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.

References

Boyle, M. (2004). Semantic feature analysis treatment for anomia in two fluent aphasia syndromes. *American Journal of Speech-Language Pathology, 13*, 236-249.

Boyle, M., & Coelho, C. A. (1995). Application of semantic feature analysis as a treatment for aphasic dysnomia. *American Journal of Speech Language Pathology, 4*, 94-98.

Coelho, C. A., McHugh, R. E., & Boyle, M. (2000). Case study: Semantic feature analysis
as a treatment for aphasic dysnomia: A replication. *Aphasiology*, *14*(2), 133-142.

Conley, A., & Coelho, C. (2003). Treatment of word retrieval impairment in chronic Broca's aphasia. *Aphasiology*, *17*(3), 203-211.

Kiran, S. (2008). Typicality of inanimate category exemplars in aphasia treatment: Further evidence for semantic complexity. *Journal of Speech, Language, and Hearing Research, 51*, 1550-1568.

Kiran, S., & Johnson, L. (2008). Semantic complexity in treatment of naming deficits in aphasia: Evidence from well-defined categories. *American Journal of Speech-Language Pathology*, 17, 389-400.

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. *Journal of Speech, Language, and Hearing Research, 46*, 608-622.

Laine, M., & Martin, N. (2006). *Anomia: Theoretical and Clinical Aspects*. Hove, UK: Psychology Press.

Nickels, L. (2002). Improving word finding: Practice makes (closer to) perfect? *Aphasiology*, *16*(10/11), 1047-1060.

Stanszak, L., Water, G., & Caplan, D. (2006). Typicality-based learning and generalisation in aphasia: Two case studies of anomia treatment. *Aphasiology, 20(2/3/4),* 374-383.

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

Measure	P1	P2	P3	P4	P5	P6	P7	P8	P9
PICA (Porch, 2001)									
Overall Percentile	53/54th	73/74th	63/64th	59th	35/36th	49th	63rd	75th	38th
Verbal %ile	51/52th	68/69th	58/59th	56/57th	38/39th	39/40th	63rd	80th	35th
Auditory %ile	54/56th	65/72nd	64/73rd	46/47th	28th	54/56th	75/99th	74/99th	42nd
TAWF (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%
WAB (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
Object & Action Naming Battery (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
The Pyramids and Palm Trees Test (Howard & Patterson, 1992)									
Total	41/52	51/52	51/52	46/52	41/52	50/52	51/52	50/52	28/5
AIDS (Yorkston & Beukelman, 1984)	82	88	94	84	80	90	*	86	54
TONI (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
Spoken Word-Picture Matching	37/40	40/40	40/40	39/40	35/40	40/40	39/40	40/40	38/40
Written Word to Picture Matching	39/40	39/40	40/40	40/40	32/40	40/40	40/40	39/40	27/40
Auditory Synonym Judgments	51/60	45/60	51/60	46/60	38/60	49/60	51/60	58/60	39/60
Word Association	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) *Furniture Atypical*	8.10 (7.01) *Animals Typical*	3.4 (9.72) *Animals Typical*	4.99 (>10.0) *Birds Atypical*	1.0 (0) *Veg. Typical*	2.95 (5.22) *Clothing Typical*	6.35 (6.81) *Kitchen Atypical*	3.70 (0.70) *Animals Typical*	6.77 (13.74) *Animals Typical*
List 2	3.79 (>10.0) *Furniture Typical*	4.3 (8.17) *Animals Atypical*	18.31 (18.18) *Animals Atypical*	9.12 (1.65) *Birds Typical*	1.0 (0) *Veg. Atypical*	5.09 (5.22) *Clothing Atypical*	3.28 (0.31) *Kitchen Typical*	3.09 (2.27) *Animals Atypical*	1.17 (6.43) *Animals Atypical*
List 3	4.33 (2.70) *Animals Typical*	6.24 (3.44) *Tools Atypical*	6.22 (3.65) *Tools Atypical*	4.56 (2.87) *Clothing Typical*	1.14 (0.5) *Tools Typical*	5.22 (>10.0) *Fruits Atypical*	5.25 (>10.0) *Birds Atypical*	10.22 (3.11) *Tools Atypical*	11.50 (7.66) *Furniture Atypical*
List4	4.59 (0) *Animals Atypical*	4.72 (2.55) *Tools Typical*	4.47 (3.98) *Tools Typical*	3,37 (0.7) *Clothing Atypical*	1.95 (.59) *Tools Atypical*	0.54 (1.86) *Fruits Typical*	5.22 (>10.0) *Birds Typical*	10.54 (>10.0) *Tools Typical*	7.52 (10.73) *Furniture Typical*
List 5	9.56 (7.66) *Clothing Atypical*	8.96 (4.88) *Vegetables Typical*	5.06 (4.25) *Birds Typical*	11.5 (5.01) *Music Atypical*		5.58 (3.03) *Furniture Typical*			2.03 (8.42) *Veg. Typical*
List 6	4.74 (0.50) *Clothing Typical*	3.13 (3.13) *Vegetables Atypical*	6.01 (6.39) *Birds Atypical*	2.56 (>10.0) *Music Typical*		3.15 (3.34) *Furniture Atypical*			18.31 (>10.0) *Veg. Atypical*
List 7	5.25 (0) *Vegetables Typical*	5.92 (3.74) *Kitchen Atypical*	8.76 (12.42) *Clothing Atypical*	5.41 (4.74) *Tools Typical*		4.83 (4.63) *Animals Atypical*			8.90 (10.96) *Clothing Atypical*
List 8	>10.0 (7.66) *Vegetables Atypical*	5.48 (2.01) *Kitchen Typical*	11.5 (3.23) *Clothing Typical*	3.93 (1.86) *Tools Atypical*		1.12 (1.41) *Animals Typical*			4.01 (2.77) *Clothing Typical*

