Generalization after Semantic Training: Evidence from Healthy Speakers

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ABSTRACT

Kiran & Thompson (2003) and Plaut (1996) suggest that semantic training of typical items will generalize to other typical items in a category, but training atypical items will generalize to untrained typical and atypical items from that category. This study tested this hypothesis in young adults, reasoning that this effect should be robust in intact semantic systems.

30 young adults performed category generation and picture naming pre and post-training. They named 72 pictures from 3 semantic categories, then completed a semantic-feature training on 7 atypical items from one category and 7 typical items from a second category. One category remained untrained as a control.

Subjects showed generalization to untrained items only in trained categories, but there was no advantage for type of training (i.e., typical or atypical). Response times were faster at post-test, particularly for trained items and the most closely related generalization items.

These findings demonstrate that, in an intact semantic system, semantic training can result in improved access to items from the same semantic category, but not items in unrelated categories. Response times improved with task repetition; and semantic training enhanced this effect.

METHODS

Participants

- 30 young adults (age 18-24) from the University of Florida with no history of reading or language impairments participated in this study.

Materials

- 24 artifact items from each of 3 semantic categories (vehicles, clothing, & tools) were chosen from the prototypicality norms in Rosch (1975). 12 items in each category were highly typical, 12 were rated medium to low typical (atypical). Typical and atypical items did not differ in frequency. Typical and atypical items for which familiarity ratings were available did not differ in this measure.

Procedure

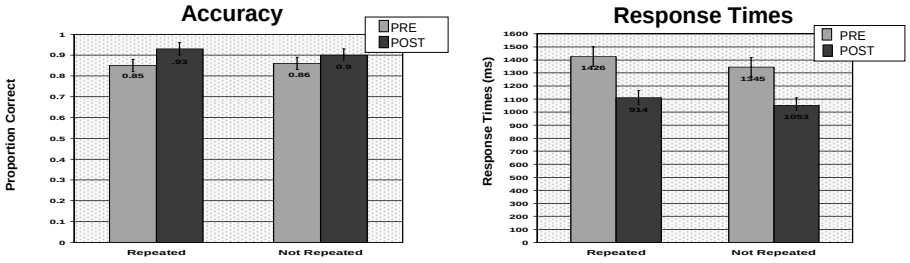
- **PRETEST**: First, participants completed a category generation task for the three categories, then they completed a picture-naming task by naming each item as it was presented on a computer screen. All items from the trained categories and half of the items from the untrained category were repeated 3 times after naming. Responses were scored for accuracy and RTs for accurate responses.
- **SEMANTIC TRAINING:** Participants generated semantic information about 7 typical items from one category and 7 atypical items from a different category. Thus, each trained category included 3 types of items: 7 trained items, 5 untrained items of the same typicality as the trained items, and 12 items of different typicality from what was trained. The other category was left untrained as a control category: it received no semantic training but half of all typical and atypical items were repeated.
  - To elicit semantic information, participants were asked 3 questions about each item:
    1) Who uses this?
    2) What is it used for?
    3) What makes it different from other things like it?
  - Training items for each category were presented three times, and the order of category presentation was chosen randomly by the computer. At each training presentation, training items were presented in random order.
- **post-test:** Participants completed the same category generation task, and the same naming task, but without feedback or repetition.

Analyses

- Dependent variables: accuracy of responses and RTs for correct responses.
- Control items: What was the effect of repetition? (2) Time x (2) Repeated x (2) Item Typicality Repeated Measures ANOVAs.
- All items: What was the effect of semantic training?
  (2) **Time** (Pre-, Post) **x** (2) **Item Typicality** (Atypical, Typical) **x** (4) **Training Types**
  - Trained items
  - Generalization items: Untrained items from the trained categories with
    - Same typicality as trained items
    - Different typicality as trained items
  - Control—Untrained category.

RESULTS

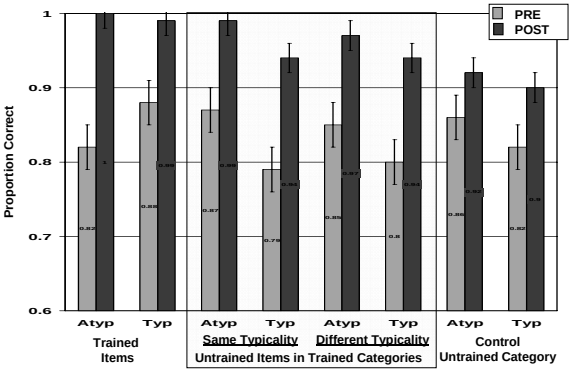
Figure 1. Effects of Repetition on Untrained Categories



- Time: $F(1,26) = 14.996$, $p < .001$, $\eta^2 = .37$
- NO EFFECTS OF REPETITION!
- NO effect of typicality or interaction with item typicality.

