

## PSYCHOLOGY

## Changes in Skin Temperature during the Heat Illusion Test

It has been observed in the past that somatic changes such as blister formation can be induced in hypnotized subjects by means of appropriate suggestion<sup>1,2</sup>. McDougall<sup>1</sup> observed in several hypnotized subjects changes of surface temperature of 10° F (5.6° C) or more, produced after a few minutes of repeated suggestion of heat or coldness. It was thought, therefore, that skin temperature might rise following an illusory stimulus of heat in the heat illusion test<sup>2,3</sup> with non-hypnotized subjects. Accordingly, the following experiment was carried out.

A heat stimulus was produced by a modified Hardy-Wolff radiant-heat apparatus<sup>4</sup>, by which the heat from a 500-W bulb was concentrated by a lens through an aperture 2 cm in diameter. The distance between the apparatus and the subject's head was one inch. Skin temperature was measured by means of copper and constantan thermocouples at two places on the forehead—one in the centre and the other 1½ in. to the right. For each of thirty subjects (17 male and 13 female students) a 'warmth perception point' was first obtained by increasing applied heat from zero until the subject reported a feeling of warmth. (The term 'warmth perception point' was used because the use of the expression 'warmth threshold' is misleading when applied to a non-psycho-physical procedure.) The stimulus was applied on the left-hand side of the forehead. The mean 'warmth perception point' was 182.7 mc/s/cm<sup>2</sup>, and the range was 59–400 mc/s/cm<sup>2</sup>. Seven of the subjects appeared to be unable to feel a sensation of 'warmth', and were able only to report the stimulus as 'hot'.

In the second part of the experiment, subjects were told that the procedure would be repeated, but on the centre of the forehead. This time, however, although the same procedure was simulated, no heat was actually applied. Under these conditions the mean temperature of the centre of the forehead rose from 34.5° to 34.7° C. This difference is statistically significant ( $P < 0.01$ ). In only one case was there an increase in skin temperature on the right-hand side of the forehead. This emphasizes the fact that the phenomenon was highly localized.

Although the overall mean change in skin temperature following simulated application of heat was positive and statistically significant, only fifteen of the thirty subjects actually showed a measurable increase. The mean rise in skin temperature for these fifteen subjects was 0.45° C. Fourteen subjects showed no change of temperature, and one showed a decrease.

Eleven subjects reported a sensation of warmth during the heat illusion test, and nineteen did not. The relation between changes in skin temperature and the reported sensation of warmth can be seen from Table 1.

Table 1

	Reported sensation of warmth	No reported sensation of warmth	Total
Rise in skin temperature	8	7	15
Fall or no change in skin temperature	3	12	15
Total	11	19	30

A chi-square test applied to these results gave a value of  $\chi^2 = 3.59$  (D.F. = 1), which indicated that the null hypothesis could only be rejected at approximately the 0.0625 confidence level.

It is interesting to note that of the eleven subjects who reported a feeling of warmth, nine were male and two were female. This relationship with the sex of the subject is statistically significant at the 5 per cent level of confidence ( $\chi^2 = 4.47$ , D.F. = 1). When the incidence of skin temperature changes was considered,  $\chi^2 = 3.39$  (D.F. = 1).

The subjects were assessed on the Maudsley personality inventory, and the group consisted of fifteen extroverts

and fifteen introverts. Scores were also obtained on the neuroticism scale of this inventory. Neither the illusory sensation of warmth nor a change in skin temperature, was found to be correlated with extroversion, introversion or neuroticism.

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<sup>1</sup> McDougall, W., *Outline of Abnormal Psychology* (Scribner's, New York, 1926).

<sup>2</sup> Weitzenhoffer, A. M., *Hypnotism: An Objective Study in Suggestibility* (John Wiley and Sons, Inc., New York, 1953).

<sup>3</sup> Eysenck, H. J., *Dimensions of Personality* (Kegan Paul, London, 1947).

<sup>4</sup> Hardy, J. D., Wolff, H. G., and Goodell, H., *J. Clin. Invest.*, **19**, 649 (1940).

## A Hypothalamic Mechanism causing Seminal Ejaculation

ON purely behavioural grounds, Beach and Jordan<sup>1</sup> have postulated that copulation is controlled by two separate systems: an arousal mechanism which initiates it, and a copulatory-ejaculatory mechanism which ends it. Vaughan and Fisher<sup>2</sup> have since reported a site in the pre-optic area of the rat which excites copulation when stimulated, while MacLean and Ploog<sup>3</sup> have listed more than 150 sites along the base of the monkey brain which yielded penile erection. But seminal ejaculation following hypothalamic stimulation was not seen, nor was it reported in any of the investigations of hypothalamic function pioneered by Hess.

The work reported here began with the discovery of seminal plugs on the floor of a cage used in a 'self-stimulation' experiment in which rats operated a lever to deliver a rewarding shock to their own brains. Further observation using a mirror tilted under the cage revealed that two rats, with identical posterior hypothalamic electrodes, regularly emitted semen within 2 or 3 min of the onset of self-stimulation. Similar electrodes were implanted in 12 more rats; all learnt to self-stimulate, and in 10 this was accompanied by a penile discharge microscopically shown to contain motile sperm.

The loss of semen was marked by some unusual features. Penile erection was never seen, and the emission usually took the form of a slow dribble rather than a frank ejaculate; however, the spontaneous or imposed termination of self-stimulation was sometimes followed by arching of the back, and one or two convulsive lurches with projectile ejaculation, after which the animal remained unresponsive for 2–3 min. Typical post-ejaculatory oral grooming of the genitalia was absent.

This result was not confined to the self-stimulation procedure in which stimulation rate was under the rat's control; it could also be elicited by trains of 0.5-sec pulses delivered by an automatic stimulator. In the latter situation the rats were tested further by simultaneous exposure to other rats. Introduced males and non-ovulating females did not receive special attention, while oestrous females provoked intermittent attempts at copulation which immediately subsided with the onset of stimulation. The failure to observe ejaculation in previous studies may have been due to the use of general anaesthesia; in the present experiment, light etherization completely blocked the ejaculatory response.

Although testosterone administration (2.0 mg in oil) led to a significant elevation of the rate at which the rats would self-stimulate, the main findings confirm the hypothesis of Beach and Jordan that the central mechanism responsible for ejaculation is functionally separable from other sex mechanisms.

De Groot stereotaxic co-ordinates for the electrode implantations were 1.5 mm posterior to bregma, 1.0 mm lateral, and 9.5 mm below the surface of the skull. Histological preparations showed electrode tips located in the medial fibres of the medial forebrain bundle. Subsequent