

## Mechanism of Stress on Human Body— Psychophysiological Aspects

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### Introduction

AS long as manned flight continues we are faced with psychophysiological limitations of the human body specially when the machines are flying at a fantastic speed. Moreover, the primary aim of an Air Force these days is to destroy enemy ground targets during war. This involves flying at a low level and at high speed. In this type of flying, a flyer faces physical and psychological stresses. While physical stress primarily consists of heat, vibrations and visual problems, the psychological stress is mainly attributable to the high performance of aircraft, reduction in time for human perception, analysis and action required of the situation. Difficulties in navigation, decreased safety margin, threat to self also add to the stress of a pilot.

The performance of a flyer will depend upon his patterns of psychophysiological responses to the stress. Therefore, it becomes necessary to study the stress and reactions of the human body which will determine one's performance in flying.

### Stress and Psychophysiological Response

Stress is caused whenever there is a threat to disrupt the maintenance of physical or mental harmony. The response pattern for the two groups of stresses i.e. physical and psychological may be similar but the physical stress primarily strains the adaptive capacities of the neurophysiological system in that it results in more extensive physiological displacement with coping mechanism being affected only indirectly. The reverse emphasis is presumably true for the psychological stress<sup>3</sup>.

The complex variable interactions affecting adjustment to stress are shown in Figure-1.

The upper right side of the diagram depicts adjustment with stress and decompensation when adjustment fails. The lower left side depicts the neurogenic-hormogenic interaction complex proposed by Selye as the General Adaptation Syndrome. Closely related to this are the hypothalamic-hypophyseal, adrenocortical and adrenomedullary-hypothalamic axes as they relate to the part which autonomic regulation plays in homeostatic maintenance as proposed by Cannon. The lower right side shows the spheres in which physiological and psychological changes can occur. In high speed low level flying, psychological stress lies in the axis of Perception-Decision-Action as the time available for action is further reduced due to low level flying. Other factors which constitute psychological stress in this type of flying are reduced margin of safety, absence of radar aided guiding facilities, demand for accurate flying and difficulties in navigation etc.

### Perception-Decision-Action

This axis involves peripheral nervous system, central nervous system and psychomotor coordination as shown in Figure 2.

Perception is a complex process of organising and interpreting sensory data by combining them with the results of the previous experiences. It involves memory also. The perceptual process is a central one and only a limited amount of the vast information can be processed at one time. Therefore, a process of selectivity becomes operative.

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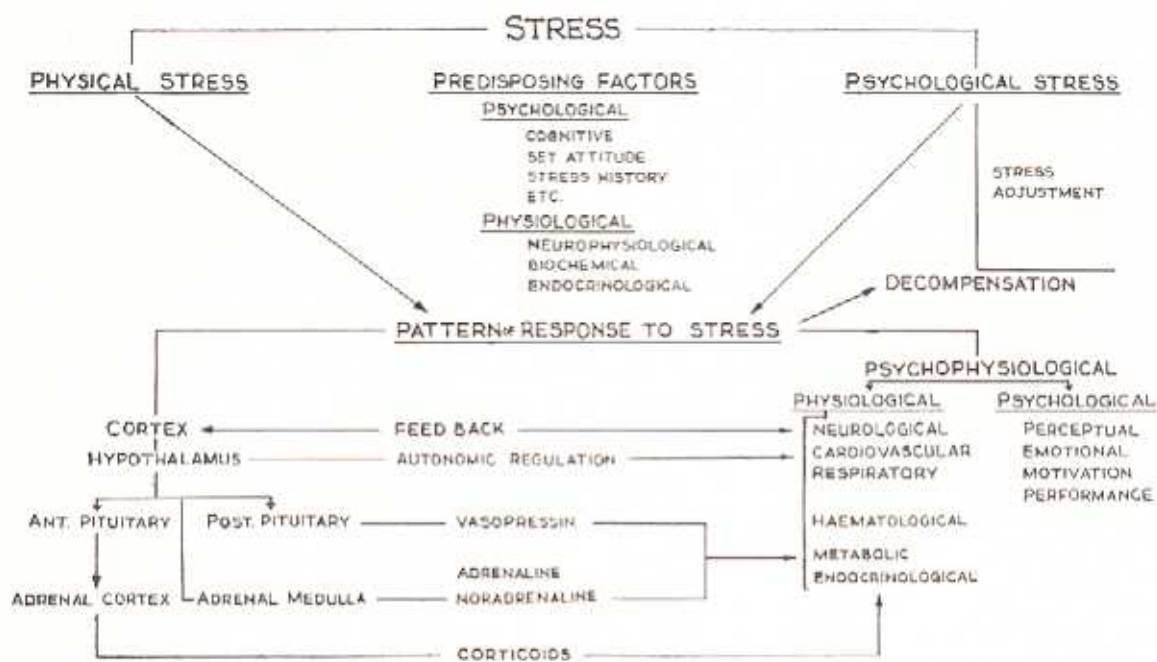


Fig. 1 Adjustment to Stress

Recent work has placed considerable emphasis on the role of the reticular formation in the perception of stimuli. This activating system is apparently essential to the arousal of the organism which must precede the reception of a stimulus from any modality. The full role of the reticular activating system is not understood but it is accepted that this system plays a critical role in the perception of stimulus, probably through its effect on general arousal and attention.

