ABSTRACT: **Purpose:** The use of a modified semantic feature analysis (SFA) treatment on confrontation naming and functional communication was investigated using 2 case studies of adults with chronic subcortical aphasia.

**Method:** Participants participated in individual treatment twice a week for 8 weeks. The modified SFA treatment used in this study included the feature of episodic memory and excluded the previously used semantic features of association and action. The other features included in the modified treatment were use, properties, category, and location.

**Results:** Baseline measures, treatment, and 2-month follow-up data were obtained. Both participants showed improvement from baseline to the final treatment session and continued to maintain naming abilities 2 months following treatment. Pre- and post-treatment scores on the Communicative Effectiveness Index (Lomas et al., 1989) that were completed by each participant’s spouse indicated significant changes in the participants’ functional communication.

**Conclusion:** More research using SFA with individuals with different types of aphasia and in different phases of recovery is needed. The use of fewer numbers of semantic features and an episodic memory feature in this modified SFA approach appears promising as a treatment for naming difficulties.

**KEY WORDS:** chronic aphasia, anomia, semantic features, episodic memory
in 40 individuals with aphasia (10 with Broca’s, 10 with conduction, 10 with Wernicke’s, and 10 with anomic aphasia) who had naming difficulties. Individuals with Wernicke’s aphasia were not responsive to phonemic cueing, whereas those with Broca’s aphasia were, improving in their naming ability. Individuals with conduction and anomic aphasia were somewhat responsive to phonemic cueing, but their performance was more similar to that of individuals with Wernicke’s aphasia. No assessments to determine the maintenance of naming ability were performed in this study (Li & Canter, 1987), so it is unclear as to whether these effects continued over time. In addition, only phonemic-based cues were evaluated in the study; therefore, the impact of semantic cues could not be assessed.

The relationship between individuals’ locus of breakdown in word retrieval and their response to a particular treatment approach remains unclear. Direct comparisons of treatments using semantic or phonological cueing are necessary (van Hees et al., 2012). Wambaugh, Linebaugh, Doyle, and Martinez (2001) found varied results employing both semantic-based and phonologically based treatments with three participants with anoma at different levels of lexical processing impairment. All three individuals responded positively to both treatments. However, one of the participants whose impairment was described as predominately phonologic showed better responses to the semantic-based treatment. Wambaugh et al. suggested that identifying the area of lexical breakdown with certainty may not be as easily ascertained as they initially assumed. In addition, they stated that “the process of lexical access is interactive to such a degree that either type of treatment may benefit all levels of processing” (Wambaugh et al., p. 947). Therefore, the need for further research in this area was suggested to determine if using an individualized lexical approach strengthens outcomes for clients with anoma.

A commonly used lexical approach for the treatment of aphasia is semantic feature analysis (SFA). This type of treatment for word finding is based on several models of lexical retrieval (Caramazza, 1997; Collins & Loftus, 1975; Gordon & Dell, 2003; Levelt, 2001; Oppenheim, Dell, & Schwartz, 2010). The theoretical basis of SFA is to improve word retrieval by accessing features related to concepts that activate networks of the semantic system (Boyle, 2010; Masaro & Tompkins, 1994; Ylvisaker & Szekeres, 1985). According to the spreading of activation model, stimulating the semantic network surrounding a target word will increase activation above its “threshold” level, which increases the likelihood that the name of an object can be retrieved (Anderson, 1995, p. 186).

Boyle (2010) suggested that organized, semantically related descriptors or features are not necessarily exclusive to a given concept. However, key features that are most activated should assist in lexical retrieval. For example, an individual with anoma may provide semantic features such as “pet, furry, friend, take for walks, and barks” when describing the concept of “dog/canine,” but some of the features (due to related activation) may also be applicable when describing “cat/feline,” although the semantic features of “take for walks” and “barks” should help to clarify the concept of “dog/canine.”

SFA studies generally use six selected features to highlight various characteristics of a given target stimulus, but a given feature may be omitted if it is irrelevant or inapplicable (Boyle, 2004). The most commonly accepted features are group, use, action, properties, location, and association (Boyle, 2004).

