Table 3
Experiment 2: Body Orientation Judgment Task (BOJ Task), Test Phase

Condition	Sample Means	Sample Variances	Population Means in Terms of σ_ϵ
1 Transformation 15 Deg R	−13.69	8.94	−1.10
2 Transformation 15 Deg L	15.35	25.35	1.23
3 No transformation (normal vision)	1.81	7.81	0.14

Table 4
Experiment 2: Kinesthetic Judgment Task (KJ Task), Test Phase

Condition	Sample Means	Sample Variances	Population Means in Terms of σ_ϵ
1 Transformation 15 Deg R	−11.38	5.67	−0.91
2 Transformation 15 Deg L	15.73	0.90	1.26
3 No transformation (normal vision)	0.58	0.45	0.05

S was again given three pretests with vision occluded; then, in the test phase, S was asked to either adjust the bar until it *looked* upright or to indicate, by pressing a buzzer, when his image *looked* upright while returning from an initial tilt of 45 deg right. There were two test trials with a 2-min interval between them.

Results and Discussion

Results shown in Tables 3 and 4 indicate that when S's visual input is transformed, "visual" judgments are made with accuracy despite the conflicting information provided by the nonvisual systems. This was the case in both the BOJ task and the KJ task. It is concluded that, while the visual information available to S in these two tasks may be different, there is sufficient information from the visual system in the BOJ task for S to perform this task with reasonable accuracy. The question remains, however, as to the extent to which Ss utilize this information when the instructions emphasize that S is to judge when his body *feels* upright, as he was instructed to do in Experiment 1.

CONCLUSIONS

In the first experiment, it was found that the whole body showed a smaller extent of "visual capture" and less tolerance to discordance when compared with "visual capture" of one limb.

By relating the second experiment to the first, it was found that "visual capture" was less consistent in the BOJ task as variations in the instructions given to Ss reduced the amount of capture in Experiment 2, relative to that of the first experiment.

While all the determinants of the effects found in the body-tilt situation with transformed visual input are not known, this study has provided evidence that "visual capture" does occur under some circumstances when vision is opposed to a complex of nonvisual sensory modalities, although these effects are smaller and less consistent than those obtained when the nonvisual cues are confined to a body subsystem.

It thus appears that the degree of visual dominance is, at least partially, a function of the amount of nonvisual information provided by other modalities but that this relationship of the interaction of modal systems is of considerable complexity.

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Concurrent task in free recall: Differential effects of LTS and STS*

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Ss carried out tasks at one of three levels of difficulty while being presented with free-recall lists. Immediate and delayed recall of the lists were then tested. The results show that difficulty of the concurrent task lowers the output from long-term store (LTS) but does not affect short-term store (STS) at all. The results are consistent with the hypothesis that information load blocks transfer of items from STS to LTS.

Several investigators (Murdock, 1965; Baddeley, Scott, Drynan, & Smith, 1969; and Bartz & Salehi, 1970) have examined the effect of a concurrent task on free recall. Their results all indicate that, like many other variables—age, presentation rate, word frequency, list length, associative structure—concurrent task load affects solely the amount held in long-term store (LTS). Short-term store (STS) is unaffected. In the present study, both delayed and immediate recall conditions are used to separate STS and LTS components fully for all serial positions. The results will also afford a check on some anomalous results (Bartz & Salehi, 1970).

METHOD

The Ss were shown 18 lists, each of 12 words. After each word they were shown an addition task at one of three levels of difficulty. The tasks, in order of difficulty, were adding 1, 4, or 7 to a two-digit number. The same addend was used throughout a list. The Ss recalled the list either with or without delay. The experimental paradigm of three levels of difficulty across two recall conditions was replicated three times per S.

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Materials

Words were monosyllabic nouns, from the Thorndike & Lorge (1944) AA frequency lists for the experimental lists and from the A lists for the practice lists and interference task. All words, numbers, and orders of list presentation were independently randomized by computer for each S.

Procedure

A memory drum rotated every 2 sec to display, alternately, a new word or a new addition task to S. The S said the list words, the sums, and the delay words out loud. On no-delay lists a yellow mark after the last addition task signaled the start of recall. On delay lists the last addition task was followed by two lines of three words each, successively, and then the yellow recall signal.

The S was told to recall only the list words, in any order. He was given 1 min for recall. Before the 18 main lists were given, the S had two practice lists, one delay, one no-delay. Recall was written.

Subjects

The Ss were 42 undergraduate students at New York University who participated as part of a course requirement.

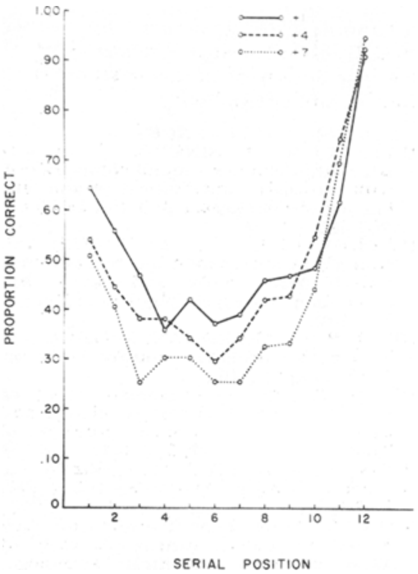

Fig. 1. Serial position curves for three levels of concurrent task difficulty, no delay.

