year students. This may explain the apparent differences (see appropriate graphs) in the neutral groups of experiments 2 and 6 vs. 4 in all cases of which subjects were threatened by shock. Öhman (1979b) argued that the magnitude and probability of the OR is determined by whether matching memory representations of the stimuli are available in the STS of the subjects or not. In a habituation experiment, the content of the STSs depends on their previous experiences in similar situations, their beliefs about the experiment and, of course, the instructions. Venables and Christie (1973) have recommended the use of subjects habituated to the experimental environment after repeated testing of subjects. Now, given that: (a) such precautions were not taken for the experiments here; (b) there were additional uncontrollable variables among experiments such as seasonal variations in temperature and humidity which might have affected the EDRs (Venables and Christie, 1973); (c) the experiments were run independently (matching subjects for sex and kinds/intensities of fears), overall statistical analysis of all the experiments was not attempted as, under the circumstances, this analysis would have been grossly inappropriate. With the benefit of hindsight it may now appear that the experiments should have been run less independently than they have. That is, in the same experiment, threat of shock, anticipation of music and no manipulation of subjects' states could have all been used as different conditions. However, such an arrangement would have made matching of the subjects much more difficult than it has been, delaying thus the progress of the experiments. Furthermore the experiments were mostly conceived in stages, as the research progressed and in the light of preceding experimental outcomes. It is hoped that these experiments provide the background and considerable knowledge on the basis of which future research could be approached and run more efficiently and more appropriately than the present one.

5 FINAL CONCLUSIONS

The OR is not simply linked to the detection of stimulus change or significance. Rather, it depends more complexly on motivational-affective factors (Bernstein and Taylor, 1979) with stimuli known (directly or indirectly) to be associated with fear taking relative precedence in their processing in threatened subjects. Thus, at least in relation to meaningful stimuli, the OR should not be considered as a "What is it?" but as a "What does this mean?" (Hulstijn, 1978b; Kimmel, 1979) or, perhaps, even more appropriately, as a "What does this mean here and now?" reflex.

The complexities associated with the elicitation of the OR and its habituation are not fully accounted for by Sokolov's or even Öhman's models. Further research using different types of stimuli in different contexts is needed before these complexities can be elucidated and a model with wide power of prediction can be established.

The increased processing given to the phobic stimuli is explained in terms of their significance suggested by subjective reports. This significance is accounted for by prior experiences, including indirect ones, within the culture. Since the OR has implications for learning and phobias are assumed to be learned responses, the above suggest that phobias may be formed around stimuli known in the culture to be associated with fear. In this context, the socio-cultural influences on the content of fears as discussed in chapter II and the known selectivity in clinical phobias (e.g. Marks, 1969) may become intelligible and no evolutionary explanations need to be invoked to account for these phenomena. Öhman's results may be explained in terms of the suggested "experiential preparedness" since even fears with a potentially biological basis (e.g. the alleged fear of snakes - see chapter II) become part of the knowledge in the culture.

An implication of the above is that phobias are fears acquired not because an object/situation presents a real threat to an individual but because the anxiety (arousal) of a threatened person enhances/establishes fears around objects <u>known</u> to be associated with fear.

The sexes do not differ in their responses to phobic stimuli and this implies that they do not differ in their propensities to acquire fears of the kinds of stimuli with which they were presented. This is corroborated by responses to FSS-III of a large sample of students.

Finally, it may be argued that with the methodology employed here (some improvements on which are necessary) a map of valencies (Marks, 1977) of fear-relevant stimuli to become phobic in a particular culture may be established. However, before such a task is undertaken further research is needed to establish whether the ORs to culturally significant stimuli lead to fear responses which have the characteristics of phobias. Several different approaches to such an investigation are possible, including the use of differential classical conditioning of the EDR. Other mechanisms which may be instrumental in the genesis of phobias includes vicarious conditioning and psychological models suggesting similarity between physiological components of the OR and phobic responses (e.g. Lader and Mathews, 1968) may also be relevant. Phobias, it is also speculated, may be formed on the basis of the propensity of threatened humans to respond vigorously to stimuli feared by themselves or others in their culture, to self-focus when aroused and to reflect/anticipate these events. Individual differences on these dimensions may determine the vulnerability of a person to become phobic.

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APPENDIX 1

FEAR INVENTORY*

Directions

The items in this questionnaire refer to things and experiences that may cause fear or other unpleasant feelings. Please place a tick opposite the item in the column that describes how much you are disturbed by it nowadays.

	Not at all	A little	A fair amount	Much	Very much
1. Noise of vacuum cleaners					
2. Open wounds					
3. Being alone					
4. Being in a strange place					
5. Loud voices					
6. Dead people					
7. Speaking in public					
8. Crossing streets					
9. People who seem insane					
10. Falling					
11. Automobiles					
12. Being teased					
13. Dentists					
14. Thunder					
15. Sirens					
16. Failure					
17. Entering a room where other people are already seated					
18. High places on land					
19. Looking down from high buildings					
20. Worms					
21. Imaginary creatures					
22. Strangers					
23. Bats					
24. Journeys by train					
25. Journeys by bus					

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*Wolpe (1973) (see experiment 1)

..../cont.

Appendix 1 (cont.)

	Not at all	A Little	A fair Amount	Much	Very much
26. Journeys by car					
27. Feeling angry					
28. People in authority					
29. Flying insects					
30. Seeing other people injected					
31. Sudden noises					
32. Dull weather					
33. Crowds					
34. Large open spaces					
35. Cats					
36. One person bullying another					
37. Tough looking people					
38. Birds					
39. Sight of deep water					
40. Being watched working					
41. Dead animals					
42. Weapons					
43. Dirt					
44. Crawling insects					
45. Sight of fighting					
46. Ugly people					
47. Fire					
48. Sick people					
49. Dogs					
50. Being criticized					
51. Strange shapes					
52. Being in an elevator					
53. Witnessing surgical operations					
54. Angry people					
55. Mice					
56. Blood					
(a) - human					
(b) - animal					
57. Parting from friends					

..../cont.

Appendix 1 (cont.)

	Not at all	A Little	A fair Amount	Much	Very much
58. Enclosed places					
59. Prospect of a surgical operation					
60. Feeling rejected by others					
61. Aeroplanes					
62. Medical odours					
63. Feeling disapproved of					
64. Harmless snakes					
65. Cemeteries					
66. Being ignored					
67. Darkness					
68. Premature heart beats (Missing a beat)					
69. (a) Nude men (b) Nude women					
70. Lightning					
71. Doctors					
72. People with deformities					
73. Making mistakes					
74. Looking foolish					
75. Losing control					
76. Fainting					
77. Becoming nauseous					
78. Spiders					
79. Being in charge or responsible for decision					
80. Sight of knives or sharp objects					
81. Becoming mentally ill					
82. Being with a member of the opposite sex					
83. Taking written tests					
84. Being touched by others					
85. Feeling different from others					
86. A lull in conversation					

APPENDIX 1a

PHOBIC STIMULI AS ADOPTED FOR USE IN THE EXPERIMENTS

1. Noise of vacuum cleaners
2. Open wounds: Wounds
3. Being alone: Loneliness
4. Being in a strange place: Strange places
5. Loud voices
6. Dead people: Corpses
7. Speaking in public: Public speaking
8. Crossing streets
9. People who seem insane: Insane people
10. Falling
11. Automobiles: Cars
12. Being teased
13. Dentists
14. Thunder
15. Sirens
16. Failure
17. Entering a room where other people are already seated: Entering a crowded room
18. High places on land: Elevated places
19. Looking down from high buildings (As No. 18)
20. Worms
21. Imaginary creatures: Ghosts
22. Strangers
23. Bats: Rats*
24. Journeys by train: Trains
25. Journeys by bus: Buses
26. Journeys by car (As No. 11)
27. Feeling angry: Anger
28. People in authority: Authorities
29. Flying insects: Insects
30. Seeing other people injected: Injections
31. Sudden noises
32. Dull weather
33. Crowds
34. Large open spaces: Open spaces

*Due to a typing error item "Rats" replaced item "Bats"

...../cont.

Appendix 1a (cont.)

35. Cats
36. One person bullying another: Bullying
37. Tough looking people: Tough people
38. Birds
39. Sight of deep water: Deep water
40. Being watched working: Being watched
41. Dead animals
42. Weapons
43. Dirt
44. Crawling insects (As No. 29)
45. Sight of fighting: Fights
46. Ugly people: Ugliness
47. Fire
48. Sick people: Sickness
49. Dogs
50. Being criticized: Criticisms
51. Strange shapes (As No. 4)
52. Being in an elevator: Lifts
53. Witnessing surgical operations: Surgery
54. Angry people (As No. 27)
55. Mice (As No. 23)
56. Blood
    (a) - human: Blood
    (b) - animal (As No. 56(b))
57. Parting from friends
58. Enclosed places
59. Prospect of a surgical operation (As No. 53)
60. Feeling rejected by others: Rejection
61. Aeroplanes: Airplanes
62. Medical odours
63. Feeling disapproved of (As No. 50)
64. Harmless snakes: Snakes
65. Cemeteries: Cemetery
66. Being ignored
67. Darkness
68. Premature heart beats (Missing a beat):
    Heart problems

.../cont.

Appendix 1a (cont.)

69. (a) Nude men
    (b) Nude women
70. Lightning
71. Doctors
72. People with deformities: Deformities
73. Making mistakes
74. Looking foolish (As No. 75)
75. Losing control
76. Fainting
77. Becoming nauseous: Nausea
78. Spiders
79. Being in charge or responsible for decision: Being in charge
80. Sight of knives or sharp objects: Sharp objects
81. Becoming mentally ill: Insanity
82. Being with a member of the opposite sex: Opposite sex
83. Taking written tests: Examinations
84. Being touched by others: Touching
85. Feeling different from others: Feeling different

APPENDIX 2

List of stimuli selected with the aid of existing norms and adopted for experiments 1 and 2[+]

PHOBIC	NEUTRAL
Corpses	Apples
Automobiles/Cars	Libraries/Chairs
Ghosts	Decoration/Industry
Anger	Charm (Humour)
Insects	Cotton
Cats	Flag
Birds	Doors
Weapons	Fabric
Dirt	Coast
Fire	Chair
Sick people/Sickness	Country houses/Wild flowers/Decoration
Blood	Coffee
Snakes	Houses
Doctors	Chairs

[+] See Experiment 1 for explanations

APPENDIX 3

List of stimuli selected with the assistance of judges and adopted for experiments 1 and 2[+]

PHOBIC	NEUTRAL
Noise of vacuum cleaners	Taste of white bread
Wounds	Clocks
Loneliness	Tolerance
Strange places	Marked trees (Tropical trees)
Loud voices	Canvas paintings (Tall trees)
Public speaking (Speaking in public)	Sun bathing (Copying a text)
Crossing streets	Sampling newspapers (Making notes)
Insane people	Elegant house/Frame picture (Processed cheese)
Falling	Returning (Cooking)
Being teased	Doing homework/Doing fieldwork
Dentists	Inventors (Carpets)
Thunder	Breeze
Sirens	Balconies (Baskets)
Failure	Balance (Assistance/Regard)
Entering a crowded room	Attending a classical concert
Elevated places	Tropical trees
Worms	Flags
Strangers	Monuments
Rats	Jars
Trains	Farms
Buses	Apples
Authorities	Newspapers (Furniture)
Injections	Radios (Slippers)
Sudden noises	Distant cottages (Mixed apples)
Dull weather	Reserved statements
Crowds	Floors
Open spaces	Large bands
Bullying	Cheering (Enrolling)
Tough people	Occupied house
Deep water	Closed eyes (Closed school)
Being watched	Having discussion

..../cont.

[+] See Experiment 1 for explanations

Appendix 3 (cont.)

PHOBIC	NEUTRAL
Dead animals	Brown plants/Cold grounds (Young plants)
Fights	Ashes (Walks)
Ugliness	Courtesy
Dogs	Walls
Criticisms	Deductions
Lifts	Gifts (Beds)
Surgery	Negotiation (Booking/Painting)
Parting from friends	Modifying a report (Favouring a picture)
Enclosed spaces	Baroque (abstract) sculpture
Rejection (Feeling rejected)	Adoption/Leisure (Seeing films)
Airplanes	Museums
Medical odours	Foreign themes (Films)
Cemetery	Cafeteria
Being ignored	Being reminded (Impressed)
Darkness	Melody
Heart problems	Money report
Nude men	Colourful house
Nude women	Colourful book
Lightning	Applause (Breeze)
Deformities	Architectures
Making mistakes	Having insights/ideals/ideas (Having soup)
Losing control	Creating (Making) sound
Fainting	Auditioning (Camping)
Nausea	Idleness/Praying
Spiders	Cigars (Booklets)
Being in charge	Making a choice
Sharp objects	Interior pages/Brief message (Brief notes)
Insanity (Becoming mentally ill)	Artistry (Reading weekly journal)
Opposite sex	Grey houses (Country food)
Examinations (Taking written tests)	Collections/Petitions (Having country walks)
Touching	Bathing

..../cont.

Appendix 3 (cont.)

PHOBIC	NEUTRAL
Feeling different	Taking interest
*Booking	Sitting
*Having ideas	Having food
*Having ideals	Having soup

*See text, Experiment 2.

APPENDIX 4

Questionnaires for matching the meaningfulness, imagery and concreteness of phobic and neutral stimuli*

4.1 Instructions for assessment of the meaningfulness of stimuli

"Words differ in capacity to arouse other words as associates - some are strongly associated with many other words, others are not. For example: 'person' is readily associated with 'people', 'man', 'woman', 'individual', etc.

On the paper in front of you there are words and phrases in two columns. For each word/phrase on the left side, there are two or more corresponding ones on the right side. Please choose one from the right side column which arouses the same or nearest number of associations as the word/phrase on the left side column. You would be allowed to think for the associates of each word or phrase of both columns for 20 seconds and I shall tell you when to start and finish thinking for each one. You do not have to reveal your associations but you must write down only the number of associations you make (for your own reference) and tell me at the end which of the right side column word/phrase has the nearest number of associations as the corresponding word/phrase on the left side column."
(The above instructions are followed by a list of words/phrases identical to those following the instructions for assessment of the concreteness of stimuli - see below.)