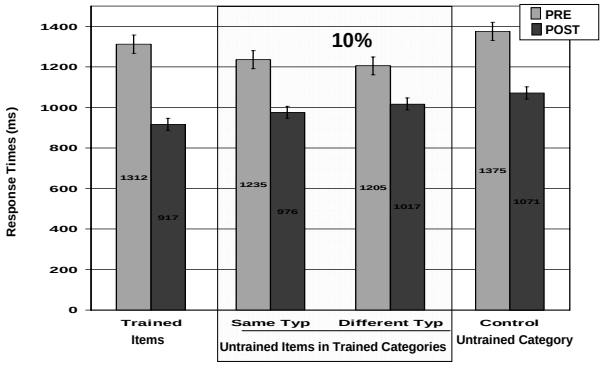
- Time: $F(1,26) = 23.734$, $p < .0001$, $\eta^2 = .48$.
- NO EFFECTS OF REPETITION!
- NO effect of typicality or interaction with item typicality.

Figure 2. Effects of Training & Item Typicality on Accuracy



- Significant main effect of Time
  - All categories were better at post-test
    - $F(1,29) = 160.520$, $p < .0001$, $\eta^2 = .85$
- Significant main effect of item typicality
  - Typical < Atypical
    - $F(1,29) = 7.132$, $p < .02$, $\eta^2 = .20$
    - Name Agreement!
- Significant Time x Typicality x Training Interaction:
  - $F(3,87) = 3.337$, $p < .05$, $\eta^2 = .10$
  - Ceiling effects in trained and generalization items
- Planned Comparisons: One-way ANOVA comparing change in accuracy across training conditions.
  - **NO differences in change of accuracy between trained items and generalization items!** All improved a similar amount.
  - Control items (from untrained category) changed significantly less than all items from the trained category.

Figure 3. Effects of Training & Item Typicality on Response Times



- **Significant main effect of Time**
  - Picture naming was faster at post-test
    - $F(1,29) = 85.704$, $p < .0001$, $\eta^2 = .75$
- Significant main effect of Training
  - Control RTs > Generalization or Trained RTs
    - $F(3,27) = 4.398$, $p < .02$, $\eta^2 = .33$
- No effect of Item Typicality
- **Significant Time by Training Interaction**:
  - $F(3,87) = 5.495$, $p < .005$, $\eta^2 = .38$
  - No difference in RTs at pre-test
  - Significant differences in RTs at post-test
    - Control items were slowest at post-test.
    - Trained items were faster than all other conditions at post-test.
    - Generalization items of the same typicality as training were also faster than control items.
    - Generalization items of different typicality from those trained did not differ from Control items.

CONCLUSIONS

In a healthy semantic system, generalization from semantic training is a robust phenomenon!

- **Accuracy** improved equivalently for trained and generalization items within a category.
  - Items in the trained category improved significantly more than items from the untrained categories.
- For **response times**, there appears to be a graded response based on semantic distance from trained items
- Following Plaut (1996), we attribute these findings to the activation of features shared by many items in a category.
  - Activation of shared features improved performance in picture naming response times (as might be expected from semantic priming studies) AND overall accessibility of items that had been previously unnamed.

No advantage for training typical or atypical items.

- May have "swamped" the semantic system!
- Spreading activation on a grand scale!
- May need to look at less training in YA to see typicality effects on training or generalization.

Results of Over-Training

➢Many of these changes happened as a result of training already known items.

- Consistent with findings in the animal literature that over-training may have distinct benefits for generalization.

Untrained items from untrained categories

- No significant effect of repetition or typicality on naming.
- More accurate and faster at post-test than pretest.
  - We believe this represents effects of repeated access attempts on the same items, rather than generalization to untrained items.
    - But we cannot rule this out using the current paradigm.

No Generalization to Untrained Task--Category Generation

- NO effects of semantic training on Category Generation in either group.
- Repeating the task had larger effects than semantic training.
- Performance in Category Generation tasks may be primarily limited by frontal lobe function.

➢Category generation may not be an appropriate task to demonstrate generalization of semantic training.

General Comments

- The success of this particular training program may depend critically on the intactness of semantic category structure.
  - We expect that patients with relatively intact semantic category structure will benefit most from this treatment.
- Individuals with impaired semantic systems may respond differently to this treatment depending on type and extent of damage.

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