EVIDENCE FOR THE SUPERIORITY OF THEMATIC CLASSIFICATION IN RETRIEVAL AND RECALL: CONTRASTING CATEGORIZATION PREFERENCE WITH MEMORY PERFORMANCE

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Evidence for the Superiority of Thematic Classification in Retrieval and Recall:

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Abstract

Seventy-one first and second grade students and 89 college students participated in 2 constrained sort-recall tasks to determine the extent to which the relationship between thematic classification and recall performance is influenced by classification preference. Results indicated a superiority for thematic classification over taxonomic classification for both cohorts, with $p < .01$. Improvements for the study and theoretical implications are discussed.
Evidence for the Superiority of Thematic Classification in Retrieval and Recall:

Contrasting Categorization Preference with Memory Performance

Initial research addressing categorization by theme or by taxonomy suggests that thematic organization, which is categorization based on objects that are spatially and functionally related and interact in the context of some event, is the basis for organizing knowledge in younger children (Blewitt & Krackow, 1992). Taxonomic organization, which is categorization based on similarities among items which can be arranged in a hierarchical format, was believed to be utilized only by older children and adults (Blewitt & Krackow, 1992; Ceci & Howe, 1978; Denney, 1974; Ricco, 1989; Smiley & Brown, 1979).

While evidence has been found to support the existence of taxonomic categorization in children of all ages (Bauer & Mandler, 1989; Markman & Hutchinson, 1984), research concerning the impact of these different classification strategies on recall and retrieval are limited in number. Most studies addressing this issue have utilized sort-recall tasks or noun-verb lists involving different stimuli for each condition. These studies have been criticized due to possible attractiveness differences between taxonomic choices and thematic choices (Greenfield & Scott, 1986).

However, Rabinowitz and Mandler (1983) addressed the issue of classification strategy and its impact on recall by using phrases that illustrated five noun-verb taxonomic categories and five event sequences which could be classified using either organization strategy. In their first experiment involving oral presentation of classified items, adult participants were randomly assigned to
one of three presentation blocks: taxonomic, thematic, or random presentation. Following presentation of the designated categorical phrases, additional instructions were given to allow an adequate interval between presentation and the ensuing free recall task. Other participants were given a sort-recall task of the chosen phrases and, likewise, randomly assigned to one of the three groups. A second experiment was conducted utilizing the same procedures, but different stimulus materials. Experiment 1 used an event sequence for schematic classifications, while experiment 2 used thematically associated items for this type of categorization. All results indicated that thematic organization led to superior recall over taxonomic organization and over random presentation. This provides evidence for functional usage of thematic classification strategies beyond childhood.

The evidence for recall superiority of thematic classification in college students contrasts the empirically supported preference for taxonomic categorization at this age presented in Denney's (1974) meta-analysis. Specifically, Denney presented information which indicated that thematic relations was the dominant basis for organization from first to third grade (ages 6 to 9), while taxonomic relations were considered the dominant categorization strategy in children from age 9 to 11. Comparisons of 6 year-old children and college students on a memory task evidenced differential preference for these two groups--college students preferred taxonomic categorization, while young children preferred thematic (Denney & Ziobrowsky, 1972).
The absence of improved recall for the preferred classification strategy in college students suggests a need for clarification of the reasons for this phenomenon. Evidence for a superiority in recall performance for thematic categorization in a population in which taxonomic categorization is salient prompts an investigation into why this is so. According to Rabinowitz and Mandler (1983), college students had difficulty organizing noun-verb phrases schematically. These classifications were not as precise as taxonomic categorizations, nor did they match experimenter-determined groupings. This denotes a hint of ambiguity to schematic/thematic classification strategies. However, the ambiguity did not adversely affect memory performance, because recall was superior when attempted following thematic versus taxonomic categorization.

Rabinowitz and Mandler (1983) propose that schematic classification facilitates recall to a greater extent than taxonomic organization due to the difference in the nature of associations among the items within each type of categorization. The grouping of items into categories organized under a superordinate label in taxonomic organization allows only vertical associations (the item with the label) as opposed to horizontal associations (associations between items within the category in ways not central to the superordinate label). In contrast to the associations among members of a taxonomic category, thematic/schematic classification involves horizontal links as well as systematic vertical associations. This is consistent with Bower's (1970b) relational-organizational hypothesis: The presence of additional organizational cues may
facilitate retrieval of encoded information. This would account for the improved recall of thematically related items.