4.2 Instructions for assessment of the imagery of stimuli

"Below there are words (or groups of words) in two columns. For each word (or group of words) on the left side, there are two or more 'corresponding' ones on the right side. Will you please, choose one from the right side column which, according to your estimation, has the nearest imagery capacity to the word(s) on the left side. (Words differ in their capacity to arouse mental images of things or events; some words arouse a sensory experience such as a picture or a sound very

..../cont.

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[*] See experiment 1 for explanations

quickly and easily whereas other words may do so only with difficulty or not at all.) Please underline the word(s) you will choose." (These instructions are followed by a list of words/phrases identical to those following the instructions for assessment of the concreteness of stimuli - see below.)

4.3 Instructions for assessment of the concreteness of stimuli

"Below there are words (or groups of words) in two columns. For each word (or group of words) on the left side, there are two or more 'corresponding' ones on the right side. Will you please, choose one from the right side column which, according to your estimation, is nearest to the word(s) on the left side in terms of concreteness. (Words are 'concrete' when denoting objects, persons, places or things that can be seen, heard, felt, smelled, tasted, etc., and contrast with 'abstract' concepts that cannot be experienced by our senses.)"

1. NOISE OF VACUUM CLEANERS
    a. TASTE OF WHITE BREAD
    b. PAINT OF LIBRARY CLOCKS
    c. PAINT OF HOTEL COUNTERS
2. WOUNDS
    a. CLOCKS
    b. CURTAINS
    c. PILLOW
    d. SHELVES
    e. SLEEVES
3. LONELINESS
    a. ADHERENCE
    b. CONTENTION
    c. GRATITUDE
    d. PREFERENCE
    e. TOLERANCE
4. STRANGE PLACES
    a. BROAD SIDES
    b. MARKED TREES
    c. REGULAR SIDES
5. LOUD VOICES
    a. FITTED DOORS
    b. CANVAS PAINTINGS
    c. SMART COLLEGES
7. PUBLIC SPEAKING
    a. DOMESTIC ACTIVITY
    b. DOMESTIC WRITING
    c. SUN BATHING

..../cont.

Appendix 4 (cont.)

8. CROSSING STREETS
    - a. SAMPLING NEWSPAPERS
    - b. ACCEPTING BOOKS
    - c. BINDING BOOKS
    - d. PREPARING HOME
    - e. ACCEPTING LETTER

9. INSANE PEOPLE
    - a. PORTABLE RADIO
    - b. WRAPPED PARCEL
    - c. RESTORED BUILDING
    - d. FRAMED PICTURE
    - e. ELEGANT HOUSE

10. FALLING
    - a. COOKING
    - b. LOCKING
    - c. COVERING
    - d. RETURNING

12. BEING TEASED
    - a. HAVING CONSULTATIONS
    - b. DOING HOUSEWORK
    - d. DOING FIELDWORK

13. DENTISTS
    - a. BEDROOMS
    - b. CARPETS
    - c. FLAKES
    - d. FOUNTAINS
    - e. INVENTORS

14. THUNDER
    - a. MINERALS
    - b. CHARCOAL
    - c. BUBBLES
    - d. BREEZE
    - e. BOXES

15. SIRENS
    - a. BASKETS
    - b. BISCUIT
    - c. BERRIES
    - d. ARMCHAIRS
    - e. BALCONIES

16. FAILURE
    - a. ASSISTANCE
    - b. DANCE
    - c. BALANCE
    - d. REGARD

17. ENTERING A CROWDED ROOM
    - a. SEARCHING FOR FILED FORM
    - b. ATTENDING A CLASSICAL CONCERT
    - c. SEARCHING FOR EFFICIENT CAMERA
    - d. TRADING WITH EFFICIENT BUSINESS

18. ELEVATED PLACES
    - a. PLANTED TREES
    - b. REPAIRED INSTITUTIONS
    - c. MANUFACTURED MATERIALS

..../cont.

Appendix 4 (cont.)

d. THOUGHTFUL BOOKS
e. TROPICAL TREES

20. WORMS

a. AVENUES
b. MENU
c. FLAGS
d. CABINETS
e. BATHS

22. STRANGERS

a. BARRELS
b. CURTAINS
c. MONUMENTS
d. PILLOW
e. SHELVES

23. RATS

a. FLATS
b. JARS
c. CHALK
d. BLINDS
e. CAKES

24. TRAINS

a. CANDY
b. FARMS
c. FABRIC
d. FLUID
e. LAWN

25. BUSES

a. RINGS
b. NOSES
c. HUTS
d. APPLES
e. ALBUM

27. AUTHORITIES

a. FURNITURE
b. MAGAZINE
c. NEWSPAPERS
d. DRAWING

30. INJECTIONS

a. SLIPPERS
b. RADIOS
c. HEADLINES
d. BLOSSOMS
e. GRAPES

31. SUDDEN NOISES

a. DISTANT COTTAGES
b. MIXED GARMENTS
c. MIXED APPLES

32. DULL WEATHER

a. RESERVED STATEMENTS
b. RESERVED ACTIONS
c. QUOTED STATEMENTS
d. ACQUIRED PICTURES
e. QUOTED ARTICLE

..../cont.

Appendix 4 (cont.)

33. CROWDS

a. FLOORS
b. LENS
c. MINERAL
d. EGG
e. BUBBLE

34. OPEN SPACES

a. LARGE BANDS
b. LARGE BLANKETS
c. LARGE TOWELS
d. PAST CALENDARS
e. QUIET VIOLIN

36. BULLYING

a. APPRAISING
b. CHEERING
c. CONSENTING
d. DEDUCING
e. ENROLLING

37. TOUGH PEOPLE

a. OCCUPIED HOUSE
b. PRINTED MATTER
c. STORED FOOD
d. LATEST NEWS
e. WASHED FRUIT

39. DEEP WATER

b. CLOSED SCHOOL
c. CLOSED EYES
d. REPORTED FACT

40. BEING WATCHED

a. HAVING COFFEE
b. HAVING DISCUSSION
c. HAVING STANDARDS
d. HAVING DINNER
e. HAVING INTERESTS

41. DEAD ANIMALS

b. LOW ROOF
c. BROWN PLANTS
d. COLD GROUNDS
e. BROWN ROOF

45. FIGHTS

a. ASHES
b. CHORDS
c. MARGINS
d. REFLEXES
e. SONATAS

46. UGLINESS

a. COURTESY
b. IMMUNITY
c. SPONTANEITY
d. VANITY

49. DOGS

a. SHELTER
b. WALLS
c. FIELDS

..../cont.

Appendix 4 (cont.)

d. FOOT
e. PICTURES

50. CRITICISMS

a. DEDUCTIONS
b. ENERGIES
c. OUTCOMES
d. QUANTITIES
e. TRANSFERS

52. LIFTS

a. BEDS
b. GIFTS
c. RIBS
d. TOWELS
e. VASES

53. SURGERY

a. BOOKING
b. COACHING
c. HIRING
d. NEGOTIATION
e. RESPONDING

57. PARTING FROM FRIENDS

a. COMPILING A REPORT
b. DASHING TO MARKET
c. FAVOURING A REPORT
d. HURRYING TO MARKET
e. MODIFYING A REPORT

58. ENCLOSED SPACES

a. BAROQUE SCULPTURE
b. LENGTHY SCRIPT
c. MOIST TOWEL
d. POSTED GIFTS

60. REJECTION

a. LEISURE
b. DEDUCTIONS
c. COMMUNION
d. ADOPTION

61. AIRPLANES

a. BUTTONS
b. DRESSES
c. MUSEUMS
d. RESERVOIR
e. SANDWICH

62. MEDICAL ODORS

a. FOREIGN THEMES
b. NATURAL ECHOES
c. FOREIGN ECHOES
d. FOREIGN BALLAD

65. CEMETERY

a. CAFETERIA
b. DOORWAY
c. STOVE
d. STRAW
e. TEXTILES

..../cont.

Appendix 4 (cont.)

66. BEING IGNORED

a. FALLING ASLEEP
b. BEING REMINDED
d. BEING COMMITTED
e. BEING IMPRESSED

67. DARKNESS

a. OPERA
b. HUMOUR
c. MELODY
d. COMFORT
e. WATERS

68. HEART PROBLEMS

a. COLLEGE PICTURE
b. FIELD PICTURE
c. STREET PICTURE
d. MONEY REPORT
e. SPACE QUESTION

69(a). NUDE MEN

a. SMART HOUSE
b. SHINING DAY
c. NEAT WORK
d. COLOURFUL HOUSE
e. EDUCATED WORLD

69(b). NUDE WOMEN

a. SMART SCHOOLS
b. COLOURFUL BOOK
c. COLOURFUL GROUND
d. COLOURFUL ROAD
e. SHINING SURFACE

70. LIGHTNING

a. BREEZE
b. BUBBLES
c. RESONANCE
d. APPLAUSE

72. DEFORMITIES

a. ANTIQUITIES
b. ARCHITECTURES
c. BATHROOMS
d. COMMUNIQUES
e. COMPARTMENTS

73. MAKING MISTAKES

a. HAVING IDEALS
b. HAVING INSIGHTS
d. HAVING ENDURANCE
e. FOLLOWING IDEALS

74. LOSING CONTROL

b. CREATING MUSIC
c. CREATING ART
d. CREATING SOUND

76. FAINTING

a. COMPLIMENTING
b. CHEERING

..../cont.

Appendix 4 (cont.)

c. CANVASSING
d. CAMPING
e. AUDITIONING

77. NAUSEA

a. BLINKING
b. EXPIRATION
c. IDLENESS
d. PRAYING
e. DISINTEREST

78. SPIDERS

a. BERRIES
b. BINDERS
c. BOOKLETS
d. CIGARS
e. CUPBOARD

79. BEING IN CHARGE

a. HAVING A FUNCTION
b. MAKING A CHOICE
c. HAVING AN INFLUENCE

80. SHARP OBJECTS

a. BRIEF MESSAGE
b. RICH SITE
c. RICH PROPERTIES
d. INTERIOR PAGE

81. INSANITY

a. IDLENESS
b. FORTITUDE
c. FLATTERY
d. FALSITY
e. ARTISTRY

82. OPPOSITE SEX

b. PRESENTED REPORTS
c. GREY HOUSES
d. GREY STATIONS

83. EXAMINATIONS

a. CANVASES
b. CHARITY
c. COLLECTIONS
d. COMPLAINTS
e. PETITIONS

84. TOUCHING

a. BATHING
b. CONTRIBUTING
c. EMERGING
d. LEANING
e. SELECTING

85. FEELING DIFFERENT

a. GETTING SERVICE
b. TAKING INTEREST
c. BEGINNING INTEREST

APPENDIX 5

Summary of judges' responses to questionnaires of appendix 4

Item No.	Concreteness (20 judges)*	Imagery (17 judges)	Meaningfulness (18 judges)
1.	8c,7a,3b	8a,4b,2c	13a,1b,4c
2.	6d,6a,3e,4c,1b	3a,1b,2c,3d,8e	12a,2b,2d,2e
3.	8e,6c,2d,3b	1a,1b,5c,1d,9e	1a,2b,2c,3d,10e
4.	10b,6a,4c	3a,9b,5c	1a,11b,6c
5.	9c,4d,3b	4b,3c,8d	11c,7d
7.	11b,7c,2a	4a,1b,12c	5a,3b,10c
8.	8a,1b,4c,4d,2e	9a,2b,4d,2e	11a,6d,1e
9.	3a,2b,4c,3d,8e	3a,3b,4c,4d,3e	2a,1b,3c,2d,10e
10.	1a,4b,5c,10d	3a,1b,2c,8d,1e	3a,5b,2c,8d
12.	13a,4b,3c	5a,4b,2c,6d	4a,11b,3d
13.	3a,3b,2c,1d,9e	2a,3b,1c,4d,6e	1a,17e
14.	3a,2b,2c,12d,1e	5b,5c,5d,2e	2b,2c,13d,1e
15.	1a,2b,1c,5d,11e	2a,1b,1c,4d,9e	3a,2b,2c,9d,2e
16.	7a,1b,8c,4d	5a,3b,5c,3d,1e	6a,3b,9c
17.	6a,7b,4c,3d	6a,6b,3c,2d	6a,12b
18.	5a,4b,1c,2d,8e	1b,2c,7d,7e	2a,2c,3d,11e
20.	3a,2b,8c,3d,4e	4a,4b,5c,2d,2e	3a,2b,9c,1d,3e
22.	5a,11c,1d,3e	2a,1b,11c,1d,2e	1a,2b,8c,3d,4e
23.	3a,3b,4c,2d,8e	3a,8b,1c,1d,4e	1a,4b,8c,2d,3e
24.	2a,12b,3c,2d,1e	3a,7b,3c,1d,3e	2a,12b,1c,2d,1e
25.	1a,4b,6c,5d,3e	5a,2b,3c,5d,2e	2a,5c,9d,2e
27.	2a,9c,8d	4a,1b,6c,5d,1e	8a,7c,3d
30.	7a,5b,6c	3a,5b,4c,2d,3e	4a,7b,2c,4d,1e
31.	8a,7b,2c	10a,5b,2c	10a,5b,3c
32.	7a,5b,3c,3d	7a,3b,1c,3d,3e	9a,4b,3c,2e
33.	11a,2c,2d,4e	10a,2b,1d,4e	11a,2c,3d,2e
34.	4a,3b,3c,3d,6e	4a,3b,1c,4d,5e	9a,4b,2d,3e
36.	3a,6b,1c,2d,6e	1a,8b,2c,2d,4e	1a,6b,3c,2d,6e
37.	4a,5b,3c,4d	6a,5b,2c,3d,1e	6a,6b,2c,2d,2e
39.	6b,9c,1d	3b,13c	8b,10c
40.	3a,5b,3c,1d,2e	1a,7b,1d,3e	4a,6b,2c,3d,3e
41.	4b,10c,2d,3e	2b,6c,7d,2e	2b,10c,4d,2e

*Some stimuli were not assessed by all the judges

..../cont.