Neurophysiological factors, it has been hypothesised, enter into the selectivity of perception through the reticular activating system. Irrelevant information is rejected in favour of relevant.

Further, actual object or stimulus perceived is influenced by the attention of the subject. Attention will be altered by the intensity of the stimulus, the nature, location, colour, movement, repetition or

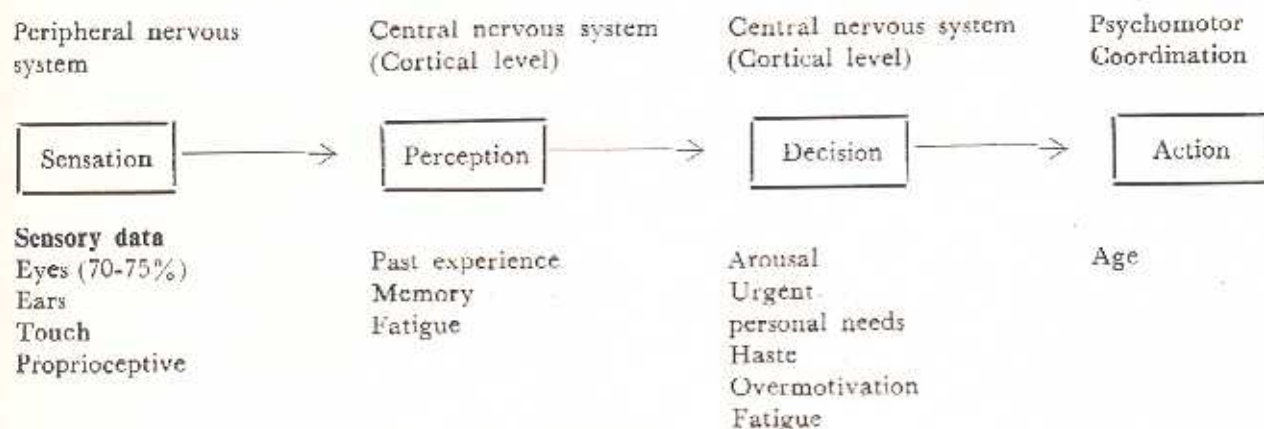


Fig. 2. Sensation-Perception-Decision-Action axis

unusualness of the stimulating conditions. Subjective factors also influence attention and perception e. g. affect, motivation, mental set, experience etc.

Decision can be defined as a course of action consciously chosen from available alternative for the purpose of achieving a desired result<sup>2</sup>. When there are two or more alternatives available, decision making invites choosing one course of action in preference to other. This can be very difficult in an emergency. When the time available is very short, only limited information is available to base the decision upon and there is emotional arousal even in an experienced flyer. Other factors which can affect, the process of decision making are urgent personal needs, excessive emotional arousal, impatience, haste, over-motivation, previous experience and lack of professional knowledge.

Once the decision is made the action is taken on controls which involves psychomotor coordination. The time taken from the moment of sensory stimulation to the point when the action is initiated constitutes Reaction Time. Factors of perception and decision are the ones which take the longest time and are amenable to improvement. Perception can be improved by aids that facilitate anticipation. Decision can be quickened by previewing the situation, deciding as to what would be done and practicing it. Experience, good professional knowledge and a cool mind go long way to aid perception and decision.

#### **Fear**

Fear is another stress which can be due to lack of safety margin in low level high speed flying with apprehension of hitting an obstacle and danger to self. Excessive fear affects one's performance adversely in flying. Fear is an emotion which activates the reticular and limbic systems. These in turn influence the higher cortical centres where preceptive-decision-axis gets adversely affected. Fear can be counteracted with sound professional knowledge, constant practice, high motivation, stable personality and dependable safety devices.

#### **Fatigue**

Low level high speed flying is very taxing for psychic energy as a flyer has to keep his attention and concentration esp. on navigation—on which he cannot get much help from the base. At the same

time, he has to follow exact course, identify landmarks, spot the targets and avoid obstacles. This produces a lot of stress which might lead to fatigue and human error leading to accidents. The fatigue is experienced more after having dealt with an emergency up in the air. It adversely affects the reaction time which includes all the factors like perception, decision and action. Fatigue can be prevented by proper rest and relaxation in between the low level sorties and by keeping good physical and mental health.

#### **Total work situation**

Flying cannot be separated from the total work situation. There are three elements in the work situation viz,

- (i) Nature of work itself i.e. flying in the present case which involved risk,
- (ii) Social group in which an individual interacts, and
- (iii) Policies, procedures and organisation climate.

Stress in relation to nature of work has already been discussed. In the social group of a worker, the attitudes of the seniors are of crucial importance in generating, increasing or decreasing stress. This becomes more important for a flyer for obvious reasons. Interference with the work, unnecessary criticism, holding out threats of punishment for minor lapses will increase the stress on a worker which will have its repercussion in flying. Regarding policies, procedure and organisational climate, it should be seen that they ensure discipline, justice, progress and impartiality.

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