displays after initial presentation, but the subjects were not aware of this. Half the repetitions were aural and half were visual presentations; half of both types of repetition were of numbers initially presented aurally and half-visually. The subjects were instructed to press a micro-switch when they noted any repetition of any number already seen or heard.

The principal results were: (1) Auditory and visual probing repetitions were equally well recognized, each accounting for half the total information retrieved from immediate memory storage. (2) While recognition of repetitions of both auditory and visual input declines as more information is added to short-term storage, only 59·5 per cent of visual input was recognized when repeated in contrast to 76·2 per cent of aural input. This difference is significant by the $t$-test ($P < 0{\cdot}01$). (3) Auditory information was retrieved equally well by both auditory and visual probe repetition ($P > 0{\cdot}05$ by the $t$-test). Visual repetition retrieved a significant 4 per cent more of the total visual information retrieved than did auditory repetition ($P < 0{\cdot}01$ by the $t$-test).

The considerable degree of auditory-visual interaction revealed by these results may be due in part to the particular procedure of this experiment which reflects interaction only in immediate memory. It may also be due to the use of numbers as stimuli; these factors might account for results differing from those of Cole, Chorover and Ettlinger[4]. Furthermore, these stimuli were supra-threshold, as demonstrated by 98·6 per cent correct responses by these subjects in a control test in which they had to indicate only if any two numbers simultaneously seen and heard were identical.

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## Short-term Retention of more than one Aspect of a Series of Stimuli

IT has been found that subjects recalling sequences of digits presented in pairs simultaneously to two sense organs (the two ears, or eye and ear)[1,2] show preferences between strategies of recall which have been attributed by Broadbent[3] to the existence of at least two selectively acting storage systems.

A model for this process envisages the organism as selecting between 'channels' of input. It is not clear whether such 'channelling' of stimuli entails identifications more complex than grouping by source, or to what extent the model may be extended to other processes of selective attention. A situation where subjects are required to recall more than one aspect of a series of stimuli is therefore a test case.

Fifty-two cards measuring 3½ in. × 2¾ in. were each stencilled with a single letter of the alphabet in 72-point Bodoni bold capitals. The letters made up two alphabets, one stencilled in red and the other in black. By shuffling the cards, and dealing them face upwards in time to a metronome at intervals of 0·75 sec., so that each card covered its predecessor, subjects were presented with sequences of 5 letters in random order, each letter being randomly either red or black.

Subjects were required to recall two stimulus aspects independently, reporting the colours in the order of presentation (for example, 'red–black–red–red–black'), and the letters also in the order in which they were presented (for example, '*A*–*B*–*C*–*D*–*E*'). Instructions were varied so that subjects either reported the letters first and the colours second, or vice versa. Two conditions of instructions were compared: in Condition 1 subjects were told the required order of recall before the items were presented. In Condition 2 subjects were told the required order of recall after the items were presented.

Here Broadbent's model for selection between sources predicts that where the order of recall is known in advance, recall of the first group of items reported (letters or colours in this case) will be better, and recall of the second group of items will be worse than for their equivalents in a condition in which order of recall is not known until after presentation.

Eighteen postmen aged 17–29 years were given 100 trials on each of these conditions. The two orders of recall ('colours first' or 'letters first') occurred equally often in series randomized by transposition from tables of random numbers. Nine subjects started with Condition 1 and nine with Condition 2. All departures from presented sequences were classed as errors.

Results are presented in Table 1.

Table 1. COMPARISON OF KNOWN AND UNKNOWN ORDER OF RECALL FOR GROUPED STIMULUS ASPECTS—MEAN CORRECT RECALL

| | Condition 1. Order of recall known in advance (per cent) | Condition 2. Order of recall not known in advance (per cent) |
|---|---|---|
| Colours first | 87 | 79 |
| Colours second | 72 | 76 |
| Letters first | 83 | 70 |
| Letters second | 49 | 62 |

A Wilcoxon test[4] confirms that both colours and letters, when reported first, are significantly better recalled in the known than in the unknown order of recall condition ($P < 0{\cdot}01$ two-tailed). Conversely, both aspects, when reported second, are significantly better recalled in the unknown order of recall condition ($P < 0{\cdot}01$ two-tailed).

These results show an effect similar to that demonstrated by Broadbent[2] for selection between two stimulus sources. They may only be accounted for by a theory of independent storage systems if the definition of what constitutes a 'channel'[1–3] for selection and identification of stimuli is extended to cover a considerably wider field of behaviour than that to which it was first applied.

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