Appendix 5 (cont.)

45.	4a,1b,9d,3e	4a,2b,3c,6d,2e	8a,6d,4e
46.	4a,5b,3c,6d	2a,3b,4c,8d	6a,4b,4c,4d
49.	10b,5c,3d	5b,6c,4d,2e	10b,6c,2e
50.	10a,3b,5c	6a,4b,3c,4d	8a,2b,3c,2d,3e
52.	5a,2b,5c,5d	7a,3b,2c,2d,3e	6a,7b,3d,2e
53.	4a,2b,1c,4d,6e	4a,1b,3c,3d,6e	2a,3b,2c,9d,2e
57.	2a,2b,4c,2d,8e	2a,4b,1c,3d,7e	1a,2b,2c,8d,5e
58.	9a,6b,3c	3a,2b,6c,5d,1e	8a,2b,2c,6d
60.	2a,2b,4c,10d	4a,2b,2c,9d	4a,2b,2c,10d
61.	3a,1b,11c,1d,2e	3a,2b,4c,1d,7e	2a,8c,4d,4e
62.	5a,4b,4c,5d	6a,3b,3c,5d	3a,6b,3c,6d
65.	7a,4b,5c,1d,1e	8a,4b,1c,3d,1e	11a,4b,3e
66.	5a,5b,2d,4e	5a,8b,1d,3e	5a,9b,2d,2e
67.	1a,5c,4d,8e	2a,1b,2c,4d,8e	2a,2b,6c,5d,3e
68.	1a,1b,3c,8d,5e	2a,1b,2c,7d,5e	2a,2c,11d,3e
69a.	2a,3b,9d,4e	5a,3b,6d,3e	3a,3b,9d,3e
69b.	8b,1c,2d,7e	2a,7b,2c,1d,5e	2a,8b,2c,1d,5e
70.	2a,4b,5c,7d	3a,2b,3c,9d	3a,3b,3c,9d
72.	5a,11b,2e	1a,5b,4c,2d,5e	4a,9b,2c,3e
73.	3a,5b,2d,7e	8a,3b,3d,3e	3a,8b,1d,6e
74.	4b,4c,8d	5b,4c,5d	6b,6c,6d
76.	1a,9b,2c,6e	1a,5b,1c,3d,7e	6b,2c,3d,7e
77.	10b,3c,3d,2e	2a,2b,5c,5d,3e	2a,4b,6c,3d,3e
78.	8a,1b,6d,3e	4a,8d,5e	3a,1c,11d,3e
79.	10a,2b,4c	2a,6b,6c	2a,11b,5c
80.	11a,1b,2c,4d	9a,2b,3c,3d	6a,2b,3c,7d
81.	2a,4b,1c,9d	4a,1b,3c,3d,6e	3a,2b,4d,9e
82.	14b,4c	7b,5c,1d	13b,3c,2d
83.	1a,2b,4c,1d,10e	2a,2b,5c,4d,4e	1a,6c,1d,10e
84.	7a,3b,1c,4d,2e	8a,3b,1c,2d,3e	9a,2b,2c,2d,3e
85.	1a,7b,9c,1e	4a,5b,7c,1e	5a,8b,5c

APPENDIX 6

Summary of responses of 277 subjects to FSS-III

	ITEMS RATED AS NOT FEARED		ITEMS RATED AS FEARED	
	No. of subjects	% of subjects	No. of subjects	% of subjects
1. Noise of vacuum cleaners	222	80.14	55	19.86
2. Open wounds	151	54.51	126	45.49
3. Being alone	211	76.17	66	23.83
4. Being in a strange place	221	79.78	56	20.22
5. Loud noises	205	74.01	72	25.99
6. Dead people	118	42.60	159	57.40*
7. Speaking in public	116	41.88	161	58.12*
8. Crossing streets	260	93.86	17	6.14
9. People who seem insane	180	64.98	97	35.02
10. Falling	169	61.01	108	38.99
11. Automobiles	256	92.42	21	7.58
12. Being teased	213	76.89	64	23.11
13. Dentists	174	62.82	103	37.18
14. Thunder	252	90.97	25	9.03
15. Sirens	236	85.20	41	14.80
16. Failure	82	29.60	195	70.40*
17. Entering a room where other people are already seated	200	72.20	77	27.80
18. High places on land	227	81.95	50	18.05
19. Looking down from high buildings	165	59.57	112	40.43
20. Worms	249	89.89	28	10.11
21. Imaginary creatures	262	94.58	15	5.42
22. Strangers	245	88.45	34	11.55
23. Rats	174	62.82	103	37.18
24. Journeys by train	273	98.56	4	1.44
25. Journeys by bus	270	97.47	7	2.53
26. Journeys by car	264	95.31	13	4.69
27. Feeling angry	184	66.43	93	33.57

..../cont.

Appendix 6 (cont.)

	ITEMS RATED AS NOT FEARED No. of subjects	ITEMS RATED AS NOT FEARED % of subjects	ITEMS RATED AS FEARED No. of subjects	ITEMS RATED AS FEARED % of subjects
28. People in authority	233	84.12	44	15.88
29. Flying insects	190	68.59	87	31.41
30. Seeing other people injected	218	78.70	59	21.30
31. Sudden noises	186	67.15	91	32.85
32. Dull weather	235	84.84	42	15.16
33. Crowds	213	76.90	64	23.10
34. Large open spaces	270	97.47	7	2.53
35. Cats	268	96.75	9	3.25
36. One person bullying another	73	26.35	204	73.65*
37. Tough looking people	184	66.43	93	33.57
38. Birds	267	96.39	10	3.61
39. Sight of deep water	237	85.86	40	11.44
40. Being watched working	168	60.65	109	39.35
41. Dead animals	182	65.70	95	34.30
42. Weapons	191	68.95	86	31.05
43. Dirt	224	80.87	53	19.13
44. Crawling insects	179	64.62	98	35.38
45. Sight of fighting	105	37.91	172	62.09*
46. Ugly people	233	84.12	44	15.88
47. Fire	173	62.45	104	37.54
48. Sick people	183	66.06	94	33.94
49. Dogs	249	89.89	28	10.11
50. Being criticized	146	52.71	131	47.29
51. Strange shapes	273	98.56	4	1.44
52. Being in an elevator	247	89.17	30	10.83
53. Witnessing surgical operations	144	51.99	133	48.01
54. Angry people	161	58.12	116	41.88
55. Mice	247	89.17	30	10.83

..../cont.

Appendix 6 (cont.)

		ITEMS RATED AS NOT FEARED		ITEMS RATED AS FEARED	
		No. of subjects	% of subjects	No. of subjects	% of subjects
56.	Blood				
	(a) Human	210	75.81	67	24.19
	(b) Animal	218	78.70	59	21.30
57.	Parting from friends	119	42.96	158	57.04*
58.	Enclosed spaces	206	74.34	71	25.63
59.	Prospect of a surgical operation	121	43.68	156	56.32*
60.	Feeling rejected by others	72	25.99	205	74.01*
61.	Aeroplanes	237	85.56	40	14.44
62.	Medical odours	232	83.75	45	16.25
63.	Feeling disapproved of	146	52.71	131	47.29
64.	Harmless snakes	212	76.53	65	23.47
65.	Cemeteries	236	85.20	41	14.80
66.	Being ignored	137	49.46	140	50.54*
67.	Darkness	226	81.16	51	18.41
68.	Premature heart beats	229	82.67	48	17.33
69.	(a) Nude men	252	90.97	25	9.03
	(b) Nude women	263	94.95	14	5.05
70.	Lightning	244	88.09	33	11.91
71.	Doctors	253	91.34	24	8.66
72.	People with deformities	198	71.48	79	28.52
73.	Making mistakes	147	53.07	130	46.93
74.	Looking foolish	132	47.65	145	52.35*
75.	Losing control	129	46.57	148	53.43*
76.	Fainting	201	72.56	76	27.44
77.	Becoming nauseous	149	53.79	128	46.21
78.	Spiders	176	63.54	101	36.46
79.	Being in charge or responsible for decision	228	82.31	49	17.69
80.	Sight of knives or sharp objects	242	87.36	35	12.64

..../cont .

Appendix 6 (cont.)

	ITEMS RATED AS NOT FEARED		ITEMS RATED AS FEARED	
	No. of subjects	% of subjects	No. of subjects	% of subjects
81. Becoming mentally ill	120	43.32	157	56.68*
82. Being with a member of the opposite sex	268	96.75	9	3.25
83. Taking written tests	188	67.87	89	32.13
84. Being touched by others	255	92.06	22	7.94
85. Feeling different from others	218	78.70	59	21.30
86. A lull in conversation	220	79.42	57	20.58

*Over 50 per cent of subjects reported they feared the corresponding stimuli (see text, Experiment 3)

APPENDIX 7

Questionnaire for matching phobic and neutral phrases in terms of their frequency

Words/phrases differ according to the frequency of their occurence in the language (both in spoken and written language).

Below there are phrases in two columns. You are asked to compare each on the left side with the five ones on the right side. Please choose one from the right side column which, according to your estimation, is nearest to the corresponding on the left side in terms of its frequency in the language.

SPEAKING IN PUBLIC			
	1.	PREPARING FOR SCHOOL	(0)[*]
	2.	TALKING OF WEATHER	(2)
	3.	PREPARING TO READ	(4)
	4.	STUDYING AT HOME	(0)
	5.	GOING TO COLLEGE	(4)
PARTING FROM FRIENDS			
	1.	CARRYING THINGS OUT	(2)
	2.	TYING THINGS TOGETHER	(3)
	3.	ARRIVING AT COLLEGE	(0)
	4.	WALKING ALONG STREETS	(3)
	5.	GOING TOWARDS COLLEGE	(2)
FEELING REJECTED			
	1.	BEING REGISTERED	(2)
	2.	BEING RESPECTED	(1)
	3.	BEING COMMITTED	(3)
	4.	BEING CONSULTED	(2)
	5.	BEING IMPRESSED	(2)
BEING IGNORED			
	1.	BEING COACHED	(1)
	2.	BEING COMBED	(0)
	3.	BEING DRIVEN	(2)
	4.	BEING ASLEEP	(2)
	5.	BEING ADVISED	(5)
LOSING CONTROL			
	1.	WRITING LETTER	(2)
	2.	TALKING ALOUD	(4)
	3.	HEARING BUSES	(0)
	4.	ADVISING CHILD	(1)
	5.	WALKING ALONE	(3)

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[*] The numbers in parentheses indicate how many judges chose each supposedly neutral phrase (right side column) as equivalent to the corresponding potentially phobic phrase (left side column) in terms of frequency.

APPENDIX 8

Questionnaire for rating phobic and neutral stimuli in terms of their affectivity[*]

Words/phrases differ as far as their affective content is concerned. Here you are presented with some words/phrases which you are asked to judge according to how pleasant or unpleasant their content is (for you). Please place a tick opposite the item in the column that describes your feelings for the content of the item. Place a tick in column "1" for items which are very pleasant, in column "7" for words/phrases which are very unpleasant and in column "4" for those with relatively neutral content. Use the between columns for intermediate assessments.

	Number of subjects giving each rating						
	1	2	3	4	5	6	7
CORPSES				1	3	2	4
DRAWERS	1			9			
APPLES	1		5	3	1		
GLOVES	2	1	3	2	2		
CASTLES	2	2	4	2			
MARKETS	1	2	3	2	2		
SPEAKING IN PUBLIC					4	4	2
PREPARING FOR SCHOOL				4	2	2	2
TALKING OF WEATHER			1	6	3		
PREPARING TO READ		2	1	4	1	1	1
STUDYING AT HOME	1	2	2	1	4		
GOING TO COLLEGE	1	1	3	4	1		
FAILURE					2	4	4
FASHION	1	1	3	2	1	2	
OPINION	4	2	1	2	1		
REALITY	3	1		3	1	1	1
ANALYSIS	1	1	3	3	2		
FACULTY	1		1	5	2	1	
BULLYING					1	6	3
GROOMING		4	2	1	2		1
CLEANING		1	2	4	3		
RENEWING	1	2	1	3	2	1	
WORKING		1	1	4	4		

..../cont.

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[*] See Experiment 3 for explanations

Appendix 8 (cont.)

	1	2	3	4	5	6	7
ENROLLING				3	2	4	1
FIGHTS				1	3	3	3
SLIDES	1	4	3	2			
CYCLES	2	4	3	1			
REGARDS		1	4	4	1		
WASHES	1		1	4	3		1
ACCENTS		2	3	2	1	1	1
PARTING FROM FRIENDS				1	4	3	2
CARRYING THINGS OUT	2		1	3	2	1	1
TYING THINGS TOGETHER	1	1	4	3	1		
ARRIVING AT COLLEGE	2		2	5	1		
WALKING ALONG STREETS	1	1	1	3	1	1	2
GOING TOWARDS COLLEGE		2	1	5	1	1	
SURGERY	1	1		2	2	4	
SHAVING		2	4	3	1		
LINKING		1	4	4	1		
DUSTING		1	1	3	2	2	1
VACANCY		2	1	5			2
VICINITY	1		1	6	1		1
FEELING REJECTED			1	1	2	3	3
BEING REGISTERED	1		2	5	1	1	
BEING RESPECTED	3	4	2	1			
BEING COMMITTED	1	1	1	1	4	2	
BEING CONSULTED	1	6	1	1		1	
BEING IMPRESSED	2	3	4		1		
BEING IGNORED		1	1		1	5	2
BEING COACHED		2	1	3	1	2	1
BEING COMBED	1	2	1	3	1	1	1
BEING DRIVEN		1		4	2		3
BEING ASLEEP		2	4	4			
BEING ADVISED		1	4	3	2		
LOSING CONTROL		1	1	1	1	4	2

..../cont.

Appendix 8 (cont.)

