Chapter III

Conclusion

The importance of lexical representation for reading comprehension has been stressed. Semantically related items are useful for vocabulary knowledge instruction and the nature of the relations doesn't seem to make much difference, as evidenced by the equivalent learning and performance across the three types of semantic lists presented in this study. Thus, the results of this study supports the claim that semantic structure does not account for differences in vocabulary knowledge as function of the instruction. One possible conclusion is that the use of more tightly related lists in the study by Beck and her colleagues would not prove significantly beneficial. That is, teaching words in their semantic grouping may be more important than that the items form tightly connected interrelations. This may be why they were able to show appreciable learning even with their loosely related lists.

A second factor, speed of instruction, indicates that while the speeded task may add excitement to learning, it interferes with learning during earlier instructional cycles, instead of contributing to learning. The subjects in the speeded task condition required more trials to reach criterion. Although the additional trials helped them learn the words to levels that surpassed the nonspeeded group, the benefits of the instruction are due to the additional trials rather than the speeded exercise. Observational data showed that subjects in the speeded condition were more likely to become frustrated with the task than those in the nonspeeded condition. When their scores were not as good on subsequent trials, they would get discouraged and attempt to terminate their session. These and observations like them indicate that the task was very demanding when speed was a factor. Future research should focus on the benefits of slowing the task down, yet still allowing the computer to control the onset of each timed constraint. In this way, some optimal speed or range of speeds could be identified in order to maintain the motivational features of the task.

In the present study, semantic list type was manipulated by varying the three types of tightly organized lists. It was suggested that different types of semantic relations differentially affect learning and organization. Taxonomic structure has the property of relating coordinate members to a superordinate concept, while thematic items have direct coordinate level connections. These structural differences have been shown to accompany differences in learning, demonstrating the ease of thematic structure retrieval over taxonomic (J. Mandler, 1979). A third type of structure forms an embedded structure of subordinate categories, which could be cross-classified. Cross-classification has been shown to form a structure similar to thematic (Broadbent, Cooper, & Broadbent, 1978).

One contribution from this study is the task itself. RESCUE demonstrates the power of microcomputer-mediated instructional tools. The task taught 180 words over a three and a half month period. Although this was twice as many weeks as originally anticipated, it is considerably shorter than the nine months it took the Pittsburgh group to teach 147 words. The difference suggests that cognitive theory can be useful in the design of microworlds that deliver educational materials in more efficient and equally effective ways as a didactic approach.

Further research is needed to determine the effectiveness of the program for passage-level comprehension. The present study restricted comprehension testing to the sentence level. As shown in their high scores on the open-ended pretest, these subjects were able to conjure up their own words to adequately complete this task. Reading passages requires processing of more complex relations among ideas conveyed in the text. The speeded task should also be investigated further to determine if decreasing its speed will shorten the number of trials needed to reach criterion to levels comparable to the slow version. In this way, the testing between the two versions may be provide a clearer understanding about speeded tasks in pre-reading instruction.

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Appendix

Rescue Microworld Courseware

Rescue is a microworld instructional software program. It is implemented using the UCSD pascal software programming language for the Apple microcomputer. In the microworld, the student is to pretend that they are aboard a spacestation that is the headquarters for space travel. They are told that enemy spacecraft will attempt to land in the spacestation to capture it. Their job is to discriminate between enemy and friendly spaceships. At this point the instructional features of the microworld are considered. The student must develop their expertise in a word classification task in order to make carry out the task with integrity. It is the juxtaposition of the imaginary world and the school-like task in a tightly intertwined activity system that specifies the properties of effective microworld "courseware". To facilitate the discussion, the fast or speeded version of RESCUE will be considered here.

<u>Display</u> <u>Format</u>. In Rescue, the student is shown a spacestation positioned in the center of the screen with six words displayed below (see Figure 1). The cumulative and current score counters are displayed in the upper left and right screen corners, respectively. The student must use the category words in the lower display and the target word which appears in the box above the fuel gauge to determine if an on-

