Semantic Feature Analysis Treatment for Aphasic Word Retrieval Impairments: What's in a Name?

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This article delineates differences among treatment paradigms that have been called semantic feature analysis treatment and reviews the outcomes of these treatment studies regarding improved naming of treated items, maintenance of treatment effects over time, and generalized improvement to untreated items. Differences in outcomes among the treatment paradigms highlight the importance of using different names for different treatment paradigms. **Key words:** *aphasia, anomia, semantic therapy, semantic feature analysis treatment*

In her review of therapy for naming disorders, Nickels[1] described anomia as one of the most frustrating and distressing of aphasic impairments. She stated that the remediation of spoken word production impairments is of the utmost importance for people with aphasia. Although Nickels noted that one cannot yet predict which therapy task will be effective for which kind of naming impairment, she argued that one can move closer to this goal by using the same treatment task to study many cases.

Recently, a number of single-subject studies have reported the use of semantic feature analysis (SFA) at the confrontation naming level as a treatment for word retrieval impairments in aphasia. Thus, it appears that aphasia researchers are taking Nickels' argument to heart by using the same treatment task, SFA treatment, with a number of individuals with aphasia. However, examination of these studies reveals that the treatments that are called SFA are not always the same treatment.

In the discovery stage of treatment research, some changes in methodology are to be expected as investigators seek to develop and refine the treatment and assess its potential to move to the next stage in the research continuum.[2] At what point, however, do such changes confuse rather than clarify the data? Is it helpful to refer to treatment paradigms that ask participants to perform different language processing tasks by the same name? How can one interpret the evidence arising from different language processing tasks called by a single name? It seems unlikely that applying the same name to different treatment tasks will move us closer to Nickels'[1] goal of predicting which therapy task will be effective for which naming impairment. The goal of this article is to delineate the differences among treatment paradigms that have been called SFA treatment and to review the outcomes of these treatment studies. Of particular interest is whether the different treatment paradigms result in different outcomes in terms of improved naming of treated items, maintenance of treatment effects over time, and generalized improvement to untreated items.

Theoretical Basis of SFA Treatment

SFA treatment was first developed by Ylvisaker and Szekeres[3–5] to provide an organized method of activating semantic networks. It is based on models of lexical retrieval[6–10] that conceive of the semantic system as a network of concepts. A concept is an organized structure of semantic features that provides the meaning of the concept.[11] One semantic feature may be connected

Top Stroke Rehabil 2010;17(6):411–422

www.thomasland.com

doi: 10.1310/tsr1706-411

to a number of concepts. For instance, the semantic feature <grows on trees>[*] is connected to APPLE, ORANGE, LEMON, PEAR, and LEAVES, among others. A concept may have many semantic features. For example, semantic features for APPLE include <a fruit>, <grows on trees>, <has a core>, <has seeds>, <has skin>, and <used for cider>.[12] Semantic features differ in their degree of informativeness for a target concept, with distinguishing features considered to be more informative than other features.[11] In the previous example, the feature <used for cider> is a distinguishing feature of APPLE because it distinguishes apples from other similar fruits, whereas <has seeds> is not a distinguishing feature because all fruits have seeds.[12]

Models of lexical retrieval suggest that when one tries to name a pictured object, the features for that object are activated.[6–10] The activation spreads from the features through the semantic network to the concepts with which they are associated. The activated concepts, in turn, spread the activation to their associated lexical items. Ultimately, the lexical item receiving the greatest amount of activation is selected. This can occur either because all of its semantic features have been activated, thus raising its activation level above similar items, or because 1 or 2 distinguishing features have been activated, causing a stronger degree of activation for the target item than for other items.[10,11] The activation from the selected lexical item then spreads to the phonological representation associated with it, and a motor program executes the production of the spoken name.[9]

As described by Ylvisaker, Szekeres, and colleagues,[3–5] SFA treatment involves using a feature analysis chart like that in **Figure 1**. Individuals with lexical retrieval problems are asked to generate the semantic features of the target concept. The clinician attempts to guide the individual in achieving maximum activation of the target by directing feature generation to include the most distinguishing semantic features. According to lexical processing theory, activating the semantic features, particularly the distinguishing features, should result in strong activation of the target, increasing the likelihood that the individual will be able to activate the production of its name.[13]

