We have previously proposed that for patients with naming deficits, training atypical examples within a semantic category is a more efficient treatment approach to facilitating generalization within the category than training typical examples of the category. Evidence for this claim comes from two related studies. In one study with four patients with fluent aphasia (Kiran & Thompson, 2003) training atypical examples (e.g., *ostrich, pumpkin*) belonging to two animate categories (e.g., *birds, vegetables*) resulted in generalization to untrained typical examples (e.g., *robin, cucumber*). In contrast, training typical examples improved naming of those items whereas naming of untrained atypical examples remained unchanged. Similar findings were observed in a follow up study (Kiran, Ntourou, Eubanks, & Shamapant, 2005), where five patients with fluent and nonfluent aphasia were trained on either typical (e.g. *recliner, suit*) or atypical (e.g., *hammock, apron*) from two inanimate categories (e.g., *clothing, furniture*). A theoretical framework for this selective generalization (Kiran, in press) suggests that atypical examples (e.g., *ostrich*) are more complex than typical examples because within a category (e.g., *birds*) atypical examples consist of core (e.g., *lays eggs*) and more distinctive features (*runs, long legs*) compared to typical examples (e.g., *robin*), which consist of core features and shared prototypical features (*e.g., small size*) but fewer distinctive features. Also, extensive evidence from online reaction time studies suggest that atypical examples are represented further away (in time and space) from the category prototype and typical examples.

The present study extends the examination of the typicality effect to well defined categories such as *female* and *shapes* that have a clear definition and category boundaries and that have items that meet membership requirements to the same degree. There is some degree of debate regarding the representation of typicality in these categories. For instance, Armstrong et al., have demonstrated typicality effects within these categories (e.g., *mother* is considered more typical of the category *female* than *cowgirl*) (Armstrong, Gleitman, & Gleitman, 1983). In contrast, Larochelle et al. (Larochelle, Richard, & Soulierres, 2000) have argued that category dominance and familiarity are better representatives of well defined categories than typicality.

Two experiments were conducted to investigate the nature of category typicality in well defined categories in patients with aphasia: (a) an online category verification experiment, and (b) a naming treatment experiment.

Experiment 1: Online Category Verification

Methods. Normal young (N= 10), elderly (N= 10), and aphasic patients (N = 18) participated in an online category verification task. The aphasic patients were divided into two groups based on their severity determined from the Western Aphasia Battery. Twelve participants were assigned to the low performance (LP) group (AQ range = 35-84) and 6 participants were assigned to the high performance (HP) group (AQ range = 85-98). Primes were superordinate labels of three categories (*shapes, body parts* and *females*) while targets were typical and atypical examples of the categories, nonmembers and nonwords. Norms for typicality of category exemplars were developed prior to initiation of the experiment. Participants viewed written words presented on a computer screen and judged whether each example belonged to the preceding superordinate category.

Results. Accuracy on the task was relatively high for all groups except the LP aphasic group (F (3, 677) = 80.47, $p < .0001$). In the accuracy analysis, significant interaction effects between category and typicality were noted for all four groups: young (F (6, 168) = 4.8, $p < .0001$), elderly (F (6, 168) = 2.18, $p < .05$), HP (F (6, 168) = 14.2, $p < .0001$) and LP (F (6, 168) = 10.5, $p < .0001$). Analysis of accurate reaction times revealed significant interaction effects for young (F (6,168) = 2.5, $p < .05$), elderly (F (6,168) = 2.3, $p < .05$), and HP (F (6,168) = 4.05, $p < .001$)

but not the LP aphasic group. For all four groups, accuracy and latency of *atypical shapes* was significantly worse than all other response types. Additionally, for the HP and LP group, accuracy and latency was also significantly worse on *typical shapes* compared to other responses.

Discussion. Results of the present experiment illustrate typicality effects in well defined categories. An interesting category and typicality interaction emerged with *atypical shapes* being consistently more difficult to judge than typical examples and other atypical examples (*females, body parts*) suggesting that the latter two categories may represent more stringent category boundaries. Unlike their high performing aphasic counterparts, the low performance aphasic group did not demonstrate the expected effects of typicality

Experiment 2: Treatment of well defined categories

In the second experiment, three aphasic individuals received a semantic feature treatment to improve naming of either typical or atypical examples of the category *shapes*, while generalization was tested to the untrained examples of the category. We hypothesized that training aphasic individuals to produce atypical examples from a category would result in generalization to typical examples of the category. Training typical examples was predicted to result in no improvements in atypical examples.

