

Maximizing Generalization Effects of Semantic Feature Analysis

Numerous treatments have been developed that have successfully facilitated naming in aphasia (see Laine & Martin, 2006 for a review). However, in most cases, positive treatment effects have been observed primarily with trained items, with limited improvements in untrained items. That is, response generalization remains a challenge in the treatment of anomia.

Semantic Feature Analysis (SFA; Boyle, 2004; Boyle & Coelho, 1995; Coelho, McHugh, & Boyle, 2000; Conley & Coelho, 2003) is one treatment approach that has shown promise with respect to response generalization. SFA has been associated with improvements in naming of untrained items within the same semantic category as trained items, as well as items in untrained categories (Boyle, 2004). However, generalization has not been complete (i.e., has not occurred to all untrained items) and has not occurred with all participants. Boyle has suggested that generalization within categories likely occurs because of stimulation or strengthening of semantic networks. She has also speculated that generalization across semantic categories may be the result of the repeated use of the structured, methodical feature descriptions of SFA.

Training atypical category exemplars has also been shown to have potential for promoting within category generalization (Kiran & Thompson, 2003; Kiran & Johnson, 2008). Kiran and colleagues have employed a semantic treatment while controlling typicality of trained and untrained items within animate and inanimate categories (Kiran, 2008; Kiran & Johnson; Kiran & Thompson, 2003). In general, training of atypical exemplars has resulted in generalization to untrained typical exemplars, but training of typical exemplars has not resulted in changes in naming of atypical exemplars. However, these effects have not been demonstrated with all participants (Kiran, 2008) and have not been clearly replicated across laboratories (Stanszak, Waters, & Caplan, 2006) or different treatments.

The purpose of this investigation was to facilitate the mechanisms of generalization in the treatment of word-retrieval. SFA was utilized in combination with Kiran et al.'s semantic feature judgment task with items controlled for typicality. Because the typicality effect in treatment has not been clearly demonstrated with persons with non fluent aphasia, the majority of participants in this investigation presented with Broca's aphasia.

In order to maximize the potential benefits of the SFA as a compensatory strategy, a phase of treatment was included in which *overt* use of the feature analysis strategy was trained. That is, the traditional SFA approach has relied on the therapist (and treatment chart) to guide the participant through feature analysis. In order to promote use of the feature descriptions as a compensatory strategy (and stimulate generalization across and within categories), participants were required to practice generating the semantic feature categories on their own.

Method

Participants

Nine individuals with chronic aphasia and significant word finding difficulties served as participants. Descriptive data and pre treatment assessment results are shown in Tables 1 – 3.

Experimental Stimuli

Twenty-six items (13 typical and 13 atypical) for each of four semantic categories (2 animate and 2 inanimate) were selected for each participant. Eight items were designated as treatment items and five were designated as generalization items for both typical and atypical category exemplars. Items were matched as closely as possible for factors that could influence retrieval or production. (Note: three participants received training for only 2 categories in the initial phase of treatment due to difficulty in finding appropriate categories or time constraints)

Categories included animals, vegetables, fruits, birds, furniture, clothing, tools, kitchen utensils, and musical instruments. Determination of typicality of items within categories was based upon normative data from 60 non-brain-damaged individuals.

Experimental Design

Multiple baseline designs across behaviors and subjects were used to examine the effects of treatment on the retrieval of object names. Naming of the experimental items was measured repeatedly in a baseline phase, with number of probes extended across participants.

Treatment was applied sequentially to categories, with order of training of typical or atypical exemplars counterbalanced within participants. For example, if typical items were trained prior to atypical for the first category, then atypical items were trained prior to typical for the second category.

During the treatment phases, probes were continued to measure performance with trained and untrained behaviors. Probes were conducted following every two treatment sessions (at the start of the next session) for items designated for treatment in the category receiving treatment. A reduced probing schedule was used for all other items not under treatment to reduce the number of naming attempts which could impact responding (Nickels, 2002).

