CHAPTER-III

PROBLEM AND HYPOTHESES

When people lie they get measurably nervous about lying thereby leading to increased arousal, which can be assessed in terms of changes in physiological measures such as heart beat, blood pressure, breathing, respiration etc. It is generally believed that lying causes the individual to experience emotion, and that this is accompanied by a change in the body’s physiological activity (i.e. the result of a change in the activity of the autonomic nervous system). The polygraph is a set of equipment that accurately measures various sorts of involuntary bodily activity (heart rate, blood pressure, respiration and palmer sweating). It is used to measures physiological changes caused by the sympathetic nervous system while the subject is asked and answers a series of questions (Davis, 1961). From the graphical recordings of physiological measures in response to questions on a polygraph test, sometime aided by observations during the polygraph examination, examiners infer a psychological state namely, whether a person is telling truth or lie. In some countries polygraphs are used as an interrogation tool with criminal suspects or candidates for sensitive public or private sector employment. In India, the polygraph test (Lie detector test) is at present used by investigators as an aid to investigation but has no evidentiary value in courts. The record of physiological and biological responses through a polygraph machine is yet to be admissible in the court of law. However, such behaviour record enables the investigating officer to decide on the directions to be pursued. However, any court in India does not bar its use in the aid of investigation. In fact the Government of India through the National Human Rights Commission has laid down specific guidelines relating to administration of Polygraph Test on a suspect/accused.

Polygraph test outcome have serious negative consequences for guilty examinees, and therefore attempts are made to influence polygraph outcomes by producing physiological responses that may lead the examiner to conclude that the examinees are telling the truth. Method to achieve this are called “countermeasures”. Countermeasures are deliberate techniques that some guilty people or even an innocent subject may sometime also use to influence the outcome of the test.
Countermeasures are generally employed to increase arousal to control questions thereby reducing the possibility of detection. Major classes of countermeasures include using drugs and alcohol to dampen polygraph responses, mental countermeasures (e.g., relaxation, production of emotional imagery, mental dissociation, counting backward, hypnotic suggestion and attention focusing techniques) and physical countermeasures (e.g., breath control, behaviors that produce pain before or during questioning, such as biting one’s tongue, or behaviors that produce muscle tension before or during questioning, such as pressing one’s toe to the floor or controlling a variety of muscles in the body).

Maschke and Williams (2003) have suggested that effective countermeasure strategies can be easily learned and that a small amount of practice is enough to give examinees an excellent chance of “beating” the polygraph. Because the effective application of mental or physical countermeasures on the part of examinees requires skill in distinguishing between relevant and comparison questions, skill in regulating physiological response, and skill in concealing countermeasures from trained examiners, claims that it is easy to train examinees to “beat” both the polygraph and trained examiners require scientific supporting evidence to be credible. However, the available research suggests that detection is difficult, especially for mental countermeasures, but the studies are weak in external validity (e.g., low stakes for examiners and examinees), and they have rarely systematically examined specific strategies for detecting physical or mental countermeasures.

Some studies have demonstrated that certain measures derived from Electroencephalogram (EEG) and Event Related Potentials (ERPs) can be used more successfully in the GKT when detecting use of countermeasures (Allen et al., 1992; Boaz et al., 1981; Farewell & Donchin, 1991) as the Multichannel Physiological Recording (MPR) is mediated by peripheral nervous system. Since deception is a cognitive phenomenon that takes place in the brain, the potential of MPR in a lie detection system would be inferior to the more proximal, CNS correlates of brain activity that could be obtained by EEG and fMRI. Because brain activity is closely related to lying brain imaging could provide a more effective means to explore and better understand the possible psychophysiological correlates of polygraph testing. Combination of electrodermal responses and fMRI in lie detection procedures have shown that reaction time and SCR amplitudes are linearly related to activity in the
cerebellum, the right inferior frontal cortex, and the supplementary motor area. This result provides a first link between behavioral measures, sympathetic arousal, and neural activation patterns during a GKT examination (Gamer et al., 2007). Some researchers investigated the use of P300 response (a specific brief electrical wave in a person's electroencephalogram which is a measure of the way the brain pays attention and discriminates between potentially important and non-important stimuli) and initial studies indicated that this kind of paradigm was immune to the influence of countermeasures. However, recent countermeasure studies (Rosenfeld et al., 2008) have shown that subjects can be trained to make concealed responses to the non-meaningful items, which significantly increased to the irrelevant stimuli and therefore, no difference is found between guilty and irrelevant stimulus conditions. This makes it virtually impossible to distinguish probe and irrelevant P300s, whose differences would otherwise be usually diagnostic for deception.

