Generalization after Semantic Training: Evidence from Healthy Speakers

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ABSTRACT

Kiran & Thompson (2003) and Plaut (1996) suggest that training typical items may only facilitate access to other typical items in a category, but training atypical items should facilitate access to both 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 named 72 pictures from 3 semantic categories, then completed a semantic-feature training on atypical items from 1 category and typical items from a second category. One category remained untrained.

Subjects showed generalization to untrained items only in trained categories, but no advantage associated with type of training (i.e., typical or atypical). Response times were faster at post-test but there was no effect of semantic training or even repetition

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 unrelated categories. Response times, however, appear to be improved by any attempts at access, and seem to be unaffected by repetition or semantic training.

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 items from each of 3 semantic categories (vehicles, clothing, & tools) were chosen from the prototypicality norms in Rosch (1979). 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

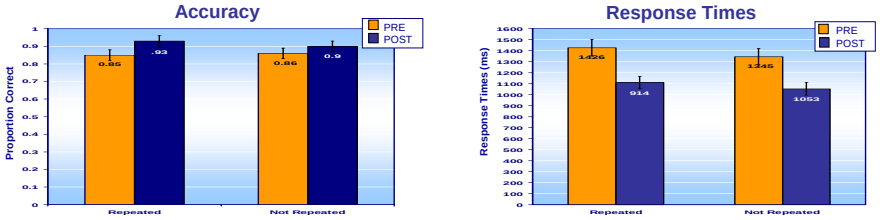
- Participants first named each item as it was presented on a computer screen. All items from the trained categories and half of the items from the untrained category were repeated 3 times after naming. Responses were scored for accuracy and RTs for accurate responses.
- Participants generated semantic 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 3rd category received no semantic training, but half of all typical and atypical items were repeated to gauge the effects of repetition.
- To elicit semantic information, participants were asked 3 questions about each item:
  1) Who uses this? (all items were artifacts)
  2) What is it used for?
  3) What makes this item different from other things like it?
- The training items for each category were presented three times each, and the order of category presentation was chosen randomly by the computer. At each training presentation the trained items were presented in random order.
- After semantic training, participants again named all the items as they were presented by the computer.

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** (4) **Training Types x** (2) **Item Typicality** (Atypical, Typical)
    - **Training types**: Trained items, Generalization items (Untrained items from the trained categories of Same typicality as trained items, Different typicality as trained items), Control—Untrained category.

RESULTS

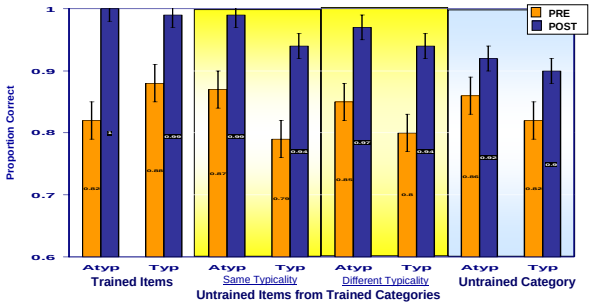
Figure 1. Effects of Repetition on Untrained Categories



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

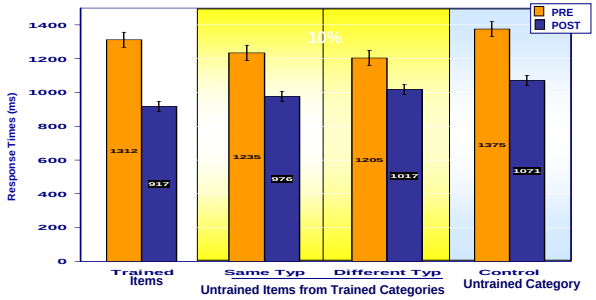
- Time: $F(1,26) = 23.734$, $p < .0001$, $\eta^2 = .48$.
- NO EFFECTS OF REPETITION!
- NO effect of typicality or interaction with item typicality

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
    - $F(1,29) = 7.132$, $p < .02$, $\eta^2 = .20$
- Significant Time by Training Interaction:
  - $F(3,87) = 3.337$, $p < .03$, $\eta^2 = .10$
  - No difference in accuracy at pre-test
  - Significant differences in accuracy after training
    - Trained items were at ceiling at post-test
    - Control items were least accurate at post-test
    - Trained items > Untrained items from Trained Categories > Control items
    - No effect of whether generalization items were of the same or different typicality from trained items.

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
    - Trained items were faster than other conditions post
    - Control items were slowest at post-test
    - Generalization items of the same typicality as training were faster than control items.
    - Generalization items of different typicality from those trained did not differ from Control items.

CONCLUSIONS

This study tested the hypothesis suggested by Plaut (96) and Kiran & Thompson (2003) that training typical items may only facilitate access to other typical items but training atypical items should facilitate access to both typical and atypical items from that category. We looked at changes in picture naming performance of 30 young adults on 4 types of items:

- Untrained items from an untrained category (half were repeated to test effects of simple repetition)
- Trained items (in 1 category trained typical, 1 trained atypical)
- And 2 types of Generalization items:
  - Untrained items from trained categories of the same typicality as those trained (e.g., untrained typical items from a category in which other typical items were trained)
  - Untrained items from trained categories differing in typicality from those trained (e.g., atypical items from a category in which typical items were trained)

Untrained items from untrained categories

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

Generalization items

- These findings present strong evidence that, in an intact semantic system, generalization of semantic training can be achieved with little difficulty to items from the same semantic category.
- Following Plaut (1996) we attribute these findings to the activation of features that are shared by many items in a category.
  - Activation of these shared features improves performance in picture naming response times (as might be expected from semantic priming studies) as well as overall accessibility of items that had been previously unnamed.
- The lack of typicality effects is somewhat unexpected considering recent findings from the aphasia treatment literature.
  - These findings show that, under optimal circumstances, typical items can be as effective as atypical items at stimulating the semantic network underlying a category in an intact semantic system.
- We believe that the success of this particular training program depends crucially on the intactness of semantic category structure.
  - Thus, patients who can demonstrate relatively intact semantic category structure will benefit the most from this treatment.
  - This could be tested by using performance on category verification, category sorting or semantic priming tasks as predictors of treatment success.

Naming Typical vs. Atypical Items

- Typical items tended to be harder (less accurate and slower) to name than atypical items.
- This may be due to inter-item confusability (Stanczak et al., 2005).

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