Ylvisaker, Szekeres, and their colleagues[3–5] provided descriptions of SFA treatment that were general in nature. They did not provide patient data or detailed descriptions about implementation of the technique. They reported that the therapist initially plays the primary role in cuing the patient to generate the semantic features but gradually shifts the burden to the patient by fading prompts.[3] Their descriptions emphasized the importance of using the structured procedure consistently, and they recommended that therapists carefully direct patients in using the feature analysis chart until the patients can complete an analysis with minimal cuing.[4] The authors theorized that with this kind of persistent, systematic practice in generating semantic features, individuals may engage in more organized word retrieval without the deliberate use of compensatory strategies.[5]

To operationally specify the SFA treatment program and to investigate its efficacy, Massaro and Tompkins[14] published a multiple-baseline, single-subject study that applied SFA treatment to 2 individuals who had sustained traumatic brain injury. Their purpose was to treat the communication disorders of the participants by providing them with practice organizing their verbal output and increasing the amount of information they retrieved. The investigators instructed the participants to state all they knew about topics by generating the following semantic features: group, action, use, location, properties, and associations. Structured cues were provided when a participant was unable to generate a feature independently. Massaro and Tompkins reported that the SFA treatment resulted in increased production of semantic features for trained topics, that this improvement was maintained after treatment ended, and that it generalized to untrained topics.

Thus, the original description of SFA treatment and the first controlled study of its application emphasized the importance of the patient performing the SFA and generating the features

*Following conventions in the literature, semantic concepts appear in capital letters (eg, APPLE) and semantic features appear within angled brackets (eg, <grows on trees>).

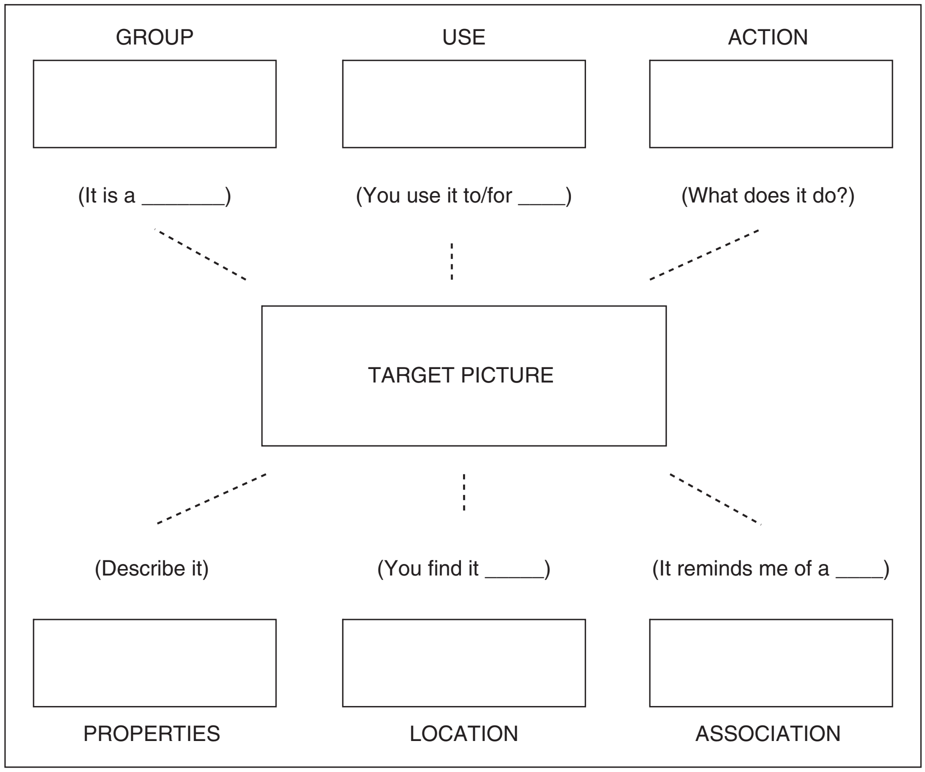

Figure 1. Semantic feature analysis (SFA) chart used during SFA treatment.

with guidance from the clinician. This has not always been the case when investigators apply SFA treatment to word retrieval impairments in aphasia. Some investigators have adhered