Following application of treatment to the initial categories, two additional categories were selected for use in the compensatory strategy training phase. Baseline probes were conducted for those categories. Then, treatment was applied to one category. The purpose of this treatment phase was to determine if the modified treatment would result in increased generalization within and across categories.

Follow-up probes were conducted at two and six weeks post-treatment.

Dependent Variable

Correct verbal naming of the experimental items in probes served as the dependent variable. Colored pictures of the experimental stimuli were presented one at a time in random order and participants were asked to name the items.

Treatment

A modified version of SFA was used to accommodate pictured stimuli from animate and inanimate categories. In addition, fifteen yes/no questions were presented regarding the semantic features of a target item (after Kiran & Thompson, 2003).

One presentation of the eight treatment items constituted one trial (SFA paradigm + questions). Participants completed one trial during a treatment session. Treatment was conducted two to three times per week with sessions being 45-60 minutes.

Treatment was applied to one set of pictures until the participant reached at least 88% accuracy (7 of 8 items) in naming the trained objects in two consecutive probe sessions or until 20 treatment sessions were completed.

The compensatory strategy training entailed provision of explicit instructions to utilize the feature description in word retrieval attempts. Participants were trained to recall the feature categories depicted on the SFA chart and practiced providing the categories and specific features with minimal therapist assistance. More detail regarding this training will be provided.

Results

Accuracy of naming of the experimental words in probes for the initial phase of training is depicted in figures according to single-subject design conventions (see graphs from Participants 1 & 2 in Figures 1 & 2; all graphs are not included due to large number of graphs). Application of treatment was associated with improvements in naming for trained atypical and trained typical items across all categories for all participants except Participant 5. Effect sizes (d-index) are shown in Table 4.

Positive generalization effects were limited. Training of atypical items was associated with improvements in naming of typical items for Participants 4, 6, and 9. Training of typical items was associated with slight gains in naming of atypical items for Participant 4.

Results from the compensatory strategy training phase will also be shown graphically. All participants showed improved responding to trained items with the application of SFA-overt treatment (including Participant 5, who had not shown improvements previously). However, no changes were evident with respect to naming of untrained items.

Discussion

Discussion will include possible explanations for differential responding for individuals, differences in our results in comparison to previous findings, implications for clinical application, and directions for future study.

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Table 1

Participant Characteristics

| Characteristic | Participant 1 | Participant 2 | Participant 3 | Participant 4 | Participant 5 | Participant 6 | Participant 7 | Participant 8 | Participant 9 |
|--------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|---------------|
| Age | 58 | 59 | 61 | 47 | 59 | 52 | 66 | 64 | 54 |
| Gender | Male | Female | Male | Male | Male | Male | Male | Female | Male |
| Etiology | Stroke | Stroke | Stroke | Stroke | Stroke | Stroke | Stroke | Stroke | Stroke |
| Marital Status | Single | Married | Widowed | Married | Married | Married | Married | Widowed | Single |
| Handedness | Left | Right | Right | Right | Right | Right | Right | Right | Right |
| MPO | 126 | 42 | 31 | 187 | 65 | 13 | 65 | 18 | 9 |
| Years of Education | 14 | 12 | 11 | 13 | 22 | 11 | 16 | 12 | 12 |
| Former Occupation | Bookkeeper | Bookkeeper | Maintenance | Mechanic | Physicist | Carpenter | Military | Bill Collector | Woodworker |