	1	2	3	4	5	6	7
WRITING LETTER			2	3	1	2	2
TALKING ALOUD			4	4	1	1	
HEARING BUSES				7	1	1	
ADVISING CHILD	1	1	3	3	1	1	
WALKING ALONE	1	5	1		1		2
INSANITY		1	1			4	4
IMPUNITY			2	2	2	2	2
HEREDITY			2	4	2	1	1
ADVOCACY			3	3	4		
ADEQUACY	1		5	2	2		
RAPIDITY	2	4	4				

APPENDIX 9

List of stimuli adopted for experiments 3, 4 and 5

PHOBIC	NEUTRAL
Corpses	Drawers
Speaking in public	Talking of weather/Going to college
Failure	Analysis
Bullying	Cleaning/Working
Fights	Regards
Parting from friends	Tying things together
Surgery	Shaving/Linking
Feeling rejected	Being registered
Being ignored	Being asleep/Being advised
Losing control	Talking aloud
Insanity	Adequacy/Advocacy

APPENDIX 10

Questionnaire for rating of stimuli in terms of their pleasantness[*]

Words/phrases differ in their capacity to elicit a feeling of pleasantness. Some words induce a feeling of pleasantness in us whereas other words evoke an unpleasant feeling.

Please rate the words/phrases below with respect to how pleasant, unpleasant or "neutral" they are. Any word that appears very pleasant should be given a high pleasantness rating (at the upper end of the numerical scale). Any word that seems unpleasant to you should be given a low pleasantness rating (at the lower end of the numerical scale). Because words also differ in many other ways, such as how many other words they make you think of or how easily they can be mentally imaged, it is important that your ratings not be based on such other characteristics and that you judge only how pleasant each word/phrase is to you. Please place a tick opposite the item in the column that describes your feelings for the content of the item.

	Number of subjects giving each rating						
	1	2	3	4	5	6	7
Fashion		2	2	4	1		
Beauty				3	1	3	2
Liberty			1	2	2	3	1
Safety			2	4	1	2	
Playing games	1			2	5	1	
Posting letter		1	3	1	3	1	
Drinking water		2	1	3	2	1	
Rejoice	1			2	2	2	2
Compile		3	2	4			
Success		1			2	5	1
Regard			2	4	3		
Triumph	1	1			4	2	1
Patience			2	4	2	1	
Tribute	2		1	4	1	1	

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[*] See Experiment 6 for explanations

..../cont.

Appendix 10 (cont.)

	1	2	3	4	5	6	7
Vacuum	4	3		2			
Victory	1		1	1	4	1	1
Formula	2	2	1	4			
Solution		1	2	3	3		
Prize	1			1	3	3	1
Fibre		1	4	4			
Grain	3	1	2	3			
Blossom			2	2	3	2	
Bucket	2	3	2	2			
Eating cake	1		1	3	3	1	
Eating bread			2	4	1	1	1
Picking flowers	1		1	2	4	1	
Writing letters	1		2	3	3		
Stopping buses	2	2	4	1			
Garden			1	1	2	3	2
Circle	2		1	5		1	
Metal	2	2	3	2			
Honey	1		1	3	3	1	
Penny	3	1	2	2	1		
Kiss					2	5	2
Graph		1	2	6			
Going sailing	1	2		1	2	2	1
Shopping alone	2			3	3	1	
Falling asleep	1			2	5		1

APPENDIX 11

List of stimuli adopted for experiments 6 and 7

PLEASANT	NEUTRAL
Beauty	Fashion
Liberty	Safety
Rejoice	Compile
Success	Regard
Prize	Fibre
Garden	Circle
Kiss	Graph

APPENDIX 12

Questionnaire "A"

The items which appear below refer to things or experiences that may (or may not) cause fear or other unpleasant feelings. Please place a tick opposite the item in the column that describes how much you are disturbed by it nowadays.

	Not at all	A little	A fair amount	Much	Very much
1. 2.					

APPENDIX 13

Questionnaire "B"

The items which appear below refer to things or experiences that may (or may not) cause fear or other unpleasant feelings. Please place a tick opposite the item in the column that describes how much, you think, the general population is disturbed by it nowadays.

	Not at all	A little	A fair amount	Much	Very much
1.					
2.					

APPENDIX 14

Questionnaire "C"

The words below refer to things or experiences which may (or may not) elicit some pleasant feelings. Please place a tick opposite the word in the column that describes how pleasant you think the content of the word is.

	Not at all	A little	A fair amount	Much	Very much
1.					
2.					

APPENDIX 15

Questionnaire "D"

(A) Did you see all the words all the time? YES/NO

If your answer is 'no', about how many words did you miss?
(Even if you missed the content of a stimulus you must have noticed a flash)

(B) Did you find the experiment:

- Anxiety provoking
- Interesting
- Boring
- Puzzling
- Any other comments?

Please do not talk about the experiment at the college; it is expected that most of the subjects who will participate in it will be college students and as a very sensitive measure is used advance knowledge of the procedure will contaminate the results.

Thank you for your cooperation.

APPENDIX 16

Questionnaire "E"

(A) Did you anticipate any shocks during the experiment? YES/NO

(Please delete)

If your answer is 'yes', was your anticipation:

- Continuous
- Intermittent
- Only at the beginning
- Only in the middle
- Only at the end of the experiment

(Please tick whichever apply)

(B) Did you experience any shock? YES/NO

If your answer is 'yes', was this shock(s):

- At the beginning
- In the middle
- At the end of the experiment

(C) Did you see all the words all the time? YES/NO

If your answer is 'no', about how many words did you miss? (Even if you missed the content of a stimulus you must have noticed a flash)

(D) Did you find the experiment

- Anxiety provoking
- Interesting
- Boring
- Puzzling
- Any other comments?

Please do not talk about the experiment at the college; it is expected that most of the subjects who will participate in it will be college students and as a very sensitive measure is used advance knowledge of the procedure will contaminate the results.

Thank you for your cooperation.

APPENDIX 17

Questionnaire "F"

(A) Did you anticipate any shocks during the experiment? YES/NO (Please delete)

If your answer is 'yes', was your anticipation:

- Continuous
- Intermittent
- Only at the beginning
- Only in the middle
- Only at the end of the experiment
- Only when the words appeared

(Please tick whichever apply)

(B) Did you experience any shock? YES/NO

If your answer is 'yes', was this shock(s):

- At the beginning
- In the middle
- At the end of the experiment

(C) Did you see all the words all the time? YES/NO

If your answer is 'no', about how many words did you miss?

(Even if you missed the content of a stimulus you must have noticed a flash)

(D) Did you find the experiment:

- Anxiety provoking
- Interesting
- Boring
- Puzzling
- Any other comments?

Please do not talk about the experiment at the college; it is expected that most of the subjects who will participate in it will be college students and as a very sensitive measure is used advance knowledge of the procedure will contaminate the results.

Thank you for your cooperation.

APPENDIX 18

Questionnaire "G"

(A) Did you anticipate any music during the experiment? YES/NO

If your answer is 'yes', was your anticipation:

- Continuous
- Intermittent
- Only at the beginning
- Only in the middle
- Only at the end of the experiment
- Only when the words appeared

(Please tick whichever apply)

(B) Did you hear any music? YES/NO

(c) Did you see all the words all the time? YES/NO

If your answer is 'no', about how many words did you miss?

(Even if you missed the content of a stimulus you must have noticed a flash)

(D) Did you find the experiment:

- Anxiety provoking
- Interesting
- Boring
- Puzzling
- Any other comments?

Please do not talk about this experiment at the college; it is expected that most of the subjects who will participate in it will be college students and as a very sensitive measure is used advance knowledge of the procedure will contaminate the results.

Thank you for your cooperation.