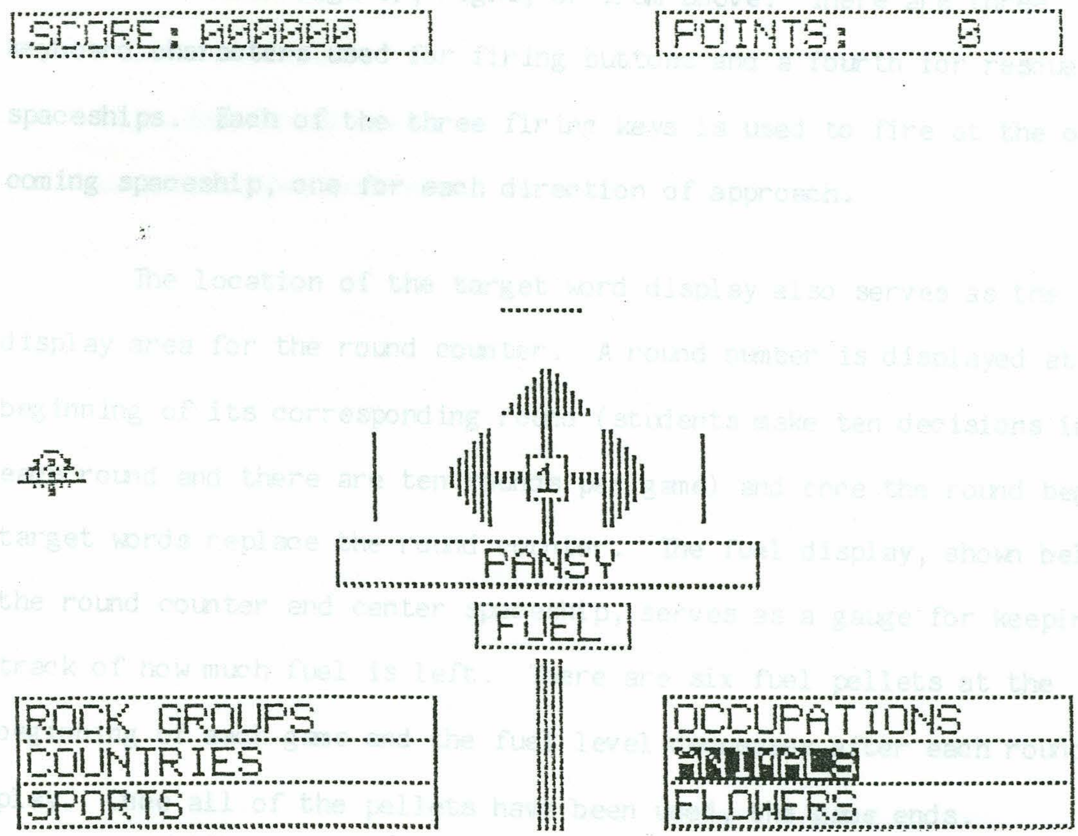

Figure 1. Display of RESCUE microworld vocabulary task.

coming spaceship is friendly or not. The small spaceship on the left of the spacestation in Figure 1 represents the object that each student chooses to either rescue or fire upon, based on their judgements about of relationship between target and category words. Each on-coming spaceship approaches the spacestation from one of three directions, the left (as shown in figure), right, or from above. There are three keyboard characters used for firing buttons and a fourth for rescueing spaceships. Each of the three firing keys is used to fire at the on-coming spaceship, one for each direction of approach.

The location of the target word display also serves as the display area for the round counter. A round number is displayed at the beginning of its corresponding round (students make ten decisions in each round and there are ten rounds per game) and once the round begins, target words replace the round counter. The fuel display, shown below the round counter and center spaceship, serves as a gauge for keeping track of how much fuel is left. There are six fuel pellets at the beginning of each game and the fuel level decreases after each round of play. Once all of the pellets have been used, the game ends.

One of the six category words is selected as an 'active' word at the beginning of each round and it remains active for the remainder of that round. The activated word is identified by the difference in display in contrast to non-activated words. This is shown in Figure 1 by the black background with white lettering for the active category ANIMALS, as opposed to the opposite coloring for the other five.

The player's piece, or point of view, is the center spacestation and smaller spaceships appear from one of the spacestation's three sides. Movement towards the center spaceship is <u>not</u> in a straight and centered pattern. Instead, the on-coming spaceship's movements are in a pattern that moves up and down. In this way, it moves in and out of the center's firing range. The firing mechanism comes out of the end of the center spaceship's that tip faces the direction of the on-coming spaceship. The firing mechanism is exposed when a firing key is pressed and disappears afer each shot. Figure 1 does not show the firing mechanism, but one could imagine a rod shaped like the end of a cannon appearing at the very most point of the three sides of the center ship. Since these firing mechanisms cannot move in coordination with the movement of the smaller vessel, the player must fire at the vessel when it is in range. Subsequently, a student's could miss a spaceship. On-coming spaceships crash into a "force field" when they are not rescued or shot before reaching the center spacestation (shown by the lines in front of the ports in Figure 1).