Table 2

Pretreatment Assessment Results

| <i>Measure</i> | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|------------------|
| <i>PICA</i> (Porch, 2001) | | | | | | | | | |
| Overall Percentile | 53/54 th | 73/74 th | 63/64 th | 59 th | 35/36 th | 49 th | 63 rd | 75 th | 38 th |
| Verbal %ile | 51/52 th | 68/69 th | 58/59 th | 56/57 th | 38/39 th | 39/40 th | 63 rd | 80 th | 35 th |
| Auditory %ile | 54/56 th | 65/72 nd | 64/73 rd | 46/47 th | 28 th | 54/56 th | 75/99 th | 74/99 th | 42 nd |
| <i>TAWF</i> (German, 1990) | | | | | | | | | |
| Total Raw Score | 17/107 | 48/107 | 36/107 | 67/107 | 8/107 | 27/107 | 39/107 | 101/107 | 0/107 |
| Comprehension | 94% | 97% | 100% | 97% | 72% | 99% | 100% | 99% | 78% |
| <i>WAB</i> (Kertesz, 1982) | | | | | | | | | |
| Aphasia Quotient | 53.4 | 82.0 | 63.0 | 66.0 | 50.8 | 66.0 | 70.7 | 90.6 | 33.2 |
| Classification | Broca's | Anomic | Broca's | Broca's | Broca's | Broca's | Broca's | Anomic | Wernicke's |
| <i>Object & Action Naming Battery</i> (Druks & Masterson, 2000) | | | | | | | | | |
| Objects | 38/81 | 72/81 | 63/81 | 71/81 | 18/81 | 47/81 | 50/81 | 79/81 | 17/81 |
| Actions | 26/50 | 32/50 | 26/50 | 36/50 | 7/50 | 15/50 | 23/50 | 46/50 | 4/50 |
| <i>The Pyramids and Palm Trees Test</i> (Howard & Patterson, 1992) | | | | | | | | | |
| Total | 41/52 | 51/52 | 51/52 | 46/52 | 41/52 | 50/52 | 51/52 | 50/52 | 28/5 |
| <i>AIDS</i> (Yorkston & Beukelman, 1984) | | | | | | | | | |
| | 82 | 88 | 94 | 84 | 80 | 90 | * | 86 | 54 |
| <i>TONI</i> (Brown, Sherbenou, & Johnsen, 1997). | | | | | | | | | |
| Percentile Ranking | 7 | 17 | 21 | 26 | 9 | 5 | 24 | 23 | 21 |

Table 3

Additional lexical pretreatment assessment results: Psycholinguistic Assessments of Language Processing in Aphasia (PALPA) (Kay, Lesser, & Coltheart, 1992)

| Measure | P 1 | P 2 | P 3 | P 4 | P 5 | P 6 | P 7 | P 8 | P 9 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <i>Spoken Word-Picture Matching</i> | 37/40 | 40/40 | 40/40 | 39/40 | 35/40 | 40/40 | 39/40 | 40/40 | 38/40 |
| <i>Written Word to Picture Matching</i> | 39/40 | 39/40 | 40/40 | 40/40 | 32/40 | 40/40 | 40/40 | 39/40 | 27/40 |
| <i>Auditory Synonym Judgments</i> | 51/60 | 45/60 | 51/60 | 46/60 | 38/60 | 49/60 | 51/60 | 58/60 | 39/60 |
| <i>Word Association</i> | 18/30 | 15/30 | 21/30 | 18/30 | 14/30 | 10/30 | 19/30 | 22/30 | 7/30 |