APPENDIX 19

DIAGRAM OF ELECTRIC SHOCK APPARATUS

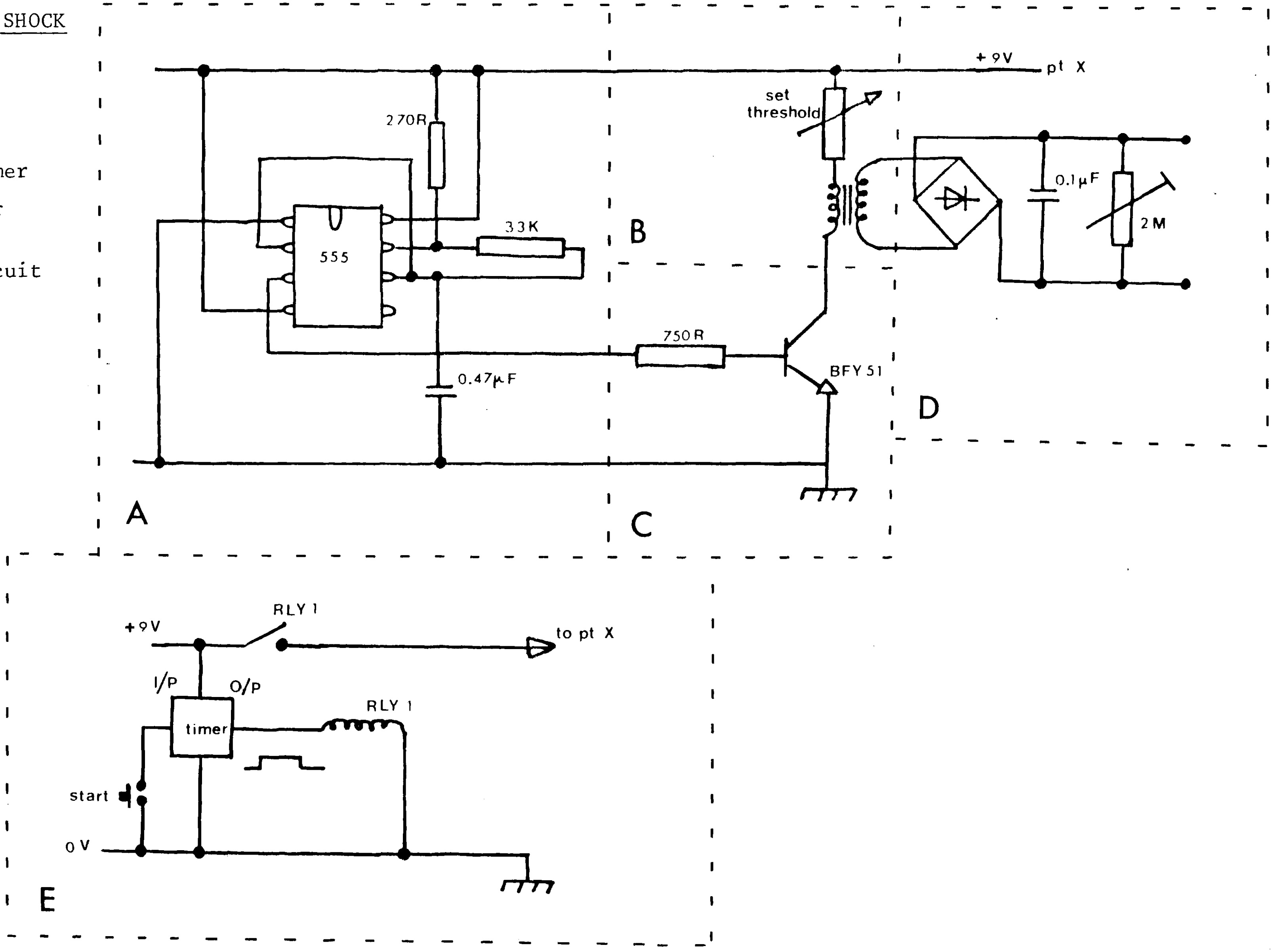
A. Oscillator 4 KHz

B. Step-up transformer

C. Current amplifier

D. Rectifying and
   smoothing circuit

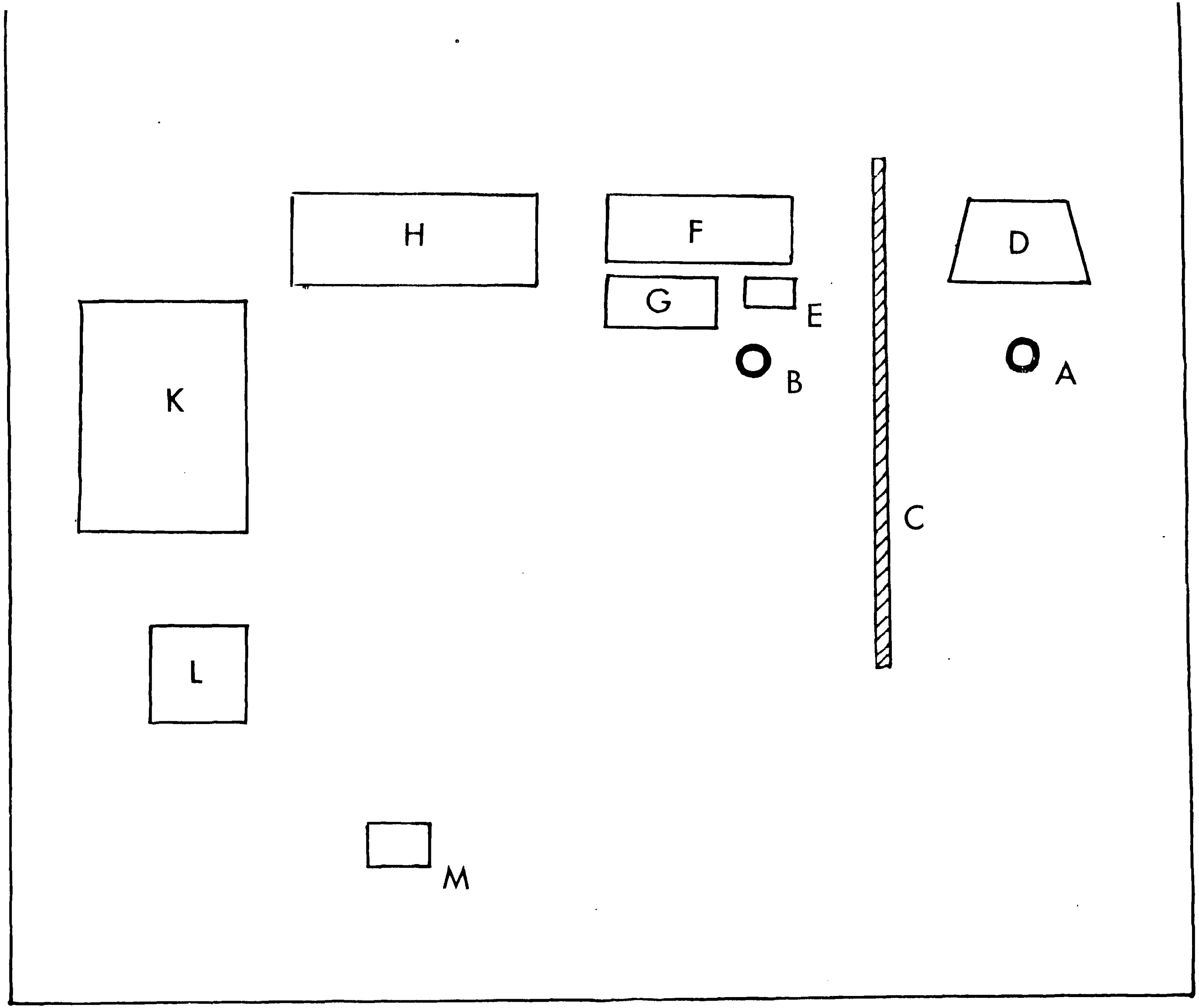
E. Pulse generator

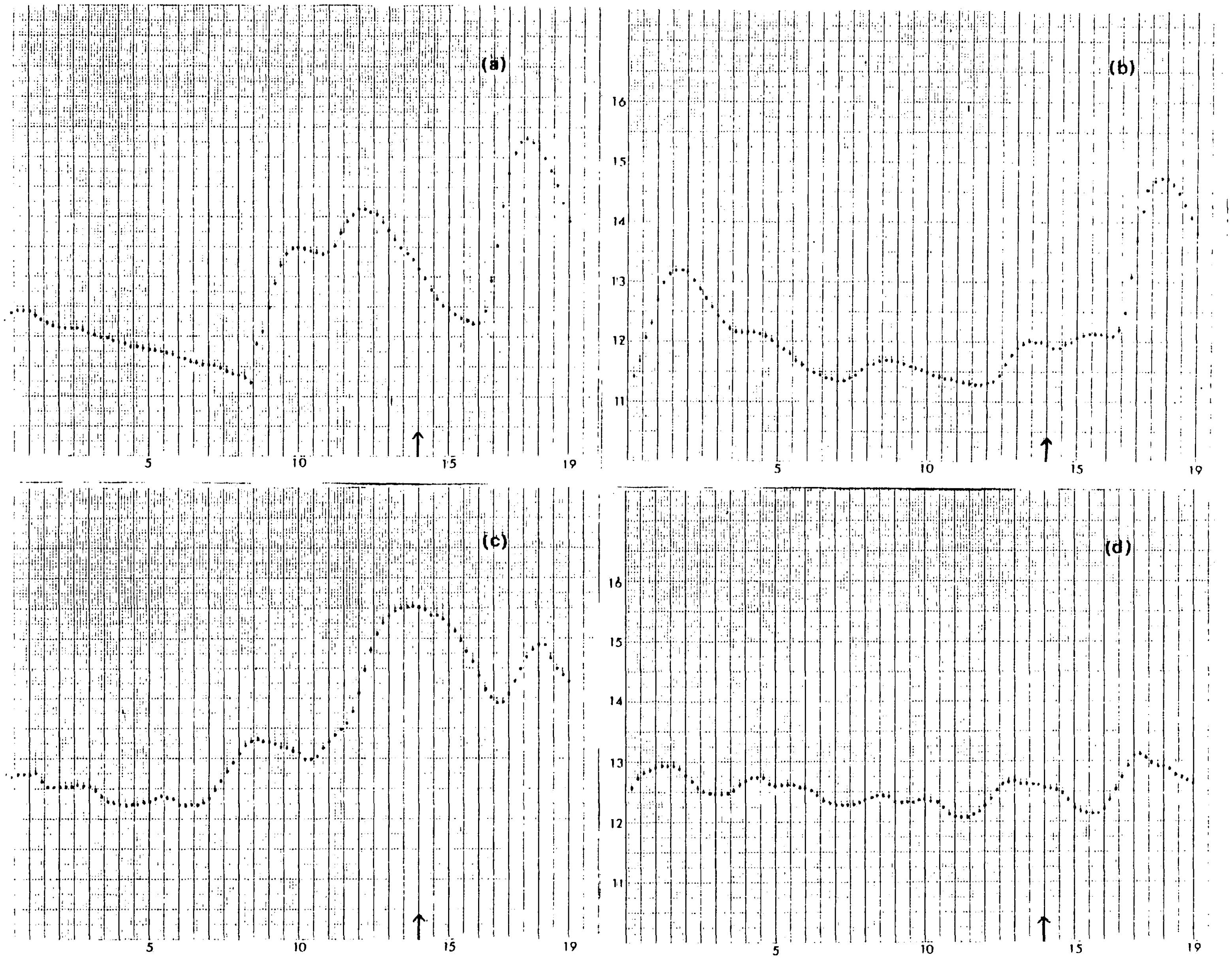


APPENDIX 20

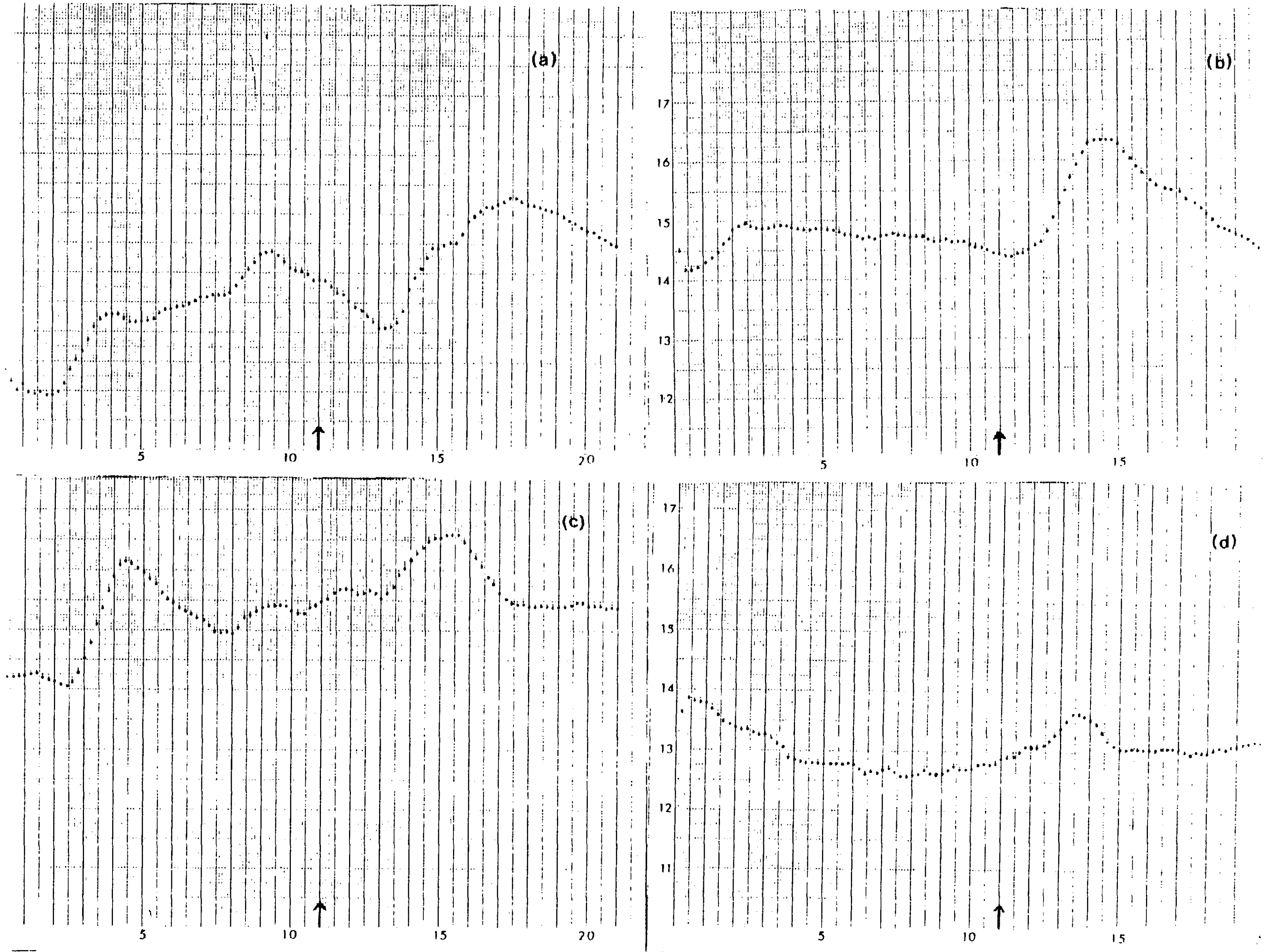
DIAGRAM OF THE LABORATORY

A. Subject
B. Experimenter
C. Black screen
D. PET computer
E. PET I/O Port
F. G. Washington oscillograph
G. Shock apparatus/Tape recorder
H. Teletype
K. PDP computer
L. PDP screen
M. Shade lamp





Appendix 21. Sample of EDRs of subject M20 to word stimuli during a habituation session. Horizontal axis = time (seconds); vertical axis = resistance (kilohms); arrow = stimulus onset. (a) = trial 2, (b) = trial 3, (c) = trial 29, (d) = trial 30. (Subject was under threat of shock, traces (a), (b) and (d) are responses to a phobic stimulus; trace ⓒ is a response to a neutral stimulus.) (cont.)



Appendix 21 (cont). Sample of EDRs of subject PD47 to word stimuli during a habituation session. (a) = trial 1, (b) = trial 3, (c) = trial 28, (d) = trial 30. (Trace (a) is a response to a neutral stimulus; traces (b), (c) and (d) are responses to a phobic stimulus.) Horizontal axis = time (seconds); vertical axis = resistance (kilohms); arrow = stimulus onset.

APPENDIX 22

PROBLEMS WITH THE PDP COMPUTER

Problems with the computer (that is, more than usually) started early in October 1979. Certain fuses had to be replaced, one after the other, and many times experiments were interrupted and data discarded. By the 24th October the situation had deteriorated to such a degree that a new fuse would not last for even a single experiment and experimentation was stopped. Engineers were called in to repair the computer. The repair was carried out on 1.11.79 and experiments were restarted on the following day. However, the computer was out of order by the 4.11.79 and the engineers were called in again. After over a week's delay the repair was carried out on 12.11.79. On that day and while the computer was tested by the computer expert in the department, a major accident occured. That is, in testing it he used (by mistake) the disk with all the up-to-date data with the result that they were totally destroyed. They included data from all the pilot studies, experiments 1 and 2 and parts of experiments 3 and 4 (the last two were run concurrently).

On the 13.11.79 experiments were restarted using a new disk. The computer was functioning adequately, apart from its occasional failure of the screen which was restored by switching on- and off- the computer a few times ... On one occasion and following my inability to restore the screen the computer expert was called in and without realizing it he changed the position of a switch on the PDP. By doing so he stopped the coordination of the PET computer with the PDP and this meant that the data from the subsequent 20 experiments were turned into irrelevant traces. What, in fact, had happened was realized after a subject had misunderstood the instructions and behaved in a way that betrayed what was going on. This incident occured on 21.11.79 On the following day the experiments were restarted.

APPENDIX 23

Pilot study 1: Raw data in ohms

	No. of subject	Sex of subject	TRIALS									
			1	2	3	4	5	6	7	8	9	10
PHOBIC STIMULI	1	M	11381	5982	3305	5101	3662	3960	4418	4096	2078	2194
	2	M	0	1133	5377	909	0	2485	2573	1624	0	1904
	3	F	2134	1570	1898	2058	699	0	1185	4729	3463	639
	4	F	2691	1586	1335	1500	1606	687	1814	843	2557	1361
NEUTRAL STIMULI	1	M	3850	4178	4018	3349	1524	1388	2084	2755	1059	1381
	2	M	1081	3798	1275	0	1826	5600	959	2935	2094	3327
	3	F	3778	0	0	0	1077	1564	3516	0	3538	4997
	4	F	1604	1514	0	669	1055	1349	1257	1826	1746	1229

Pilot study 2: Raw data in ohms

	No. of subject	Sex of subject	TRIALS									
			1	2	3	4	5	6	7	8	9	10
PHOBIC STIMULI	1	M	13211	6504	2156	1866	0	5327	8556	6837	0	0
	2	M	11878	9043	6004	5287	13177	9003	5614	6693	0	1964
	3	F	0	1695	0	0	0	0	0	0	0	0
	4	F	1034	504	0	0	0	0	0	0	0	687
	5	F	3680	3145	7676	7357	3285	3620	1321	2272	3463	5654
	6	F	1015	1019	566	1254	0	0	0	0	569	526
	7	F	3688	766	1090	0	0	7829	3708	1664	633	1764
	8	F	976	3108	1259	3814	2460	1232	2056	0	1932	0
NEUTRAL STIMULI	1	M	6090	8126	2525	1411	1578	4521	7624	607	7413	12158
	2	M	8186	3646	8140	0	2448	2446	2186	7177	2202	2907
	3	F	2165	1318	0	0	0	0	0	510	0	0
	4	F	0	0	714	0	0	650	0	0	0	615
	5	F	4118	2963	2519	5563	3201	5792	1279	2611	2446	3193
	6	F	1120	1079	0	708	0	0	583	0	0	0
	7	F	8435	0	1622	0	2864	7555	0	0	3530	0
	8	F	2434	1945	2102	0	1090	1082	0	0	533	2791

Pilot study 3: Data as for subjects 1, 2, 3, 18, 19 (Phobic group)
and 1, 2, 18, 19 (Neutral group) of Experiment 2

APPENDIX 24a. Experiment 1: Raw data in ohms and number of trials to habituation

PHOBIC GROUP

Number of subject	Sex of subject	TRIALS 1	2	3	4	5	6	7	8	9	10	11	12	Trials to habituation
1	M	3165	2677	2605	1509	1317	0	0	4348	3069	2182	2931	2208	12
2	M	1081	0	0	0	995	0	0	0	0	0	0	0	1
3	M	0	15753	2547	1616	0	781	0	869	629	0	663	1107	12
4	M	3569	2320	2557	1750	2020	2036	1329	1630	2907	2066	3151	5764	12
5	M	4195	539	4674	637	2734	0	1901	983	0	950	3903	2241	12
6	M	6082	3071	1948	2420	2374	1654	975	2693	2104	2953	2667	1151	12
7	M	6118	3091	3067	0	0	0	0	0	857	0	0	575	3
8	M	1962	2537	651	6170	4058	6911	5940	2132	6146	4448	2871	2020	12
9	M	2273	1905	3254	0	636	5372	5559	759	0	3226	1610	0	12
10	M	1980	685	576	1103	1300	862	792	826	0	680	0	933	12
11	M	1452	1757	1015	0	838	0	1345	0	0	2011	815	0	12
12	F	2435	3267	757	1710	1482	3067	2587	1249	1253	1409	1629	2322	12
13	F	2475	1409	589	1237	539	889	987	719	2356	563	0	0	12
14	F	6536	3632	0	1301	4683	0	971	4130	2132	2414	1429	1149	12
15	F	4196	1906	929	613	0	621	3500	2374	0	0	0	700	8
16	F	8721	999	0	0	0	0	0	0	506	2811	729	510	2
17	F	0	0	0	0	0	508	0	0	0	0	0	0	0
18	F	2334	695	0	0	0	2743	1608	0	0	501	963	5141	2
19	F	0	0	0	0	0	0	0	0	0	0	0	0	0
20	F	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX 24a (cont.)