A pilot study (Cox, 1996) addressed the difference in recall for taxonomic and thematic relations with a sort-recall task using pictures that could be related either taxonomically or thematically in order to avoid any possibility that recall ability was a function of the stimulus set. Because group means for the recall of thematic categories were consistently higher than those for the recall of taxonomic categories, despite apparent participant difficulty in sorting thematically, further study was needed to investigate the possibility that thematic categorization requires increased cognitive effort in populations preferring an alternative classification strategy.

Tyler, Hertel, McCallum, and Ellis (1979) investigated the impact of cognitive effort on memory and its correlation with Craik and Lockhart’s (1972) level of processing by utilizing two incidental learning tasks requiring two different levels of effort. Subjects were given anagrams determined to be either difficult or easy as nonsemantic tasks. Semantic tasks included sentence-completion problems of low or high degree of difficulty. Number of words recalled in a surprise free recall test was the dependent variable. Results indicated no correlation between levels of processing and cognitive effort. A significant difference was noted for effects of cognitive effort on ability to recall. No significant difference was found between semantic and nonsemantic tasks. Therefore, a correlation was found to exist between cognitive effort and increased recall of material represented both semantically and nonsemantically. This
suggests that cognitive effort implies greater elaboration, as suggested by Craik and Tulving (1975) in the modified levels of processing theory. By relating an item to a greater number of facts, a process which may well lead to greater cognitive effort and, therefore, serve as an intervening variable in the Tyler et al. (1979) study, the number of potential retrieval cues are increased. Thus, recall is improved.

Evidence supporting improved recall for thematically structured categories in a population preferring taxonomic sorting suggests that phenomena associated with cognitive effort results in improved recall for nonpreferred classification strategies. The empirical evidence supporting thematic classification as the preferred strategy of children prior to the thematic-taxonomic shift predicts improved recall for items organized taxonomically.

In contrast, the relational-organization hypothesis (Bower, 1970) would be supported by improved recall for thematic categorization regardless of preference. According to the relational-organization hypothesis, imagery produces more associations between the items to be recalled (Galotti, 1994). The active relationships between the superordinate category label and the basic level items, in combination with the interaction among the basic level items, promotes greater associations which lead to more available retrieval cues. This promotes improved recall. On the other hand, taxonomic categorization identifies only an association between the superordinate label and the individual basic level items. No association between basic level items is made, aside from their congruence with the overall category name. Therefore, the relational-organization hypothesis
predicts that college students and young children will exhibit inferior recall ability for items categorized taxonomically. No link to preference is expected.

In an effort to determine the extent to which thematic classification aids in memory, it is necessary to address populations which vary according to preference. Empirical evidence supports thematic preference in young children, while taxonomic preference is supported for college students. The present study utilizes samples taken from both populations to determine if thematic classification, as supported by the relational-organization hypothesis, improves recall for individuals regardless of classification preference. At the same time, the hypothesis supported by Craik and Tulving’s (1975) elaboration coding, a modification to the levels of processing theory, in conjunction with perceptual cognitive effort, will be tested for significance. A determination that a negative correlation between classification preference and strategy employed will support elaboration coding and cognitive effort. However, a significant improvement in recall performance for both groups when utilizing thematic categorization would provide support for the relational-organization hypothesis.

Method

Participants

Participants included 28 first grade students and 43 second grade students (ages 6.75- 9.17; X = 8.01) and 89 introductory psychology students from the Ball State University subject pool. Fourteen first graders and eight second graders were excluded from the final results due to the following: 12 were used in a pilot study to ensure the efficiency of the methodology, 2 were unable to fulfill task
requirements, and 8 were absent on designated testing days. Twenty-three college students were excluded from final analysis due to failure to match set points for sorting accuracy.

**Materials and Procedure**

Two sets of 25 line drawings (see Table 1) were constructed using copies of pictures taken from children's coloring books. Pictures were cut out and pasted onto 3 X 5 inch index cards. Each set contained pictures that could be placed in both thematic and taxonomic categories. Five categories containing five units represented each set. The number of line drawings was reduced to 16 for first and second grade students due to age and ability differences in sort tasks. This reduced the sets to four categories containing four basic level items. The remaining line drawings were used as prompts to aid the children in sorting according to instructions, though one line drawing was excluded completely from testing due to the need for only four prompts for each sort-task.

A within-subject design was chosen, with complete counterbalancing of sets and conditions. Children were tested individually, and adults were tested in groups of 5-10. The experimenter read aloud a brief description of either taxonomic or thematic categorization and provided examples of how to group the pictures accordingly. Participants were informed that there was no time limit, but that they should work quickly. They were also informed that they would be asked to remember the pictures later. Children were asked to identify the pictures verbally prior to implementation of the sort-task to ensure recognition of all items. (The pilot study revealed discrepancies in the level of recognition for chosen
items. Analysis revealed individual differences were primarily responsible for these difficulties, as no single item was significantly difficult to recognize.) Any item not recognized by a participant was identified by the experimenter.