Table 4
Effect Sizes (d-Index) for End of Treatment and (Follow-up) Phases

| | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 |
|--------|---|--|---|---|--|---|---|---|--|
| List 1 | 4.62 (5.31) <i>Furniture</i> <i>Atypical</i> | 8.10 (7.01) <i>Animals</i> <i>Typical</i> | 3.4 (9.72) <i>Animals</i> <i>Typical</i> | 4.99 (>10.0) <i>Birds</i> <i>Atypical</i> | 1.0 (0) <i>Veg.</i> <i>Typical</i> | 2.95 (5.22) <i>Clothing</i> <i>Typical</i> | 6.35 (6.81) <i>Kitchen</i> <i>Atypical</i> | 3.70 (0.70) <i>Animals</i> <i>Typical</i> | 6.77 (13.74) <i>Animals</i> <i>Typical</i> |
| List 2 | 3.79 (>10.0) <i>Furniture</i> <i>Typical</i> | 4.3 (8.17) <i>Animals</i> <i>Atypical</i> | 18.31 (18.18) <i>Animals</i> <i>Atypical</i> | 9.12 (1.65) <i>Birds</i> <i>Typical</i> | 1.0 (0) <i>Veg.</i> <i>Atypical</i> | 5.09 (5.22) <i>Clothing</i> <i>Atypical</i> | 3.28 (0.31) <i>Kitchen</i> <i>Typical</i> | 3.09 (2.27) <i>Animals</i> <i>Atypical</i> | 1.17 (6.43) <i>Animals</i> <i>Atypical</i> |
| List 3 | 4.33 (2.70) <i>Animals</i> <i>Typical</i> | 6.24 (3.44) <i>Tools</i> <i>Atypical</i> | 6.22 (3.65) <i>Tools</i> <i>Atypical</i> | 4.56 (2.87) <i>Clothing</i> <i>Typical</i> | 1.14 (0.5) <i>Tools</i> <i>Typical</i> | 5.22 (>10.0) <i>Fruits</i> <i>Atypical</i> | 5.25 (>10.0) <i>Birds</i> <i>Atypical</i> | 10.22 (3.11) <i>Tools</i> <i>Atypical</i> | 11.50 (7.66) <i>Furniture</i> <i>Atypical</i> |
| List4 | 4.59 (0) <i>Animals</i> <i>Atypical</i> | 4.72 (2.55) <i>Tools</i> <i>Typical</i> | 4.47 (3.98) <i>Tools</i> <i>Typical</i> | 3,37 (0.7) <i>Clothing</i> <i>Atypical</i> | 1.95 (.59) <i>Tools</i> <i>Atypical</i> | 0.54 (1.86) <i>Fruits</i> <i>Typical</i> | 5.22 (>10.0) <i>Birds</i> <i>Typical</i> | 10.54 (>10.0) <i>Tools</i> <i>Typical</i> | 7.52 (10.73) <i>Furniture</i> <i>Typical</i> |
| List 5 | 9.56 (7.66) <i>Clothing</i> <i>Atypical</i> | 8.96 (4.88) <i>Vegetables</i> <i>Typical</i> | 5.06 (4.25) <i>Birds</i> <i>Typical</i> | 11.5 (5.01) <i>Music</i> <i>Atypical</i> | | 5.58 (3.03) <i>Furniture</i> <i>Typical</i> | | | 2.03 (8.42) <i>Veg.</i> <i>Typical</i> |
| List 6 | 4.74 (0.50) <i>Clothing</i> <i>Typical</i> | 3.13 (3.13) <i>Vegetables</i> <i>Atypical</i> | 6.01 (6.39) <i>Birds</i> <i>Atypical</i> | 2.56 (>10.0) <i>Music</i> <i>Typical</i> | | 3.15 (3.34) <i>Furniture</i> <i>Atypical</i> | | | 18.31 (>10.0) <i>Veg.</i> <i>Atypical</i> |
| List 7 | 5.25 (0) <i>Vegetables</i> <i>Typical</i> | 5.92 (3.74) <i>Kitchen</i> <i>Atypical</i> | 8.76 (12.42) <i>Clothing</i> <i>Atypical</i> | 5.41 (4.74) <i>Tools</i> <i>Typical</i> | | 4.83 (4.63) <i>Animals</i> <i>Atypical</i> | | | 8.90 (10.96) <i>Clothing</i> <i>Atypical</i> |
| List 8 | >10.0 (7.66) <i>Vegetables</i> <i>Atypical</i> | 5.48 (2.01) <i>Kitchen</i> <i>Typical</i> | 11.5 (3.23) <i>Clothing</i> <i>Typical</i> | 3.93 (1.86) <i>Tools</i> <i>Atypical</i> | | 1.12 (1.41) <i>Animals</i> <i>Typical</i> | | | 4.01 (2.77) <i>Clothing</i> <i>Typical</i> |