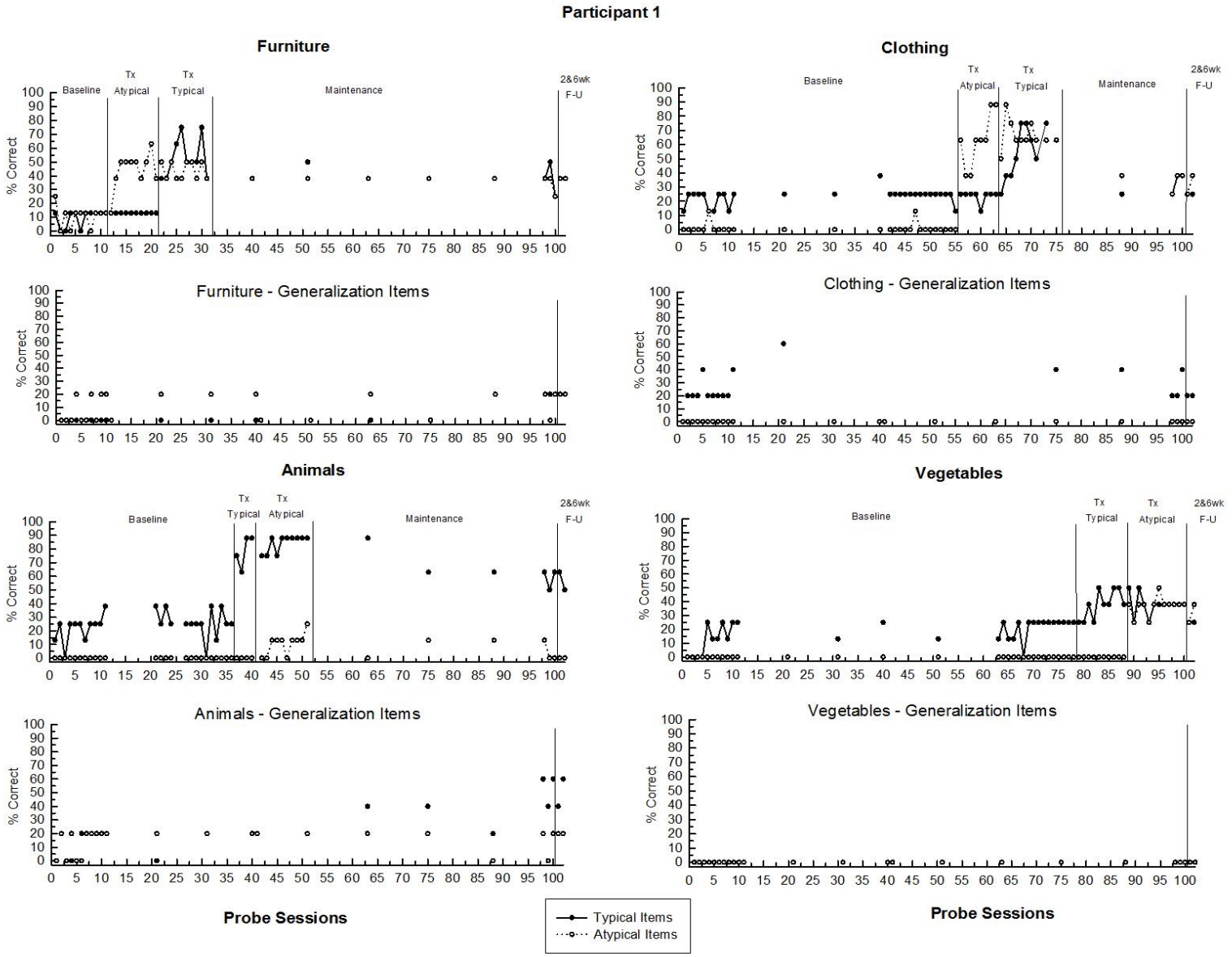
Participant 1
Furniture
Clothing
Furniture - Generalization Items
Clothing - Generalization Items
Animals
Vegetables
Animals - Generalization Items
Vegetables - Generalization Items
Baseline
Tx Atypical
Tx Typical
Maintenance
2&6wk F-U
Tx Typical
Tx Atypical
% Correct
Probe Sessions
Typical Items
Atypical Items