Several studies have focused on using SFA treatment with individuals with cerebrovascular accidents (CVAs) and traumatic brain injuries and have obtained positive results (Boyle, 2004; Boyle & Coelho, 1995; Coelho, McHugh, & Boyle, 2000; Drew & Thompson, 1999; Kiran & Thompson, 2003; Lowell, Beeson, & Holland, 1995). For instance, Boyle and Coelho (1995) used SFA in an AB single-subject design study with a 57-year-old male participant with left frontoparietal infarction that resulted in Broca’s aphasia and mild apraxia of speech. The participant was 65 months post onset. The black-and-white line drawings developed by Snodgrass and Vanderwart (1980) were used for the study. The participant was asked to generate six semantic features for each line drawing, with limited cueing from the clinician. Seven drawings that the participant could not name were used as control items. Treatment consisted of 34 drawings that the participant could not name in two of three trials. Two conditions were created using these pictures: few exemplars, which consisted of seven of the drawings, and many exemplars, which consisted of 27 of the drawings that were presented in three sets of nine. Seven drawings that were named easily by the participant were added to both conditions.

Baseline, probe, and maintenance measures of the control pictures and of the quality of information and effectiveness of communication of the participant’s connected speech were collected (Boyle & Coelho, 1995). Improvements were observed in confrontation naming of trained and untrained items. Boyle (2010), however, reported that the improvements found in naming untrained drawings were questionable due to the participant’s exposure to the untrained stimuli in every other session. No improvements were noted in connected speech. It
was found that greater gains resulted from the use of the smaller set of stimulus items (few exemplars) in comparison to the larger set. These findings are consistent with a number of other SFA studies using similar stimulus items (Boyle, 2004; Boyle & Coelho, 1995; Coelho et al., 2000).

To assess the participant’s communication outcomes, the participant’s daughter completed the Communicative Effectiveness Index (Lomas et al., 1989). This outcome measure indicated that the daughter rated improvement in her father’s communication abilities. At follow-up testing, naming accuracy was maintained at 1 and 2 months following treatment. However, Boyle and Coelho (1995) recommended that additional studies be conducted to support the use of SFA for treating naming difficulties.

In a replication study conducted by Coelho et al. (2000), improvements were again noted in confrontation naming of both trained and untrained items in an individual with a traumatic brain injury. The client presented with moderate-to-severe fluent aphasia with minimal cognitive deficits. The same Snodgrass and Vanderwart (1980) black-and-white picture stimuli were used; however, in this case, the few exemplars condition consisted of 10 stimulus items, whereas the many exemplars condition consisted of 30 stimulus items. The participant was asked to generate six semantic features for each drawing with limited cueing from the clinician. The procedures identified by Nicholas and Brookshire (1993) for the calculation of words per minute and correct information units were used to evaluate connected speech during pre- and postassessment. Tasks in evaluating connected speech included requests for procedural information, requests for information, picture sequencing, and description of two pictures. The results from this study differed from the Boyle and Coelho (1995) study in that generalization of naming to connected speech was observed. However, the results should be interpreted with caution due to the etiology of the injury and the aforementioned frequency of exposure to the untrained picture stimuli (Boyle, 2010).

In another study, Boyle (2004) provided SFA treatment to two individuals with left-hemisphere thrombolytic and embolic CVAs more than 1 year post onset. The participants were characterized as having anomic aphasia and Wernicke’s aphasia, respectively. Similar to previous studies, the author found improvements in confrontation naming of both trained and untrained items with both participants.

Conley and Coelho (2003) explored combining SFA with other treatments and modifying the existing model. The researchers studied SFA in collaboration with response elaboration training (RET), which was designed to facilitate an increase in the verbal expressive abilities of clients with aphasia (Kearns, 1985, 1986). RET involves the elicitation of verbal productions of the client’s choice in response to pictures. The clinician then assists through modeling and forward-chaining to help the client expand on his or her original production. The end goal of RET is to facilitate generalized improvement in clients’ ability to elaborate on conversational topics so they can more fully share the burden of communication with their partners (Kearns & Scher, 1988).