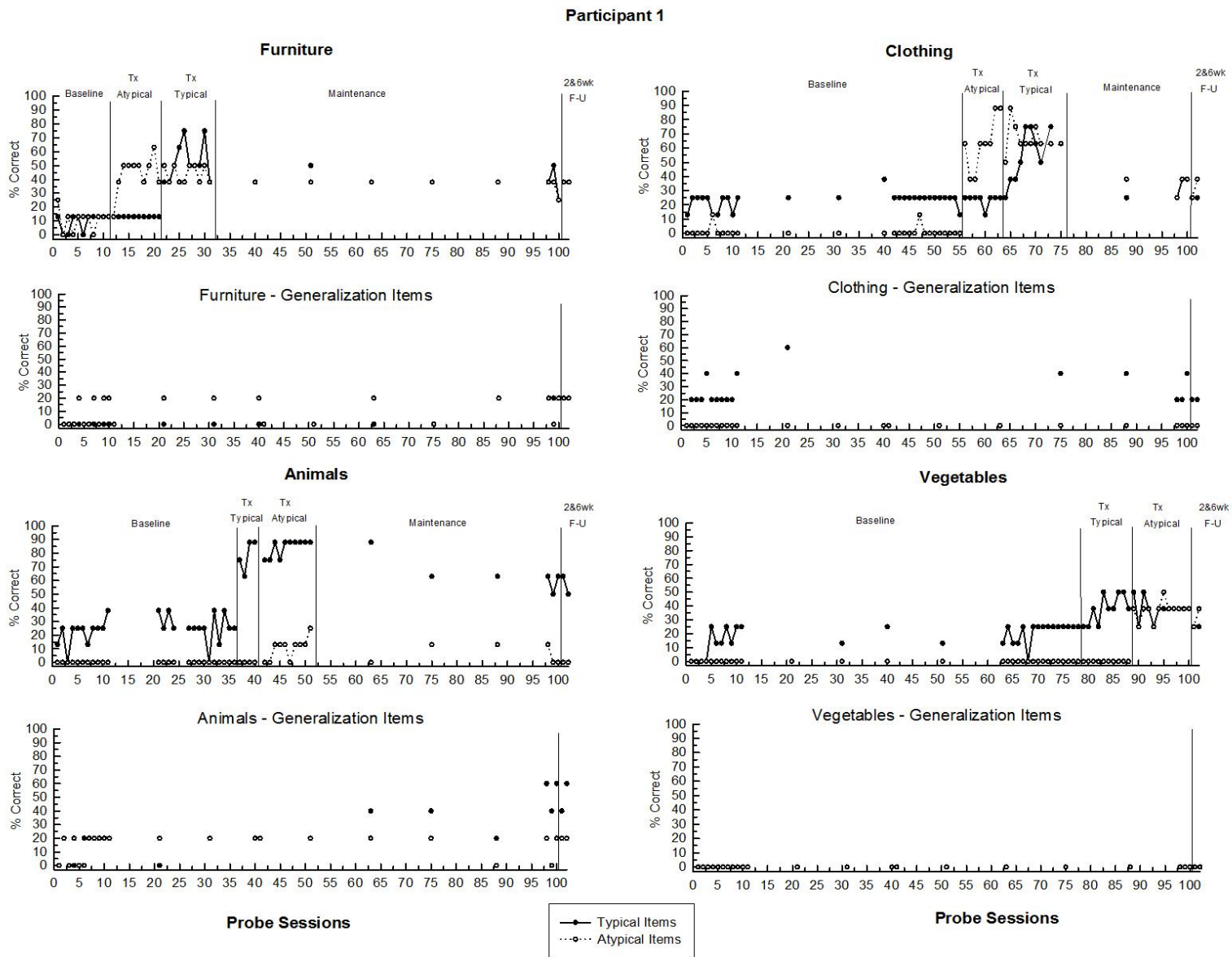


Figure 1