<u>The task</u>. Each response to an on-coming spaceship (shoot, rescue or crash) is considered a turn. The student's turns are grouped into rounds and a new round begins after ten turns. Within a round, the same cue word or words remain activated for all turns. A new active category word is randomly selected at the beginning of each new round. There are 10 rounds in a trial or game. After the on hundredth on-coming spaceship (10 rounds by 10 on-coming ships) is responded to, the fuel gauge is emptied and the trial ends with a cumulative score and a score that is the average speed of decision for each on-coming ship.

The goal of the game is to demonstrate expertise across several levels of task difficulty, such that high scores reflect accuracy and speed in judgements. When the word can be classified as a member of the category word, the approaching ship is friendly. All others denote the approach of unfriendly spaceships. Thus, the successful player demonstrates knowledge of the relationships between the target and cue words and uses this knowledge fluently. The student demonstrates his or her knowledge of these relationships by shooting the unfriendly target spaceship and rescueing the friendly ones.

Scoring. Points are scored for correct decisions and incorrect decisions result in negative points that decreases the cumulative score. A response is correct if the student shoots an unfriendly ship or saves a friendly one. In addition, regardless of the level at which the game ends, the player is shown his/her average correct response for the best Possible scores range from +300 to -300, where +300 indicates the fastest possible speed at which an correct decision, either shoot or rescue, can be made, and -300 is the fastest speed of incorrect decisions. The farther away the on-coming spaceship is from the center spacestation when the student makes a response decision, the higher their score. So, the faster the correct decision, the higher the score, but making quick incorrect decisions result in higher negative scores that decreases the cumulative score. The lowest postive score is 120, while the lowest for a negative score is -110. A score of -110 is always indicates that the ship crashed into the center spacestation. Thus, as the crash score implies, the speed of score is based on distance between the onset of the spaceship and the location of the center spacestation's force field, rather than some real-time recording device (e.g., an apple clock).

This provides a built-in criteria that boosts one score given that the accurate judgements are made with ease. Ease of judgement is assumed to be reflected in very quick and accurate judgement decisions. On-coming spaceships move towards the primary ship in time and the scoring arrangement is designed to take advantage of this feature. The earlier an accurate judgement response to an on-coming ship is made, the more points the player gets. Inversely, the longer it takes to make a correct response, the fewer points are accrued relative to earlier correct responses. There are two types of responses that are significant for accruing points for speed of response: saving a friendly ship and shooting an unfriendly one. The sooner one saves a friendly ship, for example, the higher the higher this value will be.

Performance Records and Evaluation of Model

Our implementation of a microworld courseware requires maintaining a record of the student's performance order to measure the success of the curriculum. For a given student, a performance record for each trial is generated and stored in a file for inspection. This is also a nice feature for instruction because it allows the teacher to evaluate each student's performance upon accessing the file. The file is also maintain as permanent record on the disk.

Each student's performance file contains the following:

1. the name of each category encountered.
2. the number of correct responses or judgements for each category.

3. the total number of ships encountered in the game.
4. an average correct score per category.
5. the total number correct overall or across all categories.
6. the average of the averages across all categories.
7. the percent correct for total compilation

The primary measures of interest for our research are speed and accuracy. Accuracy in judgements is measured by 2, 3, 5 and 7 above. The number correct per category is the accuracy measure for a single round. The accuracy measure for the entire game is the ratio of correct responses over all categories encountered and the total number of ships encountered, shown as the percent correct in the file. High average correct scores for a category, reflect the ease of the player's correct responses to friendly and unfriendly ships judgements. Collapsing across these category averages and averaging the averages serves as an overall index of cumulative speed. This index can also be a point of reference for determining the difficulty of each category relative to the others. That is, one can determine which categories generated scores below the overall average (difficult), those scoring above (easy), those that are close to that mean (medium).

Another student file maintains a record of word by word response data. This record contains the target word that appear with each on-coming ship, whether the student's response to the ship was correct or not, and the speed of their response. There is a cumulative record for each round and a record of error types and percent errors for each category for the entire trial. These word level and error data are important for experimental purposes. Particularly with respect to modelling the student's performance and studying individual differences.