In their study, Conley and Coelho (2003) investigated the issue of degradation in word retrieval of familiar and unfamiliar words and the amount of times the individual encountered the object nouns in everyday life. The study participant was a 57-year-old female who presented with moderate-to-severe Broca’s aphasia resulting from a left CVA and was status post 8 years injury. Treatment materials consisted of 30 photographs of object nouns. Fifteen photographs represented “high-familiarity” objects; the other 15 represented “low-familiarity” items (p. 203). An ABA single-subject design was used.

Conley and Coelho (2003) indicated that a combined SFA and RET treatment resulted in improved naming of stimulus pictures and untreated control items. As expected, naming accuracy and consistency were greater for high-familiarity items than for low-familiarity items (Conley & Coelho, 2003, pp. 203–211). In the follow-up phase, treatment effects were maintained at a higher level for treatment pictures than for control items, with better performance in each category with high-familiarity words. RET resulted in an increased number of content words produced and generalization of elaborated responses to untrained items (Conley & Coelho, 2003). Although the combined SFA and RET model was effective in improving the participant’s word retrieval, it is unclear to what extent each model contributed to the improvement of word finding and whether a combined approach was necessary.

Finally, Hashimoto and Frome (2011) used a modified SFA approach to determine if a participant’s naming ability would improve. A single-subject, multiple-baseline approach was used with a 72-year-old female with Broca’s aphasia and apraxia of speech. In this study, the researchers used three semantic features of the target item instead of the previously used six features. Responses were generated by the participant, and unlike in previous studies, could be either oral or written. The rationale for this was the questionable nature of the participant’s ability to self-generate verbal productions due to apraxia of speech. Hashimoto and Frome measured generalization by using the participant’s ability to name photographs of trained items depicted in natural contexts.
A total of 24 items from Snodgrass and Vanderwart (1980) that were divided into three categories (i.e., clothing, animals, and instruments), with eight items per category, were implemented in treatment (Hashimoto & Frome, 2011). The participant participated in treatment twice a week for 35 sessions in order to reach criterion in all three categories. For generalization measures, the same categorical items were presented as color photos. The follow-up sessions were conducted 6 weeks after the final treatment session.

The results indicated that the participant demonstrated improved naming of the trained items (Hashimoto & Frome, 2011). Although limited measures were used for generalization, the participant showed increased naming accuracy on the same trained items presented as colored photographs. Following the conclusion of treatment, the participant’s treatment gains declined for the two categories of animals and musical instruments, but she still retained naming levels higher than that of baseline. Although there were positive treatment results, the authors noted that there were certain limitations to their modified approach. First, the limited number of probes obtained at baseline had the potential to “overstate the magnitude of effect” (Hashimoto & Frome, 2011, p. 467). Second, no generalization measures were taken on the untreated items. Finally, the severity and type of aphasia of the participant, and the comorbidity of apraxia of speech, may have influenced her ability to self-generate cues reliably, thereby impacting follow-up outcomes and the systematic control of cueing. Although there were limitations in this study, the results provide valuable information regarding the positive impact of an SFA model with fewer features than usual.

When investigating language disorders, SLPs must always consider the cognitive processes involved. Word finding relies not only on concepts and semantic features, but also on memory. A memory system that may enhance an individual’s ability of word finding is episodic memory. Tulving (1984) described episodic memory as a system that “receives and stores information about temporally dated episodes and events” (p. 223). These memories are “characterized by perceptual, conceptual, and affective components that are placed within the context of personally relevant events” (Giovanello & Verfaellie, 2001, p. 109). Long-term episodic memories with an emotional component are considered to be familiar and are retained better than insignificant and more recent experiences (Bayles & Tomoeda, 2014; Yonelinas, 2001).

Recalling episodic memories related to a target word may promote additional semantic features that can assist in word finding. For instance, if the target word is “golden retriever,” talking about past episodic memories of your dog and fun activities that you shared together may provide the necessary self-cueing to find the target word. As suggested by Boyle (2010), the use of specific and distinguishing information may help participants retrieve information more effectively than general descriptors. Episodic memory may produce these specific and distinguishing features recalled in a personal event.