NEUTRAL GROUP

1	M	0	0	0	0	0	0	2044	1371	2478	967	0	0	0
2	M	2189	823	569	769	0	0	1120	0	0	0	716	926	7
3	M	0	833	985	0	510	0	0	0	0	979	0	0	5
4	M	1438	0	0	0	0	3792	1850	0	704	8316	2687	2178	1
5	M	2410	4390	1425	1986	957	0	713	637	1588	2262	0	2000	12
6	M	4558	717	2274	0	1439	0	3854	9189	1502	0	1011	4326	12
7	M	5550	1902	4525	1722	2939	4561	1145	1462	1906	1546	2158	1013	12
8	M	1664	1387	919	1181	1121	1471	1586	1980	2150	1051	1089	0	12
9	M	0	0	0	2933	4406	2768	1777	3077	0	5557	2277	713	0
10	M	629	813	0	1606	1065	882	882	649	1081	1610	1373	0	12
11	M	8486	3053	0	4665	1462	2264	1866	1227	0	1938	3452	0	12
12	F	4226	7383	6570	4198	8771	10558	7253	2150	13874	9499	6040	989	12
13	F	523	905	605	0	0	0	0	0	0	0	0	0	3
14	F	0	705	0	1738	805	1093	1662	837	941	2314	543	551	12
15	F	8672	0	927	2739	0	2112	1960	0	0	1678	2048	0	12
16	F	1251	1433	1421	1720	0	775	2115	763	0	0	0	0	8
17	F	0	0	753	0	0	749	0	835	901	789	505	621	12
18	F	10442	0	0	0	546	0	953	0	0	0	0	0	1
19	F	550	0	0	0	0	0	0	0	867	997	751	571	1
20	F	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX 24b. Experiment 2: Raw data in ohms and number of trials to habituation

	Number of subject	Sex of subject	T R I A L S												Trials to habituation
			1	2	3	4	5	6	7	8	9	10	11	12	
PHOBIC GROUP	1	M	24492	4026	16985	9017	17087	1263	8945	11713	18232	2771	0	1315	12
	2	M	2440	0	669	1037	1073	0	0	1117	1159	2142	0	2873	12
	3	M	3932	4905	1780	4090	1958	6647	0	1914	2248	0	3003	2917	12
	4	M	13582	12543	12559	16599	8986	12691	12861	11978	6361	6089	2450	4936	12
	5	M	1015	1000	0	687	0	0	3182	645	4119	3411	963	0	12
	6	M	1361	818	0	1760	0	0	0	639	0	0	0	790	4
	7	M	5049	5560	0	2797	9684	8778	3600	4832	5933	4410	3320	0	12
	8	M	1129	0	0	536	0	9136	2187	0	0	0	0	0	7
	9	M	0	0	0	876	537	2723	1122	983	770	1986	1849	611	0
	10	M	3395	2118	9494	597	5501	690	3271	0	0	0	2933	0	7
	11	M	5296	3298	1410	1562	1274	0	1602	1667	4643	2889	8054	1928	12
	12	M	4957	3277	4176	3191	2519	4757	4472	3163	6014	2100	3397	3956	12
	13	M	13099	3577	1908	3123	0	0	1447	2322	0	1576	0	4701	12
	14	M	6152	1139	1435	0	2947	7986	6272	0	1510	0	0	0	9
	15	F	0	0	0	0	0	0	0	614	0	0	0	0	0
	16	F	1194	0	1146	2498	885	897	0	0	1873	876	0	4231	12
	17	F	3716	2776	2908	1137	819	1226	1066	824	1024	2306	1283	0	12
	18	F	3846	1846	1562	1281	2008	0	1283	6757	3307	2475	1157	1860	12
	19	F	2476	706	2033	1023	1216	1500	579	1604	2249	663	0	0	12
	20	F	12911	1770	4738	4639	8770	5106	0	7647	3515	0	0	0	9

APPENDIX 24b (cont.)

NEUTRAL GROUP

1	M	4352	0	761	0	0	0	3155	3051	5844	0	2561	4162	3
2	M	13617	579	4926	0	0	0	590	0	612	0	0	0	3
3	M	6566	2079	0	0	0	0	0	1222	0	0	0	0	2
4	M	0	0	0	0	0	0	0	0	0	0	0	646	0
5	M	5694	0	4599	7301	2048	4324	2090	709	7337	2855	2915	0	12
6	M	6253	1727	2311	2952	3304	0	1775	2488	2945	0	888	0	12
7	M	2139	2262	4852	1160	3662	0	1325	3519	2139	0	3711	1919	12
8	M	3634	855	1281	541	1556	3111	1670	1029	2705	1966	1015	0	12
9	M	828	0	0	0	0	0	584	0	0	0	0	0	1
10	M	0	0	0	0	0	0	0	0	0	0	0	0	0
11	M	0	0	0	0	1166	1062	1097	0	0	876	0	0	0
12	M	0	517	0	0	0	673	0	0	612	0	0	544	2
13	M	4395	0	569	1842	0	0	0	0	0	0	0	0	4
14	M	887	1930	1756	1650	1047	0	1347	3345	1700	1257	0	2581	12
15	F	2024	1308	882	583	0	1065	854	1308	0	513	0	0	12
16	F	0	0	0	0	697	0	1001	977	787	0	581	0	0
17	F	1900	1039	2148	0	1323	1404	2169	0	621	0	0	3980	12
18	F	2290	2713	4549	4759	589	613	1468	1760	801	0	0	7291	12
19	F	1576	1153	637	1454	1830	3978	3061	1381	4701	2156	1652	1189	12
20	F	1287	0	0	0	833	1111	817	0	825	1704	705	843	1

APPENDIX 24c. Experiment 3: Raw data in ohms and number of trials to habituation

PHOBIC GROUP

Number of subject	Sex of subject	TRIALS												Trials to habituation
		1	2	3	4	5	6	7	8	9	10	11	12	
1	M	0	742	3490	1772	1005	3226	803	5520	1670	5360	5469	2230	12
2	M	512	0	815	0	0	0	0	0	0	0	0	0	3
3	M	0	0	0	0	0	0	0	0	0	0	0	0	0
4	M	2020	1252	1032	1009	962	1414	2317	1363	1092	878	2822	1252	12
5	M	3990	5746	4848	3889	3470	1996	2606	4857	0	0	2832	707	12
6	M	3363	5748	0	3693	0	0	0	0	0	2537	537	0	4
7	M	2967	5958	4040	1942	6128	3594	7704	3015	9714	2903	0	2655	12
8	F	0	0	0	0	0	0	0	0	0	0	0	0	0
9	F	1807	657	0	0	512	0	897	1053	0	0	1323	0	12
10	F	0	0	0	0	0	0	0	0	0	0	0	0	0
11	F	1943	1498	0	0	0	1823	0	1405	0	0	0	0	2
12	F	0	548	530	0	0	0	0	0	0	0	502	0	3
13	F	0	763	2560	690	0	0	0	0	0	0	538	0	4
14	F	583	0	0	0	573	0	0	976	0	0	545	0	1
15	F	9453	1696	0	0	0	0	0	0	0	0	0	0	2
16	F	0	0	0	0	0	743	0	0	0	0	0	0	0
17	F	15727	13345	8086	0	0	0	0	0	0	14736	0	22732	3
18	F	11223	6073	649	2208	0	0	0	0	2014	1881	581	556	4
19	F	7809	0	1687	12583	1096	2418	11841	5295	6167	7520	0	1389	12
20	F	0	2134	1434	3137	1847	2105	1075	5566	908	3015	2792	2590	12

APPENDIX 24c (cont.)

NEUTRAL GROUP

1	M	1336	0	0	0	0	1204	0	2486	4217	1124	1299	995	1
2	M	1694	1382	0	0	0	522	0	0	0	911	0	0	2
3	M	0	1864	0	0	0	0	0	0	0	0	0	0	2
4	M	4472	1082	2668	2298	2299	3017	1211	587	0	1491	0	0	12
5	M	1710	669	0	1579	1984	1994	2264	4527	0	0	922	2042	12
6	M	3103	0	1745	1211	0	0	0	0	0	0	0	0	4
7	M	3428	1679	0	0	0	0	0	738	0	0	0	0	2
8	F	2719	1534	1321	2272	2290	537	1129	1450	0	0	607	673	12
9	F	5583	5253	2197	2691	4481	2240	7112	4273	1450	0	1171	1700	12
10	F	0	0	1120	0	0	0	0	0	0	0	1433	643	3
11	F	1652	2082	1293	1317	1657	2441	2131	0	3772	0	2239	0	12
12	F	869	595	0	0	0	0	0	0	0	0	0	0	2
13	F	3594	3141	6448	6358	8036	0	6218	0	0	937	1211	833	12
14	F	2277	0	2225	766	1591	2203	0	0	1049	1411	0	0	12
15	F	18014	7107	1329	0	3137	12388	597	0	12406	0	8584	22258	12
16	F	8995	783	1293	813	1255	975	953	991	0	955	1319	907	12
17	F	0	0	0	0	0	0	0	0	0	0	0	0	0
18	F	0	1206	0	0	0	0	4147	5481	0	0	0	0	2
19	F	3043	0	0	0	0	0	0	0	0	0	0	0	1
20	F	7977	0	0	0	0	0	0	910	0	0	0	0	1

APPENDIX 24d. Experiment 4: Raw data in ohms and number of trials to habituation

PHOBIC GROUP

Number of Subject	Sex of Subject	TRIALS												Trials to habituation
		1	2	3	4	5	6	7	8	9	10	11	12	
1	M	3305	1827	3248	2890	3016	3206	4915	5613	1936	3763	5188	2795	12
2	M	2587	1801	868	0	657	564	843	763	0	2828	713	1019	12
3	M	1691	947	2148	2019	2679	1520	1618	1927	2185	1433	1591	1402	12
4	M	1917	1436	1090	3053	1547	2112	0	0	863	1254	1265	852	12
5	M	1938	1035	951	1158	1103	2472	740	2664	1505	2707	625	1795	12
6	M	0	0	0	0	0	0	577	0	0	0	0	0	0
7	M	5196	3286	4300	4504	3710	7804	7985	2609	4665	2914	2409	5075	12
8	M	1124	762	1354	0	1413	859	0	1215	0	0	736	2194	12
9	M	586	0	0	573	0	0	672	0	0	0	1864	0	7
10	M	15236	9571	12053	4633	9694	2102	2290	5609	18107	23665	12050	18261	12
11	F	4536	4297	3050	2520	1892	966	0	879	0	0	0	0	8
12	F	3651	1155	944	2443	3237	2354	3092	2291	2065	2336	1085	1168	12
13	F	0	1590	0	0	0	0	0	0	568	0	0	0	2
14	F	0	0	1231	0	0	0	0	0	0	0	0	0	3
15	F	3743	4080	1274	3482	3362	2671	1264	0	0	0	0	0	7
16	F	1445	1552	913	588	0	655	1110	1185	1760	0	1663	981	12
17	F	5813	10984	3134	2735	2008	1905	3007	3789	3040	3215	3759	8479	12
18	F	0	1956	6421	0	0	806	7406	1523	0	6122	0	0	12
19	F	3576	3201	1895	0	0	6761	3879	2964	0	8300	0	0	12
20	F	0	0	525	0	0	0	0	0	662	601	0	0	3

APPENDIX 24d (cont.)