Participants were instructed to begin. The time was recorded at the completion of the grouping task. Participants were then given tasks to complete for a 15-minute delay interval (this was to avoid further rehearsal of the pictures before recall). Children were given puzzle mazes to complete, while college students were given framework number crosswords. Following the delay, participants were asked to try to remember as many of the pictures as they could from the sort-task. Adults were asked to write down all the pictures they could remember, while the children's responses were given orally and recorded by the experimenter.

Immediately following the first condition, participants underwent the same procedure for the second condition using the other stimuli set. Complete counterbalancing was used to control for carryover and order effects.

In order to determine if a difference existed for retention in long-term memory for taxonomic versus thematic relations, all participants were tested two days following completion of the final condition. This time, participants were asked to report any pictures they could recall from both stimulus sets.

**Results**

Sort-tasks were evaluated for categorization strategy used in order to determine taxonomic or thematic classification. For college students, categorizations were classified as thematic if 15 of the 25 items were sorted.
thematically. The same criterion was used for taxonomic classification. For
children, categorizations were classified as thematic if 10 of the 16 items were
sorted thematically. Again, the same criterion was used for taxonomic
classification. This was necessary due to the lack of training participants received
on the categorization strategies and to ensure that recall was evaluated according
to classification used.

Statistical analyses utilized SPSS-X and BMDP computer programs.
Alpha level was set at $p < .05$. Correlated t-test of repeated measures indicated a
significant difference between classification strategies for both college students
and first and second grade students. College students evidenced increased recall
performance for thematic classification over taxonomic classification during
initial recall ($t = 9.28, p = .000$), with an eta squared value of $.287$. Final recall
results further supported increased recall performance following thematic
classification ($t = 9.82, p = .000$) with an eta squared value of $.44$. Within-
subject (individual) differences accounted for 49.8% and 38.6%, respectively, of
the remaining variation in scores.

First and second grade students were also analyzed using correlated t-tests
for repeated measures. Initial recall results indicated thematic classification
promoted improved recall over taxonomic classification ($t = 3.18, p = .003$), with
an eta squared value of $.047$. Final recall results, eta squared = .141, further
supported thematic classification as more effective than taxonomic classification
in aiding recall ($t = 5.46, p = .000$). Further analysis utilizing 2X2 ANOVA for
repeated measure revealed no significant difference for school attended, gender, or age of students.

Discussion

The purpose of the present study was to determine if improved recall for items organized thematically versus taxonomically, evidenced in college students, was due to increased cognitive effort utilized when organizing items in a manner inconsistent with classification preference or due to an overall effectiveness of thematic classification as a mnemonic strategy. Results of this study tentatively supports the superiority of thematic classification over taxonomic classification in reference to improved recall performance.

Statistical analysis revealed that both recall and retrieval are enhanced by utilizing thematic classification, regardless of classification preference. However, eta squared values indicated an extreme amount of variability within subjects, allowing interpretation of the results to be only tentative. Children had no difficulty with the sort-task, once prompts were used to facilitate the sorting, but recall performance was low for both conditions. This is consistent with empirical evidence indicating that young children (prior to the third grade) have great difficulty performing free recall tasks, due, possibly, to an inefficiency in switching between modes of organization during recall (Ceci & Howe, 1978). Prior evidence indicating that young children prefer to encode and recall items which are organized thematically (Hasher & Clifton, 1974, Melkman & Deutsch, 1977) predicted improved recall following thematic classification for the children
in this study. Evidence from the present study provides support for this occurrence.

However, the low eta squared values representing the predictability of recall performance according to classification strategy does not indicate a strong relationship between children's preference for thematic classification and improved recall. Only 5% of initial recall results and 14% of final recall results can be predicted by knowing the type of classification strategy used. One explanation for this could be the nature of the free recall task. A second explanation could be that the present study examined some children who were in the process of shifting from thematic to taxonomic categorization preference. The reliance on empirical data to classify the preference of children, coupled with the advent of accelerated learning which now begins at preschool age, makes this explanation plausible—though unlikely—due to the limited recall performance exhibited by the children and its correlation with age. It is suggested that future studies test participants for individual preference prior to evaluation of performance on sort-recall tasks. Additional suggestions include using cued recall tasks instead of free recall tasks to promote stronger performance for both classification strategies. This may reveal a stronger relationship between thematic classification and improved recall.