The Present Study

Based on the literature reviewed, there continue to be questions about the use of SFA as a treatment for anomia. In an attempt to answer some of these questions, we examined the use of a modified SFA model in improving confrontational naming and discourse for two individuals with subcortical aphasia secondary to left CVAs. Based on findings by Hashimoto and Frome (2011) that participants showed gains in naming accuracy using fewer semantic features, we incorporated fewer features in our SFA model. Specifically, we excluded the semantic feature of association, which could be addressed through the features of category, properties, and personal memory. Additionally, we determined that action was often confusing if the stimulus item was an inanimate object (e.g., apple) because the object did not perform an action. Instead, we determined that the semantic feature of use addressed the actions of both inanimate and animate objects more effectively.

Due to the interactive relationship between language and cognition, we also added episodic memory as a semantic feature in the present SFA treatment to determine if it was helpful in word finding. We used this modified SFA approach to assess the participants’ ability to retrieve trained items and to determine if these skills generalized to overall communication effectiveness.

We asked the following research questions:

- Will a modified SFA treatment improve the ability of two adults with chronic subcortical aphasia to name trained stimulus items?
- Will a modified SFA treatment improve the participants’ communication effectiveness as judged by their spouses?

We hypothesized that a modified SFA approach would increase confrontational naming of trained stimulus items with participants with chronic subcortical aphasia. Additionally, we expected this modified SFA treatment to have positive changes in each participant’s everyday communication effectiveness as judged by his spouse.
METHOD

Participants

Two individuals voluntarily participated in this study. Both participants had left CVAs that resulted in subcortical damage in the area of the basal ganglia. Participant 1 (P1) was a 58-year-old, right-handed male with subcortical aphasia secondary to a left hemorrhagic CVA. He was 9 years post onset. His most recent Western Aphasia Battery (WAB; Kertesz, 2007) aphasia quotient (AQ) indicated a score of 53, or Wernicke’s aphasia. However, the prior WAB AQ indicated conduction aphasia, with the only difference on the Auditory Verbal Comprehension score. P1 did not exhibit any physical limitations at the time of the study. Participant 2 (P2) was a 58-year-old, right-handed male with subcortical aphasia secondary to a left ischemic CVA. He was 11 years post onset. His most recent WAB AQ indicated a score of 60.2, or conduction aphasia. P2 continued to have right-sided hemiparesis.

Although the findings from the WAB AQ classified the participants with either Wernicke’s or conduction aphasia, Helm-Estabrooks, Albert, and Nicholas (2014) refer to aphasia related to damage in the basal ganglia to be more borderline fluent type. However, this type of aphasia is not identified on the WAB. Therefore, given the extent of the location of the CVAs, the participants’ types of aphasia are best described as subcortical in this study.

Materials

We randomly selected 57 Snodgrass and Vanderwart (1980) black-and-white drawings. These were enlarged to fit on 3- × 5-in cards and were placed in the center of a table facing the participant. Five semantic feature categories surrounded each card presented (see Figure 1). The semantic features were use, properties, category, personal memory, and location. The elimination of the two features of association and action was the first modification in this SFA treatment. The second modification was the addition of the feature of personal memory.

Procedure

For the baseline measure, we presented 57 Snodgrass and Vanderwart (1980) black-and-white line drawings to each participant across three trials with no feedback. Data were recorded on performance, and four target pictures that were named correctly across all three trials were randomly chosen to be included as easily named stimulus items throughout the treatment sessions. This was a replication of procedures that had been used in past studies (Boyle & Coelho, 1995; Coelho et al., 2000). Eight target pictures that

Figure 1. The modified semantic feature analysis treatment chart. The stimulus item was placed in the center, and the participant began with the feature “Use” in the top left corner. Next, the features of properties, category, personal memory, and location were discussed in that order.
were named incorrectly in three out of three trials at baseline were randomly selected as stimulus items for treatment.

Following baseline data collection, each participant received two 60-min treatment sessions per week for 8 weeks. Each participant received a total of 16 treatment sessions. Follow-up data were collected 8 weeks after the final treatment session.

