Channel by channel report of visually presented "Stroop" items'

MICHAEL C. CORBALLIS² AND RUDOLPH PHILIPP

MCGILL UNIVERSITY

Twenty Ss were tested for immediate recall of series of three color words each printed in a color different from the color it named. Ten Ss who were instructed to report all the words and then all the colors—"channel by channel" report—were more accurate in their recall than the other ten Ss who were instructed to report each word and its color in turn—"temporal" report. This supports the theory that channel by channel report depends on categorization of items at a fairly late stage in the processing of the items, and not on separation of the items at input. It also shows that efficient channel by channel report can be obtained with items presented visually.

Broadbent (1954) presented pairs of spoken digits through earphones to Ss such that one digit of a pair was presented to one ear at the same moment that the other digit was presented to the other ear. If S heard three such pairs at a rate faster than about one pair every 1.5 sec., he usually reported all the digits presented to one ear followed by all the digits presented to the other ear, a "channel by channel" mode of report. If the pairs were presented more slowly S usually reported the digits pair by pair in the temporal order of presentation, a "temporal" mode of report.

The channel by channel mode of report is of particular interest because it represents a transformation of the temporal order of items at some stage of memory. There is still some question, however, as to what constitutes a "channel." Yntema & Trask (1963) found that if Ss heard three pairs of items, each pair consisting of a spoken word and a spoken digit presented simultaneously, their report was more accurate if the "channels" corresponded to words and digits respectively, even if this meant alternating between ears, than if the channels corresponded to the separate ears. This suggests that channeling depends on how the items are categorized and that categorization must take place at a fairly late stage in the processing of the items. It evidently does not depend simply on the stimulation of separate receptor organs.

The present study was an attempt to demonstrate channel by channel report of visually presented items when all the information was presented to the same receptor surface. Each stimulus "pair" consisted of a single printed word which could be categorized in two ways, first according to its meaning and second according to the color in which it was printed. Each word named one color and was printed in a different color, a technique adapted from the Stroop Test (Thurstone & Mellinger, 1953). We hypothesized that channel by

channel report—report of all words followed by report of all colors—would be more efficient than temporal report—report of each word and its color in turn.

Method

The stimulus words were filmed in color on 16 mm moving film. Each word was brightly illuminated against a dark background. There were six possible words: WHITE, RED, GREEN, BLUE, YELLOW, and PURPLE. These were also the six possible colors. Twenty series, each consisting of three word-color combinations, were filmed. Words and colors were selected randomly except in the following respects: Each word was always filmed in a color different from that named by the word; within each series no word or color could be repeated, but it was possible for one word and one color to be the same, e.g., the third word and first color could both be BLUE.

The stimulus words were projected onto a screen about 11 ft. from S. The words were projected under two conditions, Masking and Non-masking. For 10 of the 20 series, presented under the Masking Condition, all words were projected onto the middle of the screen. For the other 10 series, presented under the Non-masking Condition, the first word of each series was presented to the top of the screen, the second to the middle of the screen, and the third to the bottom. Each word was always projected for 0.25 sec. and the interval between offset of one word and onset of the next in the series was 0.25 sec. Presentation rate was thus 2 words per sec. A small white dot was projected 1.0 sec. before each series to serve as a ready signal, and again 0.5 sec. after each series as a signal for S to respond.

Ss were 20 volunteers from an introductory psychology class. They were divided into two groups, "Channel by Channel" and "Temporal." The Channel by Channel Group was instructed to report all the words in the order of presentation followed by all the colors in the order of presentation. The Temporal Group was instructed to report each word and the color in which it had appeared, in the order of presentation. (Preliminary investigation indicated that it was generally easier to report words before colors.) Both groups were instructed not to begin their report until they saw the white dot which followed the series, and all Ss were asked not to guess.

Before experimental trials began each S was shown a series of word-color combinations, presented singly, and asked to name each color. This was done to ensure that S could correctly name the colors. In the experi-

mental trials, Masking and Non-masking Conditions were presented in counterbalanced order. The projector was stopped after each series to allow S time to respond, and all responses were recorded on tape.

Results

Two methods of scoring were used: (1) *Number of correct responses*. This method credited one point for each correct word or color regardless of position or order. A named word or color was scored correct if it corresponded to a word or color actually presented. (2) *Number of correct series*. One point was credited for each totally correct series. For a series to be scored correct all three words and all three colors had to be reported in precisely the order determined by the instructions.

Mean scores for each measure are shown in Table 1. Analyses of variance showed that the Channel by Channel Group scores significantly higher than the Temporal Group; for number of correct responses $F=21.96$, $df=1/16$, $p<.001$, and for number of correct series $F=3.63$, $df=1/16$, one tailed $p<.05$. Although scores were higher for the Non-masking than for the Masking Condition, the difference was not significant for either scoring measure.

In addition to being the more efficient mode of report, channel by channel report was evidently also the preferred mode. Six of the 10 Ss in the Temporal Group spontaneously switched from temporal to channel by channel report, contrary to instructions. On any occasion that this occurred S was immediately instructed to report the items in the temporal order on subsequent trials. On no occasion did any of the Ss in the Channel by Channel Group switch to temporal report.

Discussion

There are two points we should like to emphasize.

Table 1. Mean correct responses per series and mean correct series under Masking and Non-masking Conditions for Channel by Channel Group and for Temporal Group

	Channel by Channel		Temporal	
	Masking	Non-masking	Masking	Non-masking
Mean correct responses (maximum = 6)	5.15	5.29	4.01	4.37
Mean correct series (maximum = 10)	2.9	3.7	1.9	2.2

First, all previous demonstrations of channel by channel report have involved differential stimulation of separate receptor organs, even though it has not always been the case, as in Yntema & Trask's (1963) experiment for example, that the report channels have corresponded to these separate receptors. The present results go one stage further in that they demonstrate efficient channel by channel report without any peripheral separation at all. This finding reinforces the conclusion drawn by Yntema and Trask that channeling occurs at some fairly late stage in the processing of items and depends on how they are categorized, or "tagged."

Secondly, the present experiment is the first demonstration of efficient channel by channel report when all the information is presented visually; Sampson & Spong (1961a, b) were unable to obtain channel by channel report of items presented visually in pairs, one to each eye. Whether or not items presented in pairs will be channeled or reported pair by pair seems to depend, not on modality per se, but on the nature of the categories available for grouping the items. It is evidently fairly easy to group pairs of visually presented digits and treat each pair as a unit (temporal mode of report), but relatively difficult to group pairs of spoken words or Stroop items into single units. Further work using different category combinations and comparing the relative efficiency of the two modes of response at different presentation rates should clarify the nature of organizational units in short-term memory.

References

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Notes

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2. Now at the University of Auckland, Auckland, New Zealand.