

The Complexity Account of Treatment Efficacy (CATE) predicts that selective training of complex targets will produce generalization to less complex targets that are operationally defined as possessing a subset relation (Thompson, Shapiro, Kiran & Sobecks, 2003). Category verification tasks find that atypical words have longer RTs than typical words within the same category (e.g., Smith, Shoben, Rips, 1974) suggesting atypical words are more complex. Kiran and Thompson (2003) used family resemblance models to hypothesize that atypical words contain subset information of typical words. Training atypical words was predicted to promote learning about the variation of semantic attributes within a category, including subset information about typical words. Training typical words was hypothesized to produce learning of fewer semantic attributes. Patients were trained to produce atypical words and generalization to the production of untrained typical words within the same category was observed. No generalization occurred to untrained atypical words when the production of typical words was trained.

However, family resemblance models predict the opposite subset relation between typical and atypical words. Typical items have greater family resemblance, where family resemblance is the total sum of weighted semantic attributes for a given item. Semantic attributes shared by many members of the category are more heavily weighted. Semantic attributes of typical items are frequent amongst both typical and atypical items within the category and by definition contain better subset information of atypical items. Semantic attributes of atypical items are infrequent within the category and are more frequent in *other* categories (Rosch & Mervis, 1975). Therefore, the opposite argument of Kiran and Thompson (2003) can be made where typical items contain better subset information than atypical items, suggesting that complexity and subset relations can be dissociated. The results from Kiran and Thompson motivate a deeper understanding of semantic complexity, typicality, and treatment generalization. This study is designed to investigate the relationship between online typicality effects, production training of typical and atypical words, and generalization.

Methods

Subjects: Two aphasic patients with pervasive naming deficits were chosen. Patient HS is a fluent aphasic while patient BM is a non-fluent aphasic. Both patients demonstrated normal online typicality effects using a category verification task such that typical items were verified significantly faster than atypical items.

Design: A single subject multiple baseline experimental design was used to examine learning of typical and atypical words in addition to generalization of untrained words. Eight typical and eight atypical birds and vegetables were selected for a total of thirty-two probes. Each patient received baseline probes on all thirty-two items preceding treatment. For each probe, the patient was asked to name the picture and correct responses were those named accurately within twenty seconds of presentation. After baseline probes were collected, patient HS was trained simultaneously on eight atypical vegetables and eight typical birds while patient BM was trained simultaneously on eight atypical birds and eight typical vegetables. Training consisted of a first naming attempt, semantic attribute verification, and a second naming attempt for the 16 items trained. Thirty-one semantic attributes for vegetables and twenty-nine semantic attributes for

birds were used. Every two weeks during treatment, all thirty-two items were probed. A final probe was collected six to seven weeks post-treatment.

Results

Probes accuracies for patient HS and patient BM were calculated in multiple baseline format by typicality and semantic category for baseline, treatment, and the post-treatment probes (see Figure 1). For patient HS, typical birds were named but no learning of the atypical vegetables occurred. No generalization to untrained items occurred for either category. The follow-up probe found that patient HS was able to name typical birds after six weeks without training and continued to name other items poorly. Patient BM learned to produce atypical birds but not typical vegetables. No generalization to untrained items occurred. The follow-up probe after seven weeks found the lowest performance on trained typical vegetables and untrained typical birds and the best performance on trained atypical birds.

Discussion

Patient HS was able to produce the trained typical birds but after twenty treatment sessions showed no learning in the production of the trained atypical vegetables. In fact, naming performance on the trained atypical vegetables was approximately the same as the untrained atypical birds and typical vegetables. This finding suggests that all patients may not benefit from training on atypical words as these items may not be learned. Patient BM was able to produce the trained atypical birds, but after more than twenty treatment sessions did not learn to produce the trained typical vegetables. No generalization to untrained typical birds occurred even after several weeks of producing atypical birds with an accuracy of 7/8 items. This provides evidence against the hypothesis that learning atypical words will generalize to typical words within a category. These results show a typicality-based difference in treatment outcome that is not mediated by an underlying difference in typicality effects, as both patients demonstrated normal online typicality effects in a category verification task.

The critical question is why one patient was able to learn typical items while the other learned atypical items, despite both patients showing the same typicality effect in online processing. Online typicality effects may be mediated by *automatic* semantic retrieval where the association between the target and semantic knowledge is sufficient using bottom-up activation. In contrast, learning to name new items may be mediated by *controlled* semantic retrieval that is engaged when automatic retrieval is insufficient to meet task demands, particularly when there is weak activation, response competition, or response selection (see Badre and Wagner, 2002). The left inferior prefrontal cortex has been shown to subserve controlled semantic processing in many functional neuroimaging studies (e.g., Petersen et al. 1988). Additionally, there is evidence that patients with left prefrontal lesions are impaired on semantic tasks that require cognitive control (Metzler, 2001; Thompson-Schill et al. 1998). Differences in typicality-based learning are interpreted in the framework that controlled semantic processing may be impaired in the non-fluent patient while it is spared in the fluent patient. The demands of controlled semantic retrieval are hypothesized to be greater when processing typical items as the similarity between typical items may activate multiple representations through semantic interference. Controlled semantic processing would be necessary to correctly select the

appropriate target. Patient BM may experience difficulty learning typical item that contain greater semantic interference due to impairments in controlled semantic processing. A preserved ability to learn atypical items is argued as semantic interference is less for these items and the demands on controlled processing are less. Meanwhile, patient HS was able to learn typical items despite semantic interference due to adequate resources for controlled processing, but experienced difficulty learning atypical items as they are more difficult to learn.