Treatment began with a total of 12 pictures (eight stimulus items and four easily named items). During treatment, each participant was shown the picture card stimulus and was asked to provide responses to each of the five designated semantic features. Each stimulus item was only provided once per session. The researcher asked the participant to describe each semantic feature relating to the target picture. The participant was then asked to name the stimulus item. If the participant named the target item before all of the features were addressed, the researcher continued to ask for the remaining features. This was done in an attempt to solidify the appropriate features and to reinforce the correct responses. If the participant produced all five features and was still unable to name the stimulus item, the researcher provided the name of the target and reviewed each semantic feature. If a semantic feature was not produced, the researcher provided verbal cues and drawings to assist the participant in producing the feature; however, no cueing was provided when naming the target picture. As the sessions continued, the participants required less cueing for each semantic feature and often moved through the SFA treatment with little or no cueing from the researcher.

Responses for each semantic feature were acceptable if they were judged by the researcher to be relevant and appropriate. The names for the target stimuli were predetermined by the researcher team, and the “High Concept Agreement and Low Name Agreement” section of the Snodgrass and Vanderwart (1980) article was used as a reference for naming the stimulus items (p. 190). Unrelated responses were not accepted as correct productions.

The personal memory category was counted as correct if the response appeared appropriate and relevant. If we were unsure about the accuracy of a personal memory response, we contacted the spouse and asked for verification.

When a stimulus picture was named correctly over four consecutive sessions, a new item from the stimuli that were not named at baseline in three out of three attempts was added. This was another modification to the typical SFA model and had not been used with previous studies. The number of stimulus items in the set grew larger as the participants became more successful in treatment.

Both P1 and P2 completed 16 sessions of the modified SFA treatment over 8 weeks and returned 2 months later for follow-up. In order to determine if the modified SFA treatment had an impact on the participants’ communication effectiveness outside of treatment, we asked each participant’s spouse to complete the Communication Effectiveness Index (CETI; Lomas et al., 1989) before and after treatment. The CETI is a 16-item psychometric questionnaire that is used to measure changes in functional communication ability. This communication measure is frequently used for research with clients with aphasia. The CETI uses a 10-point Likert scale in which spouses can rate communication effectiveness in daily activities and interpersonal relationships/social settings. The scale includes ratings between not at all and as able as he was before stroke. The CETI also includes questions related to the partner’s ability to converse with known and unknown audiences and to communicate pain and emotions. The results of the CETI were analyzed using a paired-samples two-tailed t test.

**RESULTS**

**P1**

P1 began treatment with 12 treatment pictures. Over 8 weeks of treatment, P1 showed gains in naming accuracy and added six new stimulus items, resulting in a final data set of 18 treatment pictures (see Table 1). His accuracy for naming in the first treatment session was 33% (4 out of 12 pictures named). By the final treatment session, his accuracy for naming was 71% (12 out of 18 pictures named). P1’s naming accuracy by the final treatment session increased by 38 percentage points from the first session, with the addition of six stimulus items. At the 2-month follow-up, P1 was given the same set of 18 treatment pictures in order to assess if his gains in naming had been maintained. He named 55% (10 out of 18) of the items correctly (see Table 1). Therefore, he continued to maintain some of his naming abilities for trained items.

The CETI was completed by P1’s spouse both before and after treatment. A paired-samples two-tailed t test on the CETI scores indicated statistically significant differences, \( t(15) = 3.05, p = .008, \) for communication effectiveness. Items on the CETI in which P1’s scores increased from before to after treatment included “having coffee-time visits and conversations,” “having spontaneous conversations,” and “starting conversations with people who are not close family” (Lomas et al., 1989).
P2

P2 began treatment with 12 treatment pictures. Over 8 weeks of treatment, P2 showed gains in naming accuracy and added 15 new stimulus items, resulting in a final data set of 27 treatment pictures (see Table 2). His accuracy for naming in the first treatment session was 50% (6 out of 12 pictures named). By the final treatment session, his accuracy was 93% (25 out of 27 pictures named). Naming accuracy by the final treatment session increased by 43 percentage points from the first session, with the addition of 15 stimulus items. At the 2-month follow-up, P2 was given the same set of 27 treatment pictures in order to assess if his gains in naming were maintained. He named 89% (24 out of 27) of the items correctly (Table 2), showing good maintenance for the ability to name trained stimulus items.

