FAMILIARITY-BASED RESPONDING IN AUTISM

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Abstract

The learning of items by individuals with autism often seems particularly fragile. Items that have seemingly been well learned may disappear from the individual's repertoire ("item attrition"). Here we report further results from an intensive single-case observational study of a non-vocal, low-functioning, 14-year-old male with autism (O'Grady, Boser & Gordon, IMFAR, 2001) who was being trained on a sound-to-visual picture association task. These data suggest that familiarity-based responding to distractors may be a major cause of apparent "item attrition" in these circumstances. Many instances of apparent "item attrition" in this individual appeared to be caused by the introduction of a distracter that was more familiar or more salient than the target item being tested. Of note, the subject would not make an error across semantic categories (e.g., not mistake his sister for his mother) but would make one within (e.g., mistake his father for his mother). We suggest that this subject's performance can be modeled by a relatively simple multi-stage process, with stimuli and prior familiarity both causing activation of possible responses. Familiarity-based responding causes a familiar distracter to cause an incorrect response, even though the subject "knows" the correct sound-to-visual association. This model suggests how teaching of such children may need to be modified for greater efficiency.

Background and Basic Issues

The literature does not provide good explanations for why a previously trained item should seemingly become unlearned in these individuals. Among the possibilities to consider are retroactive interference from the new items being learned (Bouton, Nelson and Rosas, 1991), or difficulty making the conditional discriminations themselves (Green, 2001). To establish an explanation, we had the following goals:

- Establish a reliable, reproducible set of criteria for item attrition.
- Determine what properties seemed to influence the occurrence of item attrition. The nature of the task itself? Properties of the stimulus being taught? The response required? The items used as foils?

Methods

Subject

- Non-vocal, low-functioning, 14 year old male with autism (AI-not real initials)
- Preschool Language Series (PLS III) score 18 in 1998
- Peabody Picture Vocabulary Test (PPVT) standard score 38 in 2000

General Task and Procedure

- Retrospective study done as part of student's education program. Informed consent given in accord with JHMI IRB requirements.
- All 8 tasks selected were functionally important for AI's development.
- All tasks were auditory stimulus to picture selection (receptive identification).
- Response field: one target, two distracters (three items total).
- Distracters were semantically related and randomly rotated.
- Computer administered using Foundations^{tm} (Infostructure, Yardley, PA) and calibrated Princeton^{tm} Touchscreen Monitor for possible responses.
- Subject instructed to "touch (item)."
- Rewarded (e.g., edibles, pennies).
- Sessions approximately 10 trials; multiple sessions could be given at a sitting.
- Items trained to a criterion of 80% correct over three consecutive days or 100% over one session.
  - If one target was being trained, then there were 10 training trials per session.
  - If two to three targets were being trained, then there were 5 training trials per target, per session.
  - If more than three targets were being trained, then there were 3 training trials per target, per session.

Specific Tasks

1. Familiar Places: digital photographs of places AI visits 1-3 times per week.
2. Familiar People-School: digital photographs of teachers.
3. Familiar People-Family: digital photographs of family members.
4. Familiar People-Family and School combined: digital photographs of family members and teachers.
5. Coins: digital photographs of penny, nickel, dime and quarter.
6. Letters: Mayer-Johnson graphics (Boardmaker; Mayer-Johnson, Inc., Solana, CA)
7. Numbers: Mayer-Johnson graphics, as above.
8. Vehicles: Photographs (Picture This collection, Silver Lining Multi Media Inc, Poughkeepsie, NY).

Figure 1: Receptive identification of Vehicles - examples of response items

Data Collection and Analysis

- Number of trials and sessions, target and distracter placement, identification of targets and distracters, correct, incorrect or prompted response, the level of prompting, and item selected by the subject were recorded.

Item Attrition

- "Item attrition" defined by the following criteria:
  1) A session was defined as the first time of the day the task was run or if the previous trial was >=10 minutes previously.
  2) A session had to have more than 2 trials of a target or the session has two trials of a target with the score of "correct + correct" or "incorrect + incorrect."
  3) The accuracy on the item in the initial session had to be >=80% .
  4) The accuracy on the item in the immediately subsequent session had to be <=66.66%.
  5) There could be no more than a 1.3-day (32 hours) interval between the defining sessions.