Methods. Three participants ranging in age between 54-75 years were involved. All three patients presented with severe naming deficits and concurrent semantic impairments. Stimuli in treatment consisted of 10 typical shapes (e.g., *cube*) and 10 atypical shapes (e.g., *spade*) that were matched for frequency, familiarity, number of syllables and distinctiveness.

Design and Treatment. A single subject experimental design with multiple baselines across behaviors and participants was employed. Prior to application of treatment, naming of all 20 examples was tested during baseline. Confrontation naming was then trained using either typical or atypical examples with the order of exemplar typicality counterbalanced across participants. For each participant, all 10 examples in the subset (e.g., atypical) of the category were trained simultaneously. Treatment steps for each item included: 1) naming the picture, 2) sorting pictures of the target category with distracters, 3) identifying semantic attributes for the target example and, 4) answering yes/no questions regarding semantic features of the target example.

Results. Participant 1 received treatment for atypical examples of *shapes*, which improved moderately from 40% to 70% accuracy although generalization to the untrained typical examples was observed from 10% to 60% accuracy (see Figure 1). Participant 2 received treatment for typical examples of *shapes* which improved only from 30% to 60% accuracy whereas generalization to untrained atypical examples did not occur (20% accuracy). After 10 sessions, treatment was shifted to the atypical examples of the category which improved to criterion (90% accuracy) although performance on the previously trained typical examples remained unchanged (see Figure 2). Finally, participant 3 was trained on atypical examples of *shapes* which improved from 50% to 100% accuracy, as generalization to untrained typical examples was observed (see Figure 3).

Discussion. Results of this experiment showed that training atypical examples of shapes and their semantic features resulted in generalization to naming of typical examples of the category. Training typical examples and their semantic features, however, did not result in generalization to atypical examples. The acquisition and generalization patterns for shapes, however, do not appear to be as robust as the effects observed in our previous studies (Kiran & Thompson, 2003; Kiran et al., 2005) indicating that well defined categories such as *shapes* may be represented differently than natural language categories such as *birds* or *clothing*. The results of the online verification task support the findings of the treatment study. Possible explanations for our results may include the relative abstractness of the category (*shapes*) and the perceived familiarity of individual items.