The CETI was completed by P2’s spouse both before and after treatment. A paired-samples two-tailed t test on the CETI scores indicated statistically significant differences, \( t(15) = 2.33, p = .034 \), for communication effectiveness. Items in which P2’s scores increased before to after treatment included “getting involved in group conversations about him/her,” “having one-on one conversation,” “having spontaneous conversations,” and “participating in the conversation with strangers” (Lomas et al., 1989).

**DISCUSSION**

Results from this study using a modified SFA to treat individuals with anomia support the findings identified in the previous literature (Boyle, 2004; Boyle & Coelho, 1995; Coelho et al., 2000; Massaro & Tompkins, 1992) that incorporated semantic-based treatment and found improvements in naming for individuals with chronic aphasia. Results from this study also showed that the participants maintained some of their naming abilities over a 2-month period following treatment. These results are similar to those of Boyle (2004), Boyle and Coelho (1995), and Coelho et al. (2000).

The pre- and posttreatment CETI scores for both participants indicated that the spouses observed functional changes in the participants’ everyday communication effectiveness outside of treatment. Perhaps the current modified SFA approach provided the participants with the ability to describe more features of words during anomic episodes in conversation. By using the newly acquired skills, it appears that the participants interacted more with conversational partners outside of the immediate family. The results were consistent with the findings of Boyle and Coelho (1995), which showed improvement in CETI scores pre- and post-SFA treatment with a single subject.

Although there were modifications made for this SFA model, the features selected assisted in the participants’ naming abilities. It appears that the elimination of the typically used features of association and action did not negatively affect the participants’ naming performance.

The modified SFA model used in this research implemented the unique feature of personal memory,
which was not described in previous studies. Long-term episodic memory has been found to be one of the stronger memory systems (Bayles & Tomoeda, 2014; Giovanello & Verfaellie, 2001; Yonelinas, 2001). This is especially evident in populations with progressive cognitive changes (Bayles & Tomoeda, 2014). The inclusion of this feature allowed the participants to access long-term stored information, which possibly promoted the production of additional semantic features and allowed time to discuss the stimulus item. Perhaps use of this feature gave the participants more opportunity in order to self-cue to find the word.

**Limitations**

Although the results from this SFA study showed improvements in the participants’ naming abilities, there were some identified limitations in the study.

- The intensity and time required for this type of SFA treatment may not be feasible for clinicians in hospital and rehabilitation settings. This study was conducted in a university setting; therefore, there were no time constraints related to insurance coverage for services. It is unknown if the same results would be obtained using this modified SFA approach with fewer and shorter treatment sessions.

- There was a small number ($N = 2$) of participants. Although the current treatment was effective for two adults with chronic subcortical aphasia, it is unclear if the same findings would be evident with adults with other types and severity of aphasia. Therefore, this research should be replicated using a larger sample size of clients with various types of aphasia. Additionally, the findings related to the current study may differ depending on the time post-CVA.

- The stimulus items of line-drawn pictures were not always functional or relevant to the participants’ daily lives. To promote generalization and to make treatment more functional to future clients, choosing different stimulus items may be worthwhile to explore.

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Table 2. Data for P2 over 16 weeks of treatment. Each column represents a treatment session, with the F column indicating the follow-up session. The session when new stimulus items were added and when they were successfully named (+) or not (–) are shown. Asterisks indicate the items that were easily named.
• This study did not gather data regarding untrained items.
• There is the possibility of reporter bias on the CETI. Scores on CETI items may have increased because the spouses knew the participants were involved in treatment. However, scores for only a few items were different on the CETI post treatment rather than an overall inflation of scores throughout the communication effectiveness measure. Future replication of this study should include generalization measures such as those outlined by Boyle (2010). Although generalization was not measured in this study, the CETI results from the current study suggest that the spouses noted a positive change in the communication effectiveness of the current participants.

Conclusion

The literature on SFA-based models for treatment continues to grow. It is still unknown which clients would benefit most from this approach to naming treatment versus a phonologically based approach. More research is needed in the area of naming treatment to answer these questions. Although the preliminary data for the current modified SFA approach indicated positive gains in naming abilities, replications of this study and additional research is needed.

REFERENCES


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