Data collected from the college students supports Bower's (1970) relational-organizational hypothesis which hypothesizes that the presence of additional organizational cues may facilitate retrieval of encoded information. Almost 29% of data for initial recall is predictable by knowing which
classification scheme is being used. The increased percentage, 44%, for final recall predictability further supports the importance of thematic classification for college students, because the higher correlation for retrieval implies stronger associations between items classified in this manner.

Support for the significance of environmental pressures in the shift to taxonomic categorization (Cole, Gay, Glick & Sharp, 1971) underscores the need for investigating the impact of redirecting the seemingly natural approach of thematic organization to the organization of items according to complementary relationships. Questions are raised as to the effect of such an obvious redirection of classification preference from thematic to taxonomic on aspects of learning. Further research should consider utilizing younger children as the experimental group designated as preferring thematic organization. Additionally, due to the hypothesis that young children show improved recall for items classified according to their preference, older children who prefer to categorize taxonomically should be evaluated for a superiority of thematic classification for recall performance. Evidence for thematic superiority in older children (11-13 years old) would further support the relational-organizational hypothesis and indicate a need to incorporate thematic organization strategies in classroom curriculums.
Table 1

*Pictures Grouped According to Their Thematic (Rows) and Taxonomic Categories (Columns): Set 1 and Set 2*

<table>
<thead>
<tr>
<th>Taxonomic</th>
<th>Set 1:</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Thematic</td>
<td>People</td>
<td>Clothes</td>
<td>Vehicles</td>
<td>Animals</td>
<td>Shelters</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Out West</td>
<td>Cowboy**</td>
<td>Stetson*</td>
<td>Wagon*</td>
<td>Horse*</td>
<td>Train Station*</td>
</tr>
<tr>
<td></td>
<td>Church</td>
<td>Angel*</td>
<td>Dress</td>
<td>Car</td>
<td>Dove</td>
<td>Church</td>
</tr>
<tr>
<td></td>
<td>Alaska</td>
<td>Skier*</td>
<td>Parka</td>
<td>Sled</td>
<td>Seal</td>
<td>Igloo</td>
</tr>
<tr>
<td></td>
<td>The Beach</td>
<td>Swimmer*</td>
<td>Bathing suit</td>
<td>Boat</td>
<td>Whale</td>
<td>Lighthouse</td>
</tr>
<tr>
<td></td>
<td>At the Farm</td>
<td>Scarecrow*</td>
<td>Bib-overalls</td>
<td>Tractor</td>
<td>Pig</td>
<td>Barn</td>
</tr>
</tbody>
</table>

| Set 2:     | Teacher*                    | Baseball Cap         | Bus                  | Fish                 | Schoolhouse          |
| School     | Baby**                      | Sweater*             | Buggy                | Cat*                 | House                |
| Baby life  | Indian*                     | Headdress            | Canoe                | Buffalo              | Teepee               |
| Indian     | Hiker*                      | Jeans                | Jeep                 | Bear                 | Tent                 |
| Camping    | King*                       | Gown                 | Carriage*            | Unicorn              | Castle               |

*indicates prompts used for first and second grade children

**indicates items excluded from the sort-task for first and second graders
Table 2

Results of *t*-tests for paired samples of Initial and Final Recall Arranged by Classification and Cohort

<table>
<thead>
<tr>
<th></th>
<th>First and Second Grade Students</th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Initial Recall</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Thematic</td>
<td>49</td>
<td>7.25</td>
<td>3.36</td>
<td><em>t</em> = 3.18</td>
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<tr>
<td>Taxonomic</td>
<td>49</td>
<td>5.88</td>
<td>2.82</td>
<td></td>
</tr>
<tr>
<td>Final Recall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thematic</td>
<td>49</td>
<td>4.25</td>
<td>2.90</td>
<td><em>t</em> = 5.46</td>
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<tr>
<td>Taxonomic</td>
<td>49</td>
<td>2.25</td>
<td>2.00</td>
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<table>
<thead>
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<th></th>
<th>College Students</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Initial Recall</td>
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<td></td>
<td></td>
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<tr>
<td>Thematic</td>
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<td>22.08</td>
<td>2.75</td>
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<td>Taxonomic</td>
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<td>17.94</td>
<td>3.76</td>
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<td>Final Recall</td>
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<tr>
<td>Thematic</td>
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<td>3.73</td>
<td><em>t</em> = 9.82</td>
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<td>12.41</td>
<td>4.79</td>
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References