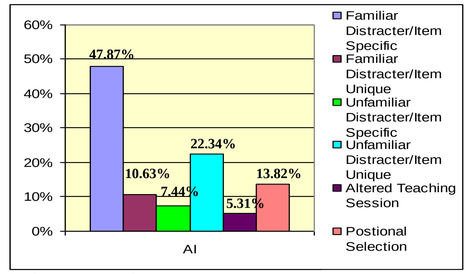
Results

- Approximately 1,954 sessions were recorded, representing a total of 25,500 trials.
  - Error correction trials (i.e., trials that were prompted) are not included in data analysis.
  - Invalid trials were not included in data analysis. Trials recorded as invalid were defined as trials in which a computer error occurred (e.g., two of the same stimuli came up on the screen) or AI engaged in behavior that interfered with the selection of stimuli (e.g., looked away from screen when stimuli was selected).
- 1,243 analyzable sessions were recorded, representing a total of 16,250 valid trials across the 8 tasks in a 21- month time period.
- 621.5 possible instances for revealing "item attrition" (each instance of attrition requires at performance over at least two sessions).
- 94 instances of "item attrition" (15.12 %).
  - 45 instances of "item attrition" (17.37 %) for response items that were line drawings (Number and Letter Identification).
  - 49 instances of "item attrition" (13.52 %) for response items that were photographs (Familiar Places, People, Coins and Vehicles).
- The "familiar" distracters were those trained to criteria or that met criteria for accurate responding during baseline testing.
- The "unfamiliar" distracters were ones never trained, or that never met criteria for accurate responding during baseline testing.
- Familiar distracters were associated with appreciably more instances of "item attrition" than other factors.

*Categories may overlap

Results (continued)

- On examination of each of these instances, the following factors seemed to account for most instances of "item attrition":
  1. Distracter chosen in error was familiar:
     a) Item Specific: The same familiar distracter was chosen each time for the stimulus (see Figure 2).
     b) Item Unique: Different familiar distracters were chosen for each presentation of the stimulus.
  2. Distracter chosen in error was unfamiliar:
     a) Item Specific: The same unfamiliar distracter was chosen for each presentation of the stimulus.
     b) Item Unique: Different unfamiliar distracters were chosen
  3. Altered Teaching Session: A change in the presentation of stimuli (e.g., known distracter put into field) from the previous session.
  4. Positional Responses: Two or more consecutive errors show a positional trend (e.g., AI selected the stimuli presented on the left 3 times in a row).



Graph 1: Percentage of Attrition across 6 categories

Prev Session	Teaching Step	Target	Pct Correct	Incorrect
2-Jun-01	Teach "mom" and "dad" in the same field with "Brother," "sister" and "mom" or "dad" as distracters.	"dad"	100% (5 trials)	No errors. "Mom" came up in two of the trials as a distracter.
3-Jun-01	Same as above	"dad"	0% (3 trials)	3 errors. Selected "mom" all 3 times.

Figure 2: Example of Familiar Distracter/Item Specific for Familiar People Family

Conclusions

- At least for this individual, with these tasks, we were able to define a consistent and reliable set of criteria for "item attrition". With these criteria, we demonstrated that "item attrition" was indeed as frequent as informal observation suggested it might be.
- For our subject, with these tasks and materials, item attrition seemed to be due to his adopting a familiarity-based response criterion. That is, he seemed to be responding on the basis of choice item familiarity, not the strength of the stimulus-response item association that was being taught.
- These results and this interpretation are clearly tentative, for many reasons including the descriptive and non experimental nature of the study, the single case, and the limited range of tasks and materials. Moreover, to clearly distinguish among all the various theoretical possibilities, such as weak stimulus-response associations or rapid forgetting, may require quantitative modeling of the data.
- Nevertheless, these results do suggest one possible cause of "item attrition" and the barriers it presents to teaching such individuals. They also suggest that the problem can be obviated by either presenting only unfamiliar items as distracters, or by specific training to emphasize that the critical distinction is the strength of the stimulus-response association, not the familiarity of the possible response items. We have adopted the former strategy in this individual's education program, with more rapid learning of materials as a result.

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