Figure 1

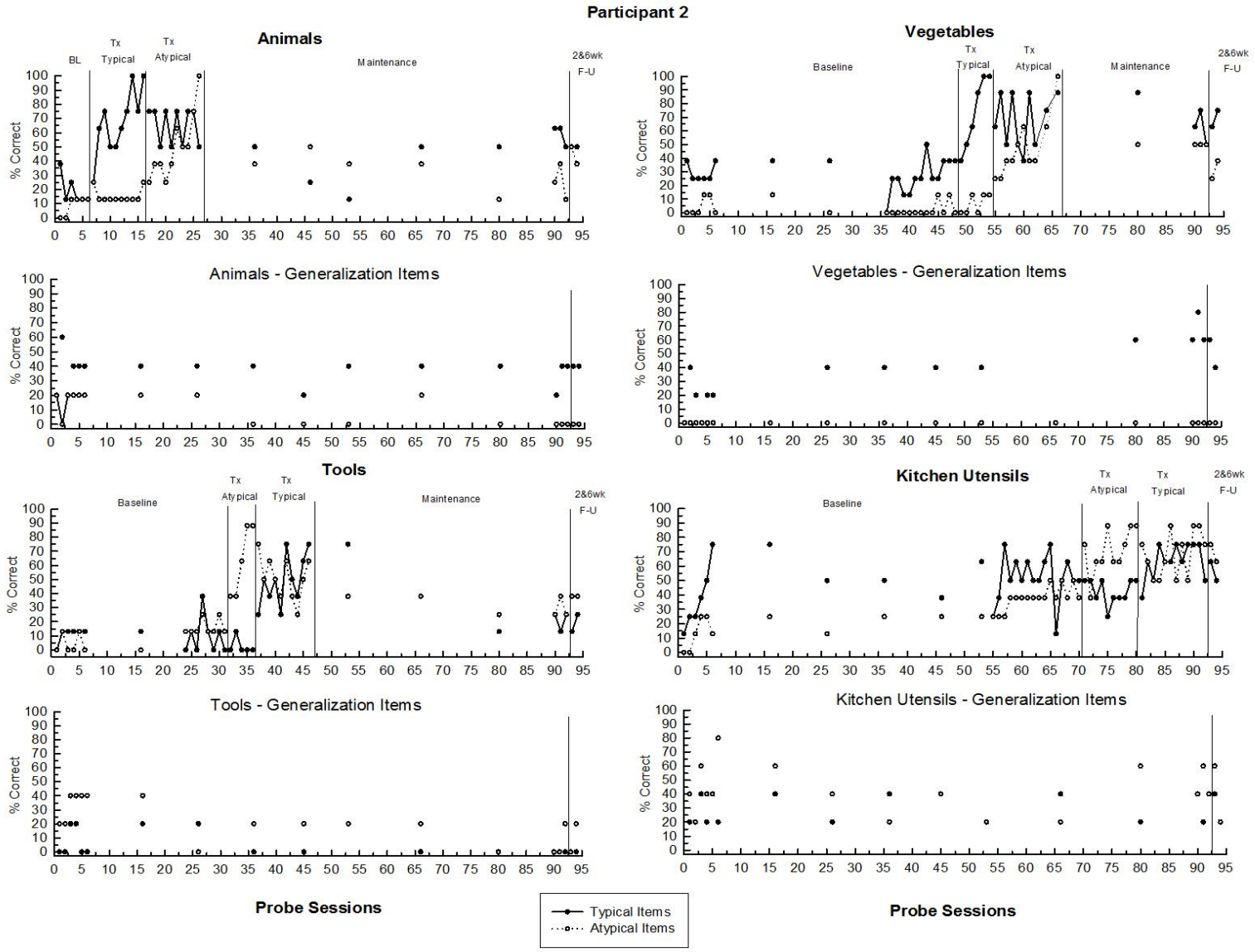
Participant 2
Animals
BL
Tx Typical
Tx Atypical
Maintenance
2&6wk F-U
Vegetables
Baseline
Tx Typical
Tx Atypical
Maintenance
2&6wk F-U
Animals - Generalization Items
Vegetables - Generalization Items
Tools
Baseline
Tx Atypical
Tx Typical
Maintenance
2&6wk F-U
Kitchen Utensils
Baseline
Tx Atypical
Tx Typical
2&6wk F-U
Tools - Generalization Items
Kitchen Utensils - Generalization Items
% Correct
Probe Sessions
Typical Items
Atypical Items

Figure 2