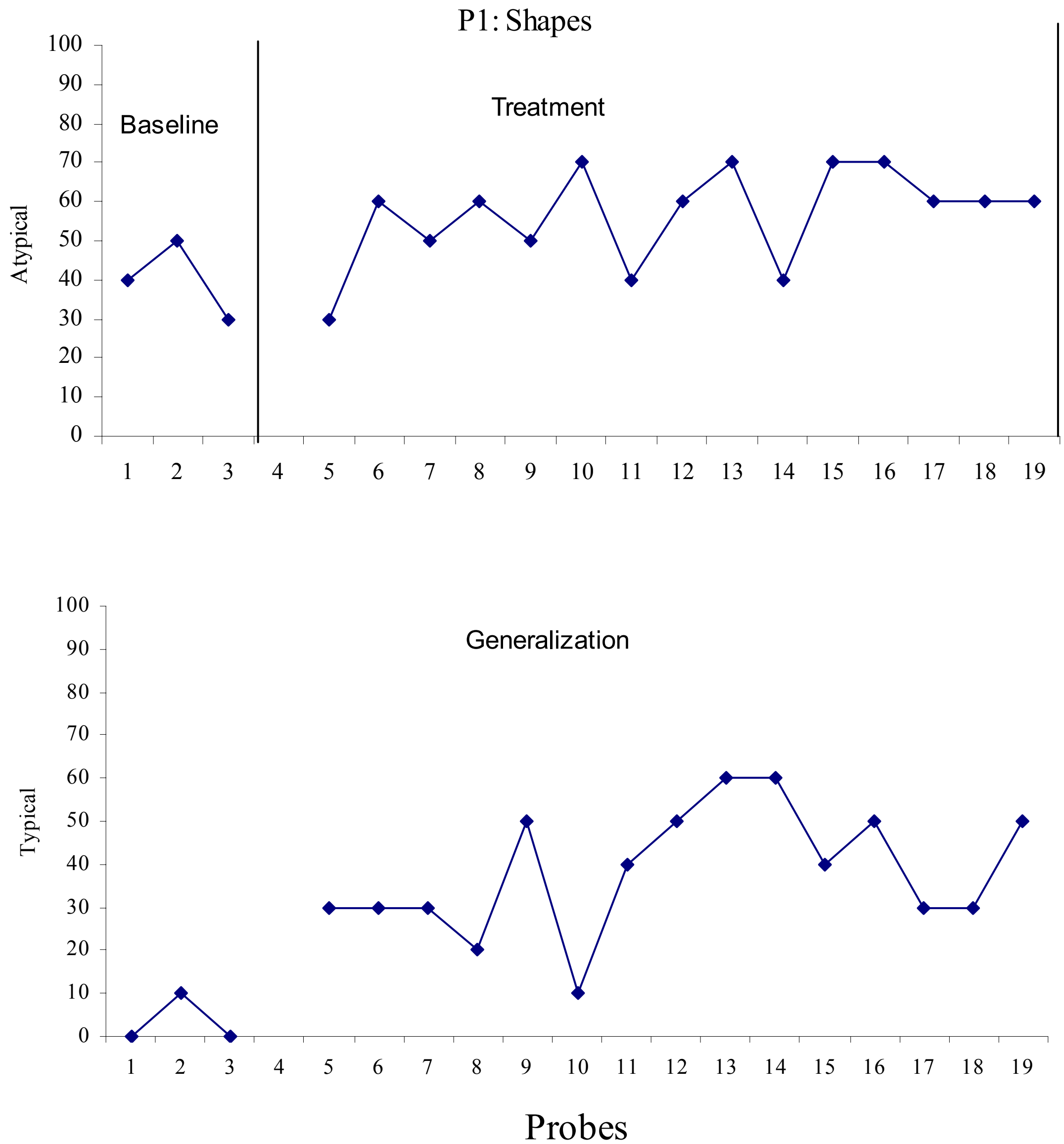
Selected References

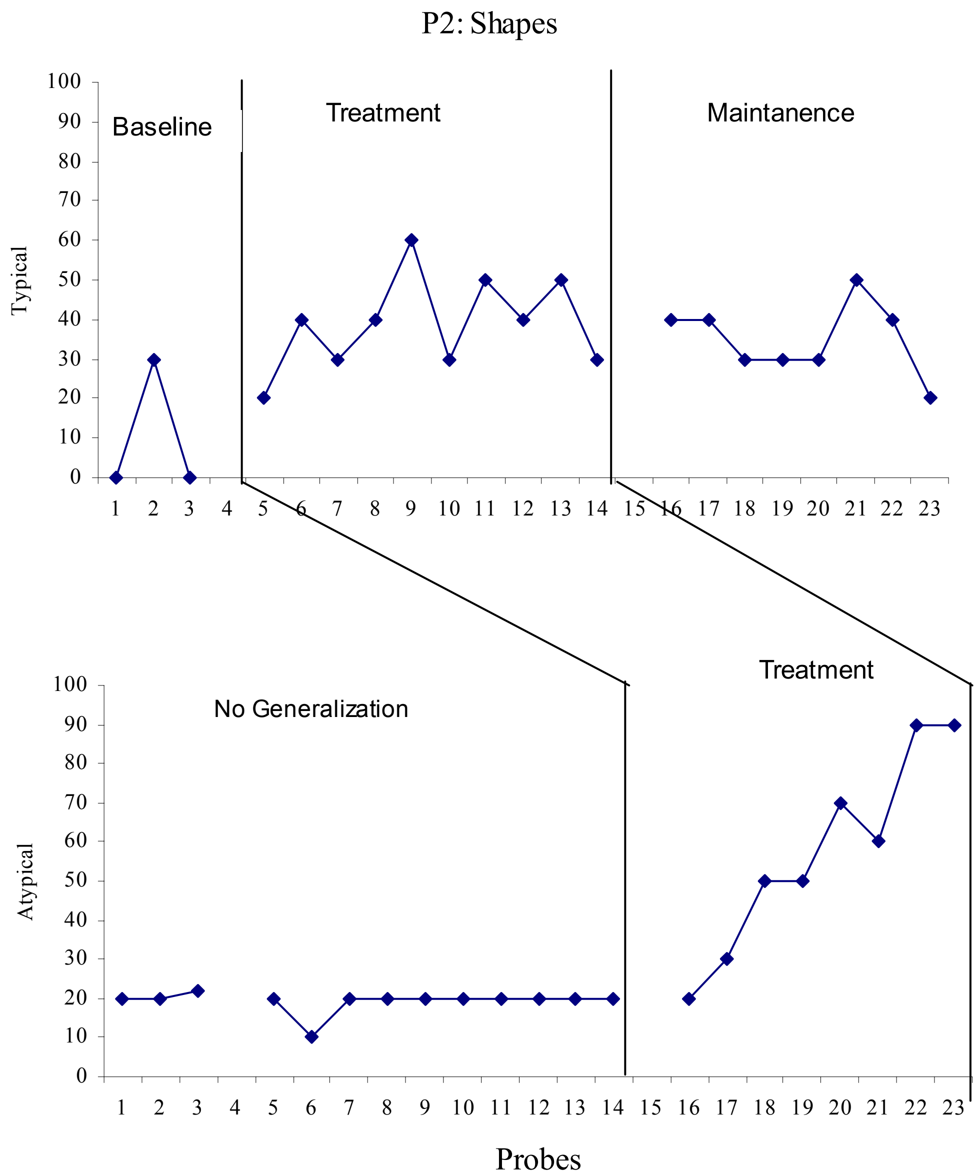
Kiran, S. (in press). Semantic complexity in the treatment of naming deficits. *American Journal of Speech Language Pathology*.