Considered from the cognitive perspective, deception is a process which would be initiated when the examinee perceives threatening stimuli. Since perception is a multiple stage process (Erdelyi, 1974) with consciousness at the final level of processing, it appears probable that use of stimuli which do not reach the conscious level of processing (subliminal) could help in circumventing the use of countermeasures. The effectiveness of subliminal stimulation has been demonstrated in stimulation of mild emotional activity and its application has been widespread in the area of marketing where it is used in advertisements to increase persuasiveness of the message. Considerable evidence is available to support the assertion that subliminal stimuli are capable of inducing behavioral and physiological change. (Dixon & Henley, 1991; Lazarus and McCleary, 1951; McCleary and Lazarus, 1949; Swingle, 1991; Taylor, 1994). Dixon (1971, 1981) has demonstrated that the human brain by its electrical response responds to the meaning of words presented to the ears during sleep and even in the deepest sleep, without awakening the subject, such words evoke dreams that are relevant to their meaning. Borgeat and Goulet (1983), showed a significant effect of "activation subliminal suggestions" on physiological measures of heart rate, EMG, and EDR during and following a stressing task. Similar results were obtained by Borgeat, Elie, Chalout, Chabout, and Louis (1985) using a selective attention (auditory attend/non-attend) paradigm on measures of EDR, EMG, and heart rate. Research indicates that
awareness threshold for threatening words or pictures may be significantly higher or lower than that for more neutral material. Simultaneous recording of EEGs (brain rhythms), heart rate and perceptual thresholds suggest that, prior to awareness of a visual stimulus which is gradually increasing in brightness, indicate that the brain may analyses the latter's meaning and, as a result, modify its own level of arousal to hasten or retard awareness of the information that it carries. Recording from the exposed brains of fully conscious human subjects, they were able to detect electrical potentials initiated by tactile stimuli of which their subjects remained totally unaware (Libet et al., 1967). Review of related research revealed one study where subliminal stimulation was considered as a lie detection protocol immune to countermeasures by Lui and Rosenfeld (2009) who used a 4 stimulus condition involving various combinations of supraliminal and subliminal presentation were used. Results indicated that subliminal primes modulate ERPs in conditions with supraliminal acquaintance name when the task involves lying.

From the above discussion it is evident that the subliminal stimuli can be used in lie detection to circumvent manipulations by countermeasures as they would be immune to conscious manipulations. Subliminal presentation of a key stimulus would elicit a stronger arousal response as compared to a neutral stimuli and because it would not be consciously perceived the subject would not be able to apply specific countermeasures to it.

**Rational of the study:** Research in the area of lie detection indicates that the major deterrent to accuracy, specifically identification of guilty, is the use of countermeasures. As lying is a conscious process which is initiated on detection of the relevant stimuli, probability of lying (subsequent use of countermeasures) could be reduced by use of stimuli which do not reach the level of conscious awareness (subliminal stimuli). Research has shown that subliminal stimuli which do not elicit conscious awareness produce physiological as well as cortical activation. Thus use of subliminal stimuli could go a long way in attenuating the probability of use of countermeasures.

In view of the above, the following problem was formulated for the present investigation.
Problem:

“Use of Subliminal Stimuli as Deterrent to Countermeasures in Lie Detection”

Objectives

The following objectives were delineated for the study.

1. To study quantitative differences in physiological arousal response to neutral supraliminal and subliminal stimulation.
2. To study quantitative differences in physiological arousal response to neutral and aversive (supraliminal / subliminal) stimulation.
3. To study the effectiveness of subliminal stimuli in reducing the probability of use of countermeasures.

Hypotheses

1. Physiological arousal responses to supraliminal neutral stimuli would be more intense as compared to subliminal neutral stimuli.
2. Physiological arousal responses to emotion laden stimuli (both supraliminal and subliminal) would be would be more intense as compared to neutral stimuli.
3. Use of Physical Countermeasures would be more for supraliminal stimuli as compared to subliminal stimuli.
4. Use of Mental Countermeasures would be more for supraliminal stimuli as compared to subliminal stimuli.

The design and methodology used to achieve the objectives of the present investigation have been described in the next chapter.