HEMISPHERIC AND ATTENTIONAL EFFECTS ON THE TRANSMISSION OF SOMATOSENSORY INFORMATION

by

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CONTENTS

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SUMMARY

The initial aim of the present studies was to determine whether information processing rates could be facilitated as a result of dividing information load between hemispheres as opposed to projecting it solely into one hemisphere. A Choice Reaction Time (CRT) paradigm was chosen as being a suitable method of measuring processing capacity and as such, of testing the question under investigation. The lateralisation of stimuli (S) and responses (R) was achieved by using tactile S delivered to the finger tips requiring an independent finger R.

Experiment 1: condition 3 measured reaction times (RT's) to tactile S when the set of alternatives lay completely on one hand and when the set of alternative S was divided equally between hands (BH). Subjects responded incompatibly. The results failed to support the predictions of models postulating complete independence of processing capacity for each hemisphere. However, some reduction in processing time was observed in the BH conditions over the within hand (WH) conditions with equivalent choice loadings. Furthermore, the results of experiment 1: condition 1 indicated that these reductions did not derive from pure response effects. Experiment 1: condition 2 also indicated that when subjects responded to tactile S with the same finger as was stimulated, that the increases in RT normally seen with increases in choice failed to occur. As a result of the findings of experiment 1, 2 models were developed which could account for the results. The first model involved a modification of the original hemispheric notions. A differentiation was made between the independent processing

capacity of each hemisphere and the attentional mechanisms which call these processes into play. Each hemisphere was conceived as being autonomous in terms of processing capacity but competing for a common attentional activation mechanism. The second model followed the same principles as the first but did not involve hemispheric notions. It again involved the postulation of a two stage system but in this case the first stage was responsible for the orientation of attention to the general morphological site on which the stimulus impinged, and the second stage involved the more detailed processing.

Experiment 1 measured RT's in a 6 choice situation in which the number of alternatives was divided asymmetrically between hands. Both models predicted that in this situation the RT's from the hand loaded with the larger number of alternatives should be greater than those from the hand with the lesser number. This prediction was confirmed.

Experiment 3 set out to determine whether the nature of the finger pairings on each hand had any effect on RT. RT's were measured in a 4 choice BH situation when the finger pairs allotted each hand were matched as opposed to unmatched. No differences were found between these two conditions.

Experiment 4 aimed to discriminate between the hemispheric and the general models. RT's were recorded in situations where the 4 alternative stimuli were divided between morphologically separate sites controlled by the same hemisphere and morphologically separate sites controlled by different hemispheres. No differences in RT's were found between these conditions which supported the more general model.

Experiment 5 was concerned with more precisely defining the parameters of the attention-orienting mechanism. In particular,

it was concerned with determining whether orientation was to the general morphological site of the impinging stimulus or whether it was to the area of space occupied by the stimulated limb. RT's were recorded in 4 choice BH situations in which the relative spatial positions of the two hands were varied. The results indicated a definite effect of these spatial manipulations which supported the notion of a spatial orientation mechanism.

Experiment 6 involved a manipulation of the stimulus-response code. Whereas in previous experiments subjects have been required to respond with a finger from the same hand as the stimulated finger, this experiment required subjects to respond with a finger on the opposite hand. The results indicated a definite effect of this S-R code change such that no differences now were found between the BH and WH conditions. The implication of this finding on the nature of both the orientation mechanism and the choice process is discussed.

Finally, the two stage somatosensory information processing system derived from the present study is outlined, its resultant neurophysiological and psychological implications considered, and further avenues of research are outlined.