NEUTRAL GROUP

1	M	3223	605	0	0	2760	950	2547	2783	1126	1553	0	4789	12
2	M	4030	3267	1780	4781	1412	1219	2276	745	1852	1375	2865	0	12
3	M	0	0	0	0	0	0	0	0	0	0	2618	501	0
4	M	3738	2104	1039	4100	0	8496	15779	6378	5922	2148	2577	0	12
5	M	1971	1200	533	601	0	0	0	0	0	0	0	0	4
6	M	3590	0	871	2100	673	1111	0	3910	0	0	0	0	8
7	M	11530	3118	2116	0	0	0	1039	0	0	0	0	0	3
8	M	25571	0	0	2020	6066	1423	0	1960	0	2248	1033	935	12
9	M	2115	1974	1096	0	1927	0	645	3478	4975	6267	4144	1278	12
10	M	1898	0	1122	1569	2467	1047	1814	0	0	0	0	0	7
11	F	2791	1080	2273	0	0	0	674	1191	0	0	835	0	3
12	F	5606	2134	6581	2419	0	3652	11595	1520	0	0	1099	0	12
13	F	0	1203	4092	2260	0	0	2869	1035	0	0	0	0	8
14	F	17531	5603	1229	0	0	0	649	867	881	941	1039	985	3
15	F	964	712	921	837	722	1548	692	1035	1262	0	0	0	9
16	F	1433	0	525	0	0	0	0	0	0	0	0	707	3
17	F	0	0	2781	0	1127	1139	1087	691	945	925	1147	0	12
18	F	5527	6635	2869	1546	2009	4994	0	0	0	4365	0	0	6
19	F	10835	1634	1313	0	0	0	0	0	0	0	889	0	3
20	F	0	551	0	0	0	1399	0	1042	0	1858	1576	0	2

APPENDIX 24e. Experiment 5: Raw data in ohms and number of trials to habituation

PHOBIC GROUP

Number of Subject	Sex of Subject	T R I A L S												Trials to habituation
		1	2	3	4	5	6	7	8	9	10	11	12	
1	M	1721	0	0	0	0	0	0	0	0	0	0	0	1
2	M	0	0	0	0	0	0	0	0	0	0	0	0	0
3	M	6172	4574	3682	4427	603	2784	767	0	2287	0	4339	0	12
4	M	2525	0	0	785	0	0	0	0	0	0	0	0	4
5	M	964	0	0	0	0	0	0	0	0	0	0	0	1
6	M	2523	3588	2717	2322	0	0	0	0	0	0	0	0	4
7	M	3458	0	0	0	0	0	766	0	1297	0	0	0	1
8	M	1905	1222	1013	774	1043	932	982	1607	550	835	2326	1107	12
9	F	1153	635	0	0	0	0	654	0	0	0	0	0	2
10	F	2060	2164	0	0	0	0	0	0	0	0	0	0	2
11	F	2247	2733	1895	1008	3165	3540	3674	2390	3107	4178	2797	2254	12
12	F	1134	1538	0	0	0	0	0	0	0	0	1694	0	2
13	F	9036	5913	7246	2804	3519	4099	2559	0	2658	1398	0	1616	12
14	F	5243	6068	1994	0	951	0	559	0	819	1664	0	1450	12
15	F	0	0	0	0	0	0	771	0	0	0	0	0	0
16	F	5850	5282	3359	0	3487	0	518	0	2394	2166	0	0	12
17	F	0	0	0	0	0	0	0	0	0	0	0	0	0
18	F	1104	0	0	0	695	1298	0	0	991	0	0	0	1
19	F	1576	3081	696	1812	0	968	4854	1543	0	1642	1161	0	12
20	F	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX 24e (cont.)

NEUTRAL GROUP

1	M	546	0	0	604	0	0	1256	0	0	0	0	0	7
2	M	9703	5816	2342	1869	0	0	0	0	0	0	0	0	4
3	M	1784	1453	0	3211	2639	1234	0	2416	1180	698	1046	1453	12
4	M	2792	2462	0	0	0	0	0	0	0	0	0	0	2
5	M	5123	6204	3255	0	574	2231	1118	3075	2712	2632	0	0	12
6	M	0	0	0	0	0	0	0	0	0	0	0	0	0
7	M	2997	2384	1812	0	0	0	0	0	0	0	1386	0	3
8	M	1751	0	0	795	0	857	1481	1686	2241	6037	1128	0	12
9	F	2782	1749	0	753	688	1487	2148	3276	512	0	1635	1082	12
10	F	4430	0	0	950	1855	0	0	0	0	0	0	0	5
11	F	0	0	0	0	0	0	0	0	0	0	0	0	0
12	F	5314	3716	2565	2489	2074	4053	1367	1670	1412	1425	3058	1976	12
13	F	1478	2415	3452	645	2175	1792	2981	2836	5811	0	1431	3025	12
14	F	1772	2050	685	0	1362	630	0	0	742	0	762	0	12
15	F	1351	677	0	0	0	0	0	0	0	0	0	0	2
16	F	3636	1139	0	0	0	1434	0	1334	0	2852	898	1034	2
17	F	12911	8337	8495	647	9715	650	2126	7772	3051	0	0	2416	12
18	F	723	0	0	0	0	1055	0	0	5522	8987	9788	1063	1
19	F	2037	1585	3840	0	997	0	3670	703	0	0	0	0	8
20	F	0	0	0	0	0	561	0	0	0	0	0	0	0

APPENDIX 24f. Experiment 6: Raw data in ohms and number of trials of habituation

PLEASANT GROUP

Number of Subject	Sex of Subject	TRIALS												Trials to habituation
		1	2	3	4	5	6	7	8	9	10	11	12	
1	M	6221	0	624	0	0	0	14129	5404	0	6723	0	4896	3
2	M	7271	4251	3959	0	551	0	0	0	0	731	0	0	5
3	M	3405	0	2724	1174	0	1988	614	1365	2938	1164	1820	2046	12
4	M	10660	6601	5806	9898	4619	0	9350	4741	9145	4052	0	8597	12
5	M	1815	1588	3747	2638	2788	3847	4232	3565	4424	4524	4832	8441	12
6	M	1164	651	1066	0	628	808	0	919	930	1673	0	0	12
7	M	2510	1468	0	0	0	0	0	2069	1493	0	2319	1985	2
8	M	3074	1959	0	555	0	2629	5728	4325	2456	1902	0	902	12
9	M	3552	1104	1086	1212	1367	1902	1025	0	1798	1930	1709	1572	12
10	M	826	682	0	754	0	533	555	3153	0	0	2283	685	12
11	M	722	1291	0	1723	3166	0	0	0	0	840	4707	5141	5
12	F	0	2612	1525	1409	0	0	1304	0	1063	0	0	0	9
13	F	2190	4617	4347	5869	6275	3075	2259	0	1881	1934	0	2619	12
14	F	1841	5215	907	10305	3024	1071	3079	4954	0	3343	8700	7069	12
15	F	676	922	0	0	610	0	0	0	0	531	0	934	5
16	F	4319	4135	3336	0	813	2783	1280	0	0	5610	0	0	12
17	F	851	617	560	1491	855	0	5073	2486	3180	972	2107	0	12
18	F	1087	568	0	0	0	0	649	0	0	0	0	0	2
19	F	3479	3657	2197	2734	1671	694	3576	4186	0	6699	3911	2150	12
20	F	0	0	0	0	0	1611	0	0	0	745	0	0	0

APPENDIX 24f (cont.)

NEUTRAL GROUP

1	M	2185	1793	1035	927	1093	0	0	2354	613	1122	971	0	12
2	M	8537	1341	3813	0	0	0	2067	1177	0	0	0	0	3
3	M	2823	2081	0	2968	0	0	0	0	0	0	0	0	4
4	M	0	0	1007	0	0	0	0	0	0	0	0	0	3
5	M	8024	0	4771	6099	3254	7553	3027	1556	3427	3805	9995	0	12
6	M	0	1039	646	1439	1341	1066	507	1305	0	0	0	0	8
7	M	2009	4225	0	1325	0	2571	0	583	2038	2641	5847	1238	12
8	M	1051	0	640	0	0	0	0	0	0	0	0	701	3
9	M	2578	2654	1019	4577	0	2138	0	2303	1554	0	3461	954	12
10	M	1738	1520	748	1298	1713	1209	1005	0	600	3252	611	0	12
11	M	740	1418	509	0	1279	0	552	719	1318	669	782	1118	12
12	F	513	0	0	0	0	0	0	0	1896	0	0	0	1
13	F	0	987	3045	1831	3423	1733	2046	0	1266	1798	2363	0	12
14	F	3097	0	0	3038	0	6704	0	0	0	0	0	879	6
15	F	3170	1473	1385	1820	3502	2722	748	2418	1324	1936	0	2632	12
16	F	1970	1900	2985	2173	2130	2231	1197	1829	3733	0	4355	1047	12
17	F	4164	0	4819	4943	2134	4504	3246	6816	3165	2828	4697	5321	12
18	F	0	0	2315	1409	0	1052	3616	0	0	11850	0	2940	12
19	F	0	0	1013	0	1941	1234	0	1221	762	0	0	1317	12
20	F	2487	3907	1801	5662	2084	5344	3708	0	4149	567	0	3635	12

APPENDIX 24g. Experiment 7: Raw data in ohms and number of trials to habituation

PLEASANT GROUP

Number of Subject	Sex of Subject	TRIALS												Trials to habituation
		1	2	3	4	5	6	7	8	9	10	11	12	
1	M	0	0	0	7114	3336	6277	1108	0	0	1252	3341	2418	0
2	M	0	4255	1626	0	769	0	1667	1873	2384	0	848	0	12
3	M	886	670	0	0	1283	0	0	1044	0	0	503	0	12
4	M	8056	7076	3122	1780	748	3419	6739	1590	0	0	0	7381	8
5	M	740	0	0	0	0	0	0	0	0	0	0	0	1
6	M	1539	0	0	0	2854	0	1137	891	964	0	894	0	1
7	M	8364	0	4003	1209	6490	3218	0	0	0	0	683	706	6
8	M	2392	2149	2172	1652	2078	2755	2654	2834	2671	1985	2573	5143	12
9	M	0	3486	0	1434	2508	2344	0	0	0	3014	2456	706	6
10	M	5712	5209	1292	2440	1243	1279	6914	1142	3166	5083	11263	11073	12
11	F	9205	0	0	0	0	0	0	0	0	0	0	0	1
12	F	6631	1059	1023	3185	1449	0	0	2080	1786	1301	0	2429	12
13	F	3636	1740	0	0	0	1425	0	0	0	0	0	0	2
14	F	1062	0	0	0	0	0	0	3500	2564	1024	0	3621	1
15	F	722	0	0	0	0	0	0	0	0	0	0	0	1
16	F	791	1223	1633	620	0	0	0	675	0	602	513	869	4
17	F	2597	3127	677	0	0	646	508	3261	1890	0	1963	0	12
18	F	4288	6596	9276	1393	7998	8901	10198	3655	3749	3981	8429	8296	12
19	F	0	0	0	0	0	0	0	0	0	0	0	0	0
20	F	4522	1708	1756	0	2380	1147	0	2737	515	0	2433	0	12

APPENDIX 24g (cont.)

NEUTRAL GROUP

1	M	2052	0	0	0	0	1259	0	0	821	0	0	0	1
2	M	6202	1430	0	1610	567	2610	1370	1849	4268	3529	0	0	12
3	M	6529	4851	3437	0	2291	4061	3327	4816	1099	3422	0	2325	12
4	M	2157	2006	1085	778	0	1191	0	0	0	0	0	0	6
5	M	16042	8383	10067	7327	1059	0	9825	2138	10848	5455	0	10568	12
6	M	1669	0	649	731	1350	762	0	0	0	2742	1445	0	6
7	M	1445	573	509	0	0	1016	648	1238	0	1500	545	1217	12
8	M	1003	0	0	0	609	0	2099	0	0	3898	0	644	1
9	M	2776	2689	3430	4050	0	11855	3104	7101	1974	4590	0	0	12
10	M	6524	3401	0	6797	3516	3515	3706	0	7830	1620	960	4291	12
11	F	2707	3406	0	1043	959	1101	0	7609	3059	2272	0	2190	12
12	F	2311	1279	0	0	2017	0	0	0	0	2052	1726	526	5
13	F	5047	3888	0	1991	0	0	0	4360	945	529	0	0	4
14	F	1918	0	0	0	0	673	0	1569	1165	1612	1312	0	1
15	F	3460	0	926	0	5899	0	1240	0	2246	4010	613	808	12
16	F	8734	5943	2785	1869	0	1588	697	2852	4010	746	5845	2039	12
17	F	1419	0	0	646	981	0	1397	0	1172	0	0	0	9
18	F	0	0	0	0	0	0	0	0	0	0	0	0	0
19	F	2766	1992	3821	2337	549	1594	4071	2856	2577	1074	1115	3667	12
20	F	0	0	0	0	1507	530	0	0	0	0	2524	1221	0

APPENDIX 25

Experiment 1: Skewness and variance values of SRR, square-root SRR,* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	0.676	5964483**	-0.407	802.679	-0.600	0.157
	2	3.051	11455071	0.894	839.602	0.406	0.103
	3	0.832	1965387	0.103	555.504	0.929	0.076
	4	2.182	2099428	0.526	536.338	1.061	0.066
	5	1.146	1958008	0.249	556.987	0.502	0.087
	6	1.654	3728896	0.674	721.285	0.856	0.148
	7	1.394	3189594	0.369	678.466	0.667	0.119
	8	1.083	1858814	0.223	546.270	1.071	0.076
	9	1.602	2579576	0.583	645.012	1.160	0.100
	10	0.662	1856535	-0.027	561.657	0.748	0.077
	11	0.679	1666951	0.081	548.837	0.721	0.069
	12	1.495	2710972	0.352	592.366	1.110	0.108
	All Trials	2.741	3566717	0.433	651.124	0.827	0.107
NEUTRAL GROUP (N=20)	1	1.117	10809812	0.362	1183.890	0.095	0.157
	2	2.042	3417225	0.680	634.845	0.556	0.126
	3	2.059	2884160	0.794	595.541	0.687	0.117
	4	0.866	2160427	0.166	642.207	0.590	0.103
	5	2.414	4465879	0.969	703.085	0.673	0.077
	6	2.289	6372206	0.790	881.540	0.401	0.100
	7	1.948	2772706	0.067	520.957	0.563	0.096
	8	2.819	4292196	0.925	644.106	0.894	0.116
	9	3.378	9176805	1.460	848.581	0.636	0.172
	10	1.708	7309600	0.557	870.252	0.113	0.179
	11	1.558	2368024	0.303	559.491	0.506	0.070
	12	1.984	1168397	0.687	408.837	0.891	0.052
	All Trials	2.673	4769683	0.810	705.793	0.698	0.115

..../cont.

Appendix 25 (cont.)