References

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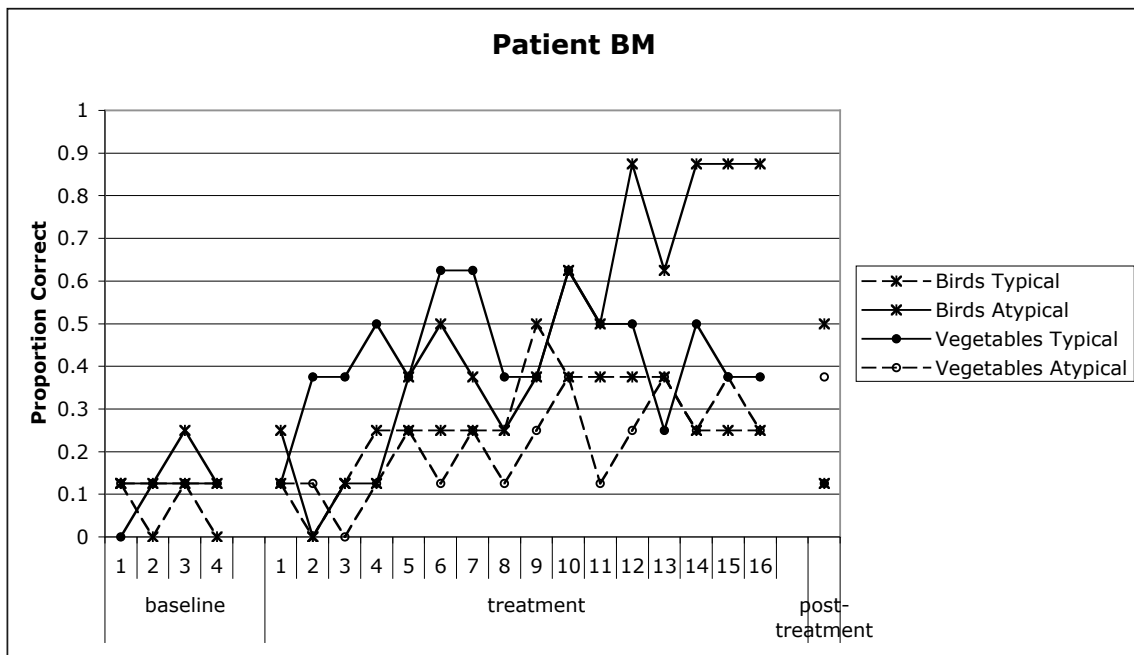
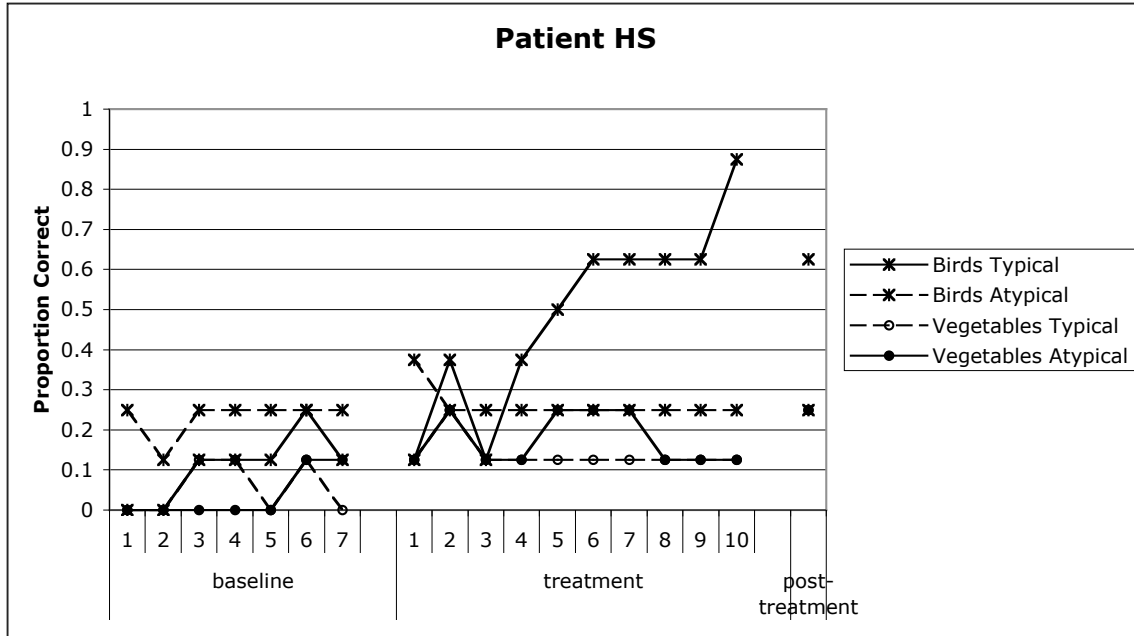


Figure 1. Patient HS (top) and patient BM (bottom) probe scores are shown for baseline, treatment, and post-treatment. Solid lines represent trained categories while dotted lines represent untrained categories.