RESULTS AND DISCUSSION

Results of the experiment are shown in Figs. 1 and 2. Figure 1 shows the serial position curve, proportion of words recalled as a function of position in list presentation, for the three levels of task difficulty in the no-delay condition. The curves for the three task loads are distinct across all positions for the long-term memory portion of the curve but merge at the last few positions. These results replicate Murdock's (1965) completely. They indicate that the effect is primarily an LTS effect. The picture is clarified further in Fig. 2, showing the serial position curves for the delay condition. Although the separation of the curves is not as clear as in Fig. 1, the overall effect of task load and delay is in line with expectations. There is no evidence of interaction between serial position and task difficulty under statistical test, as indicated below.

The curves in Fig. 2 furnish an estimate of the amount held in LTS for each serial position. The amount in STS can be estimated by using both the curves in Fig. 1 and Fig. 2 with the following equation:

$$P_i(STS) = \frac{P_i(ND) - P_i(D)}{1 - P_i(D)}$$

where $P_i(STS)$ is the estimated proportion recalled from STS at Serial Position i, and $P_i(D)$ and $P_i(ND)$ are the empirical values of the proportion recalled at Position i under the delay and no-delay conditions, respectively. The derivation of the equation is given by Raymond (1969). Estimated STS is shown in Fig. 3. The STS curves show fairly complete overlap.

Statistical analysis bears out the points made above. An overall analysis of variance of the data in Figs. 1 and 2 finds the following significant, all at the .001 level or better: delay, $F(1,41) = 123.58$; task, $F(1,41) = 21.86$; serial position, $F(1,41) = 28.71$; and Delay by Serial Position, $F(1,41) = 27.36$.

Analysis of the no-delay condition separately (Fig. 1) finds both task, $F(1,41) = 17.53$, and serial position, $F(1,41) = 45.39$, significant at the .001 level. Their interaction is not, $F(1,41) = 1.44$. This test, however, does not take account of the specifically predicted type of interaction. This can be done crudely by evaluating the interaction of the first half vs the second half of the serial positions with the three task levels, giving an $F(1,41) = 3.805$, $p < .10$. A more focused test will give a more highly significant F.

Separate statistical analysis of the delay data (Fig. 2) finds task, $F = 6.99$, $p < .001$, and serial position, $F = 7.32$, $p < .01$, significant. The interaction is not significant, $F < 1$. The last F is important with respect to a point made by Bartz & Salehi (1970). They note that their delay condition data show an interaction, with load affecting all except the final list positions. Neither the curves in Fig. 2 nor the statistical analysis agree with that finding.

To analyze the curves in Fig. 3, the data were first summed across blocks of three Ss. This was done because application of the equation for $P_i(STS)$ to the data for individual Ss sometimes gave denominators of zero. For details on this procedure, see Glanzer & Schwartz (in press). Analysis of variance of the blocked data finds only serial position significant, $F(1,13) = 15.39$, $p < .01$. Neither task, task with serial position, $F < 1.00$, is significant. No reasonable manipulation of degrees of freedom will make the latter two Fs significant.

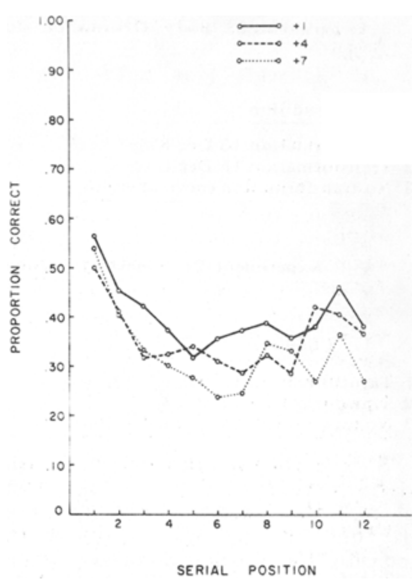

Fig. 3. Derived STS curves for three levels of concurrent task difficulty.

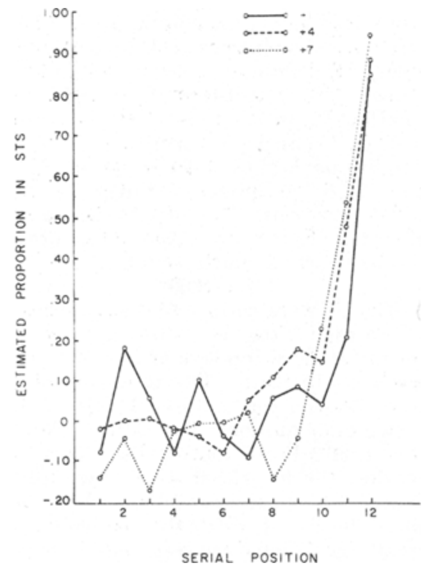

Fig. 2. Serial position curves for three levels of concurrent task difficulty, with a postlist delay.

The results support the assertion that task load affects LTS but not STS. Other data (Glanzer, Gianutsos, & Dubin, 1969) indicate that task load does not affect items after they enter LTS but that it blocks the entry of information from STS into LTS.

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