Experiment 2: Skewness and variance values of SRR, square-root SRR,* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	1.650	37176705	0.489	1521.786	-0.482	0.119
	2	1.948	8594772	0.275	918.605	0.466	0.069
	3	1.779	21404104	0.717	1480.089	0.609	0.111
	4	2.404	14854017	1.028	888.158	0.931	0.080
	5	1.625	20504708	0.631	1442.494	0.578	0.077
	6	0.956	15331897	0.315	1519.875	0.336	0.180
	7	1.639	11459790	0.439	1136.049	0.632	0.079
	8	1.363	14000811	0.533	1151.738	0.514	0.094
	9	2.327	17197748	0.504	1232.624	0.429	0.109
	10	0.798	2920830	-0.091	699.779	0.579	0.079
	11	1.720	4106804	0.519	816.181	1.231	0.080
	12	0.703	3227713	0.230	787.663	1.158	0.104
	All Trials	2.379	14654365	0.637	1169.341	0.644	0.104
NEUTRAL GROUP (N=20)	1	1.659	11035679	0.226	1069.622	-0.188	0.172
	2	0.628	836817	0.129	410.143	0.781	0.062
	3	0.937	3346195	0.319	734.082	0.802	0.085
	4	1.952	3691548	0.912	724.159	1.254	0.079
	5	1.106	1248661	0.273	468.463	0.788	0.095
	6	1.485	1866346	0.739	549.826	0.678	0.146
	7	0.510	941866	-0.421	358.023	0.431	0.097
	8	0.802	1483524	0.183	531.314	0.961	0.113
	9	1.391	4557648	0.485	767.477	0.399	0.159
	10	1.205	829667	0.814	399.763	1.300	0.090
	11	1.421	1282668	0.797	471.406	1.004	0.058
	12	1.778	3826072	0.877	754.795	0.622	0.166
	All trials	2.644	3117012	0.687	631.137	0.841	0.116

Appendix 25 (cont.)

Experiment 3: Skewness and variance values of SRR, square-root SRR,* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	1.475	20153171	0.623	1667.611	0.055	0.165
	2	1.768	11741759	0.677	1185.189	0.511	0.134
	3	1.622	4669901	0.623	821.286	0.825	0.145
	4	2.661	8547601	1.070	1014.878	1.174	0.088
	5	2.338	2346040	1.173	546.893	1.075	0.052
	6	0.921	1498056	0.562	562.784	1.223	0.104
	7	2.414	9327191	1.495	1040.024	1.266	0.103
	8	1.057	4519290	0.618	911.558	0.645	0.161
	9	2.453	6210697	1.564	855.306	2.179	0.064
	10	2.255	13437068	1.086	1349.836	1.146	0.086
	11	1.737	2147889	0.818	552.723	0.856	0.141
	12	3.619	25347455	2.224	1323.927	1.947	0.067
	All Trials	3.346	9144159	1.294	985.091	1.100	0.113
NEUTRAL GROUP (N=20)	1	2.042	17849454	0.402	1189.722	-0.587	0.170
	2	1.710	3507253	0.417	654.036	0.574	0.104
	3	1.965	2432340	0.521	615.546	0.840	0.109
	4	2.055	2442961	0.758	607.057	1.010	0.076
	5	1.811	4215289	0.661	828.105	0.921	0.111
	6	3.041	7761104	1.239	875.788	1.013	0.086
	7	1.627	4575278	0.847	834.700	1.063	0.107
	8	1.441	2988716	0.796	691.237	1.305	0.114
	9	2.893	8574529	1.804	954.974	1.709	0.108
	10	0.985	303449	0.853	252.680	1.680	0.036
	11	3.073	3715332	1.240	620.188	1.913	0.066
	12	3.727	24247270	2.585	1206.750	2.081	0.063
	All Trials	4.160	7092863	1.301	823.529	1.163	0.110

Appendix 25 (cont.)

Experiment 4: Skewness and variance values of SRR, square-root SRR* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	2.222	11920857	0.339	1048.288	-0.329	0.125
	2	1.736	8804350	0.416	847.355	0.345	0.120
	3	2.179	7875657	0.621	712.302	0.080	0.085
	4	0.493	2664544	0.026	718.210	0.496	0.109
	5	1.992	5292408	0.401	843.001	0.510	0.111
	6	1.546	4526875	0.235	682.902	0.349	0.112
	7	1.259	5870521	0.324	851.806	0.402	0.143
	8	0.917	3209300	0.039	707.742	0.676	0.110
	9	3.238	16249923	1.443	1158.807	0.567	0.131
	10	2.842	28910173	1.064	1645.930	0.189	0.174
	11	2.553	7934850	0.931	898.876	0.813	0.114
	12	2.656	18743416	1.233	1355.007	0.409	0.113
	All Trials	3.361	9903160	0.795	937.091	0.400	0.119
NEUTRAL GROUP (N=20)	1	1.770	43470556	0.563	1906.772	-0.592	0.158
	2	1.332	3258319	0.181	636.478	1.093	0.072
	3	1.550	2593898	0.064	481.385	0.782	0.103
	4	1.097	2121887	0.387	630.027	1.119	0.085
	5	1.907	2322448	0.731	602.613	1.445	0.072
	6	2.078	4550699	0.738	754.297	0.957	0.096
	7	2.376	17044141	1.311	1258.272	0.809	0.122
	8	1.524	2785278	0.314	601.324	0.896	0.085
	9	2.060	2810166	1.201	623.272	1.517	0.069
	10	1.711	2841606	0.694	677.560	1.555	0.106
	11	1.060	1466925	0.249	511.235	1.250	0.101
	12	3.038	1207142	1.596	361.297	2.692	0.059
	All Trials	4.395	8200981	1.170	844.918	1.102	0.106

Appendix 25 (cont.)

Experiment 5: Skewness and variance values of SRR, square-root SRR* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	1.187	5833724	-0.019	742.953	-0.859	0.156
	2	0.728	4825316	0.230	961.762	0.090	0.177
	3	1.793	3592723	0.854	763.713	0.867	0.084
	4	1.689	1508532	0.972	499.833	1.226	0.053
	5	1.562	1491370	1.045	489.269	1.228	0.061
	6	1.619	1647259	1.134	519.393	1.560	0.093
	7	1.873	1842154	0.974	503.585	1.564	0.093
	8	2.016	481096	1.864	248.290	2.126	0.041
	9	1.094	1124886	0.674	466.672	1.228	0.063
	10	1.799	1202747	0.926	449.927	1.741	0.098
	11	1.749	1510134	1.270	493.870	1.464	0.124
	12	1.666	471295	1.460	271.712	1.950	0.027
	All Trials	2.155	2394512	1.022	596.615	1.246	0.112
NEUTRAL GROUP (N=20)	1	1.622	10748039	0.262	889.355	-0.485	0.160
	2	1.239	5626284	0.209	888.888	0.127	0.129
	3	1.820	4751009	0.814	887.682	0.954	0.097
	4	1.555	849690	0.685	374.028	2.090	0.063
	5	2.903	4899812	1.195	732.851	1.030	0.078
	6	1.523	1084889	0.352	418.477	1.284	0.081
	7	1.062	1333804	0.574	523.839	1.433	0.105
	8	1.899	3773911	0.702	774.893	1.047	0.092
	9	1.465	3330111	0.742	740.374	1.437	0.071
	10	2.145	5746452	1.370	884.431	1.497	0.111
	11	3.041	4906514	1.299	705.301	1.327	0.075
	12	1.219	900758	0.768	421.342	1.093	0.031
	All Trials	2.637	4243276	0.915	732.542	1.142	0.106

Appendix 25 (Cont.)

Experiment 6: Skewness and variance values of SRR, square-root SRR* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	0.693	9461019	0.006	1034.816	-0.387	0.154
	2	0.959	5317808	0.239	936.115	0.350	0.147
	3	2.334	4882950	0.811	796.043	1.265	0.093
	4	2.177	2987317	0.803	658.367	1.785	0.065
	5	1.554	4904039	0.421	828.430	0.680	0.133
	6	1.696	5780254	0.671	934.852	0.916	0.093
	7	1.803	8526318	1.126	1099.185	1.244	0.099
	8	0.511	1779638	0.000	583.116	0.750	0.114
	9	0.768	1686523	0.430	597.948	0.785	0.060
	10	1.526	2249591	0.828	615.572	1.432	0.055
	11	2.048	8923932	0.889	1004.512	0.615	0.102
	12	1.407	10950420	0.727	1312.073	0.754	0.163
	All Trials	1.946	5688565	0.717	875.793	0.915	0.116
NEUTRAL GROUP (N=20)	1	1.807	13880417	0.324	868.559	-0.857	0.132
	2	1.089	5646155	0.211	964.006	0.328	0.099
	3	2.288	6017109	1.033	888.079	1.171	0.074
	4	1.614	4835350	0.659	822.397	0.883	0.061
	5	1.841	2203960	0.496	537.000	0.998	0.104
	6	2.763	7231902	0.956	803.142	0.630	0.085
	7	2.045	5718808	0.650	876.924	0.954	0.108
	8	1.132	5926058	0.425	1036.583	0.539	0.143
	9	1.718	8182652	0.487	994.058	0.448	0.104
	10	0.414	2966766	-0.318	642.124	0.389	0.142
	11	2.345	1959174	0.898	515.025	1.039	0.104
	12	2.418	6248260	0.877	852.837	0.915	0.086
	All Trials	2.307	6126167	0.620	857.723	0.718	0.117

Appendix 25 (Cont.)

Experiment 7: Skewness and variance values of SRR, square-root SRR* and range-corrected SRR for each group and each trial

	Trials	Raw score (SRR)		Square-root SRR		Range-corrected SRR	
		Skewness	Variance	Skewness	Variance	Skewness	Variance
PHOBIC GROUP (N=20)	1	1.382	7231775	0.183	674.266	-0.013	0.138
	2	0.766	3860737	-0.054	586.681	0.219	0.092
	3	0.822	3212271	0.123	710.097	0.308	0.084
	4	1.746	9731179	0.772	1084.370	0.949	0.112
	5	1.359	3158628	0.455	675.956	1.097	0.078
	6	0.782	1564010	0.226	544.291	0.847	0.086
	7	1.732	13510582	0.571	1229.337	0.557	0.131
	8	0.438	4168459	0.086	939.084	0.407	0.109
	9	2.009	5053996	0.654	858.569	0.440	0.100
	10	0.881	4937154	0.052	716.232	0.633	0.106
	11	1.470	5542276	0.571	993.676	0.508	0.131
	12	1.053	8375829	0.301	1095.876	0.388	0.144
	All Trials	1.810	5850302	0.406	849.919	0.582	0.112
NEUTRAL GROUP (N=20)	1	1.347	5843925	0.065	803.990	-0.047	0.131
	2	0.832	1686332	-0.002	553.221	0.268	0.116
	3	0.875	2381552	-0.046	492.957	0.276	0.084
	4	0.761	3914278	-0.096	747.932	0.288	0.142
	5	0.476	1620412	0.022	590.138	0.511	0.162
	6	1.077	5388953	0.169	884.597	0.118	0.127
	7	0.832	1840048	0.314	578.060	0.506	0.047
	8	2.126	2606841	0.538	599.288	0.735	0.137
	9	0.743	1899226	0.015	553.907	0.665	0.109
	10	2.626	7528546	0.978	941.165	0.875	0.111
	11	1.642	7362332	0.824	1077.323	0.643	0.161
	12	1.421	2166418	0.434	582.190	0.630	0.100
	All Trials	1.994	3666195	0.392	695.751	0.542	0.119

*Skewness and variance values of square-root SRR are presented for comparison of the range-corrected values with those derived from another commonly used transformation of raw responses (It may be noted that square-root units were used for the analysis of data in experiment 2 - see text).

**Variance values of raw responses are rounded up.

APPENDIX 26

SEX DIFFERENCES IN MEAN RATINGS OF FSS-III ITEMS[+]

Significant sex differences (females > males) in mean ratings per item as indicated by t-tests on scores with insignificant differences in variances

Item	Degrees of freedom	t (two-tailed test)
Dead people	495	2.10*
Dead animals	501	4.23*
Spiders	502	2.82*
Sight of fighting	502	4.72*
Being criticized	502	2.42*
Parting from friends	499	2.57*

Table Significant sex differences (females > males) in mean ratings per item as indicated by modified t-tests on scores with significant differences in variances

Item	Degrees of freedom	t (two-tailed test)
Thunder	201	2.70*
Sirens	200	2.40*
Elevators	201	2.90**
Worms	201	4.18**
Bats	200	5.41**
Flying insects	201	2.88**
Crawling insects	199	3.94**
Fire	201	4.26**
Darkness	201	2.44*
Snakes	201	3.05*

*p < 0.05

**p < 0.01

[+] Responses to the questionnaire appear on microfiche inside back cover. Appendix 28 provides a guide to the microfiche.

APPENDIX 27

INCIDENCE OF EXTREME FEARS ON THE BASIS OF RESPONSES TO FSS-III

Percentages of subjects responding "Very much" (5) to specific fear items*

ITEM	Percentage responding		
	Males	Females	Total
Becoming mentally ill	32	31	30
Being rejected by others	16	22	19
Speaking in public	15	18	17
Dead people	10	20	16
Failure	11	18	15
Witnessing surgical operations	11	16	14
One person bullying another	11	11	14
Prospect of a surgical operation	15	13	13
Looking foolish	11	9	9
Sight of fighting	8	16	12
Losing control	9	13	12
Dentists	10	10	11
Spiders	8	13	11
Parting from friends	6	13	10
Becoming nauseous	7	11	9
Being ignored	5	12	9
Being criticized	5	12	9
Fire	4	12	8
Feeling disapproved of	3	10	7
Harmless snakes	2	10	6

*Only those items which were checked by 10% or more of subjects in at least one column are listed.

APPENDIX 28

GUIDE TO THE MICROFICHE

On the microfiche inside the back cover of the thesis, the responses of 548 subjects to the FSS-III (version by Wolpe, 1973) are recorded. The subjects included 303 females, 201 males and 44 who withheld their name and sex when filling in the questionnaire. The responses were made using a five-point Likert-type scale ranging from "Not at all" (score 1) to "Very much" (score 5). Each subject's scores appear under the heading of a "case" (e.g. "Contents of case number 1"). The items of the survey are in abbreviated form and in order they appear on the questionnaire (see Appendix 1). Thus, "Vacu", "Woun", "Alone" stand for "Noise of vacuum cleaners", "Open wounds", and "Being alone" respectively.

Apart from the items of the FSS-III, there are additional variables under each case and which are not of interest here except variable "Sex"; males are represented by number 1 and females by number 2.