Kiran, S., Ntourou, K., Eubanks, M., & Shamapant, S. (2005). Typicality of inanimate category exemplars in aphasia: Further evidence for the semantic complexity effect. *Brain and Language, 95*(1), 178-180.

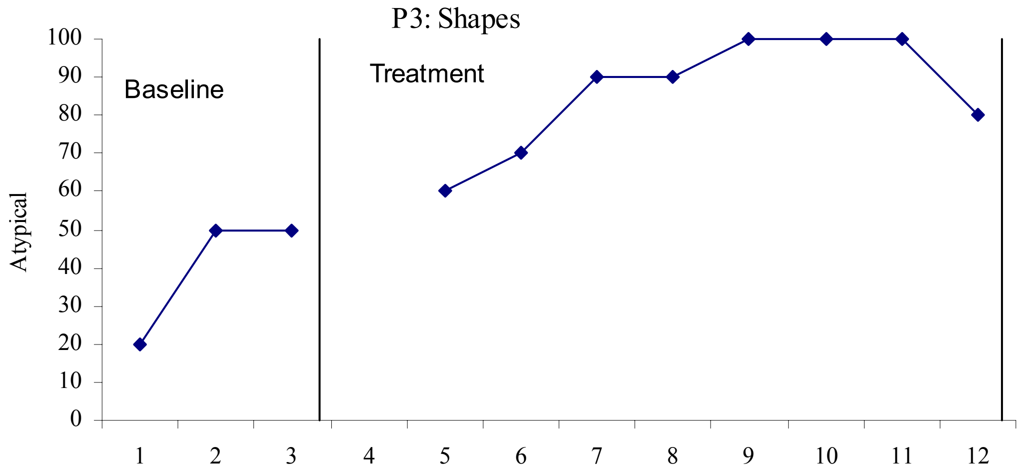
Kiran, S., & Thompson, C. K. (2003). The role of semantic complexity in treatment of naming deficits: training semantic categories in fluent aphasia by controlling exemplar typicality. *J Speech Lang Hear Res, 46*(4), 773-787.

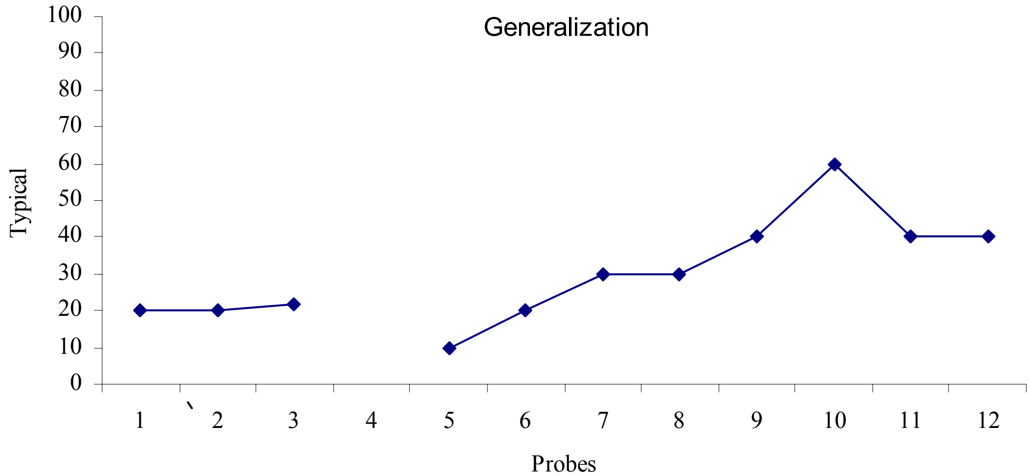
Larochelle, S., Richard, S., & Soulierres, I. (2000). What some effects might not be: The time to verify membership in "well defined" categories. *The Quarterly Journal of Experimental Psychology, 53A*(4), 929-961.


P1: Shapes
Baseline
Treatment
Atypical
Generalization
Typical
Probes



P2: Shapes
Baseline
Treatment
Maintanence
Typical
No Generalization
Treatment
Atypical
Probes


P3: Shapes
Baseline
Treatment
Atypical
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12


Generalization
Typical
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
12
Probes