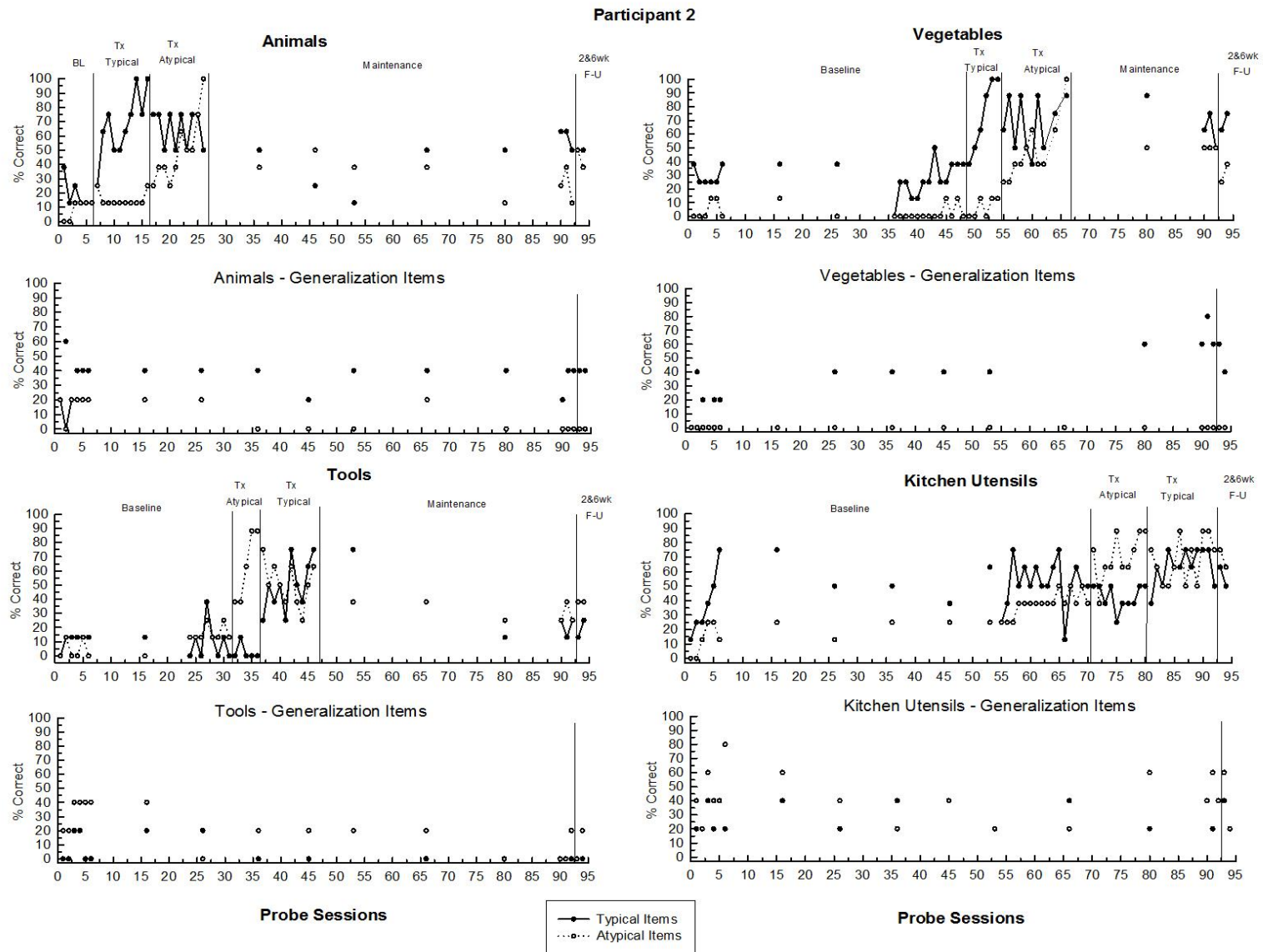


Figure 2