

# REACTION TIME FOR CUTANEOUS THERMAL SENSIBILITY

By

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Reaction time for warmth and cold sensation with 2°C, 5°C and 8°C respectively above and below skin temperature had been found out in 8 students on left hand hypothener eminence and dorsum of middle phalanx of the middle finger with average threshold temperature of 2°C above and below skin temperature. The reaction time was found to be 0.66 sec. On increasing the difference of test temperature from skin temperature the response curve of reaction time showed an inverse relation giving the shape of an ellipse within the range of  $\pm 8$ C.

Cutaneous thermal sensibility has been graded into fine and crude depending on the range of temperature. This grouping proved inadequate and cutaneous sensibility was referred to skin temperature prevailing at the time of test. O'Connor et al (1952) established a relation between skin temperature and thermal stimulus. Lele (1954) has worked out temperature thresholds at various skin temperatures on certain areas on the left hand. Dissociation of different modalities of cutaneous thermal sensibility caused by pressure, cold and procaine has been found out by Hinshaw et al (1950, 1951).

As it is imperative for a stimulus to be standardised from different parameters and not in respect of strength alone, it should be equally true for thermal stimulus. The other parameter from those considered in above mentioned researches, namely minimum time required to reach consciousness is, of course, difficult to find, but we can possibly depend on the subjective predetermined response after the application of the stimulus called 'reaction time' as we do for those of touch, sight etc. With this idea an attempt has been made to find out reaction time for cold and warm and also to find if it is related to the degrees of temperature further from threshold established by Lele (1954).

## METHODS

Reaction time for temperature was found for the areas chosen by Lele (1954) i. e. area 2 being hypothener eminence and area 4, the dorsum of middle phalanx of middle finger of left hand. Tests were conducted in 12 healthy young subjects, male (eleven) and female (one) with their skin temperature varying between 33°C and 35°C when the room temperature was 30°C. The threshold worked out by Lele (1954) was used with little variation where necessary with an average of 2°C from skin temperature. Thin glass test tubes of 15 cm. X 1.5 cm. size half filled with water of various temperature as suggested by Hinshaw (1950) were used. Record was made on a fast revolving drum. Point of stimulus was marked by magnet time



marker simultaneously as the test tube was allowed to touch the test area of about 1 cm. across. The response was recorded by second time marker signalled by the subject through a tap key as soon as he/she identified the modalities of sensation (and not when he/she felt the touch). Test tube was immediately removed and the subject spoke out his/her impression. The time between stimulus and response—'reaction time' was calculated by vibrating tuning fork giving 0.01 sec. for each cycle.

## RESULTS

Out of 10 subjects 2 cases had to be discarded because of wrong and irregular statement about their perception of warmth and cold. In the rest of the subjects, for cold sensation at area 2 the 'reaction time' ranged from 0.40 sec. to 0.70 sec. i.e. average of 0.60 sec. when the threshold stimulus for cold namely 2°C below skin temperature was used on area 4, the range was from 0.40 sec. to 0.90 sec. i.e. average mean of 0.75 sec. For warmth on area 2 the 'reaction time' ranged from 0.20 sec. to 0.80 sec. with an average mean of 0.61 sec. when the threshold stimulus of 2°C above skin temperature was used. The table below shows the detail.

Thus the 'reaction time' for temperature at threshold variation from skin temperature may be considered as 0.66 sec.

*Reaction time for cold:—*

## AREA 2.

Test T.°C relative to skin temp.	Reaction time in sec.		
	Range		Average
	Min.	Max.	Mean.
-2°	0.40	0.70	0.60
-5°	0.20	0.60	0.50
-8°	0.20	0.63	0.30

## AREA 4.

Test T.°C relative to skin temp.	Reaction time in sec.		
	Range		Average
	Min.	Max.	Mean.
-2°	0.40	0.90	0.75
-5°	0.20	0.90	0.60
-8°	0.20	0.70	0.50

*Reaction time to warmth:—*

## AREA 2.

Test T.°C relative to skin temp.	Reaction time in sec.		
	Range		Average
	Min.	Max.	Mean.
+2°	0.20	0.80	0.61
+5°	0.30	1.00	0.60
+8°	0.20	0.75	0.50

## AREA 4.

Test T.°C relative to skin temp.	Reaction time in sec.		
	Range		Average
	Min.	Max.	Mean.
+2°	0.42	0.90	0.70
+5°	0.23	1.00	0.60
+8°	0.20	0.56	0.35



## DISCUSSION

Temperatures from 34°C to 43°C for warmth and temperature down to 30°C for cold had been used by Lowenstein and Dallenbach (1951); such arbitrary ranges had been used by others also; but the minimum time it should be in contact with skin is no less important and thus the other parameter namely minimum time needed for perception of a sensation defined as the 'reaction time' has to be taken into consideration though a modality like this has got a high adaptability. Although the number of cases done in the venture is insufficient to form any concrete relation, it gives us a trend in the type of response that one may get.

On increasing the difference from skin temperature the average 'reaction time' decreased in regular order giving an elliptical shape of the curve (Fig. 1) within the range tested. It is to be seen, therefore, if we can apply the following formula within a certain range of test temperature.

$$\log RT = 3 \sqrt{1 - \frac{T^2}{b^2}}$$

RT is the 'reaction time', a & b are two axes of ellipse and T = temperature in relation to skin temperature.

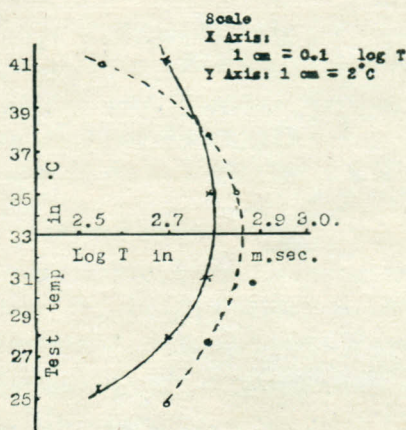


Fig. 1. Log of reaction time in m. sec. against test temperature in °C. Continuous line is for area 2 while interrupted line for area 4.

This may possibly give us more complete understanding when more cases are done with still wider range of test temperature as also with wider range of skin temperature. It is likely that the 'reaction time' may vary with the variation of skin temperature as the variation of threshold has been observed by Lele (1954). Though the average mean 'reaction time' has been calculated in this work as 0.66 sec., it is obvious from the experiment that it varies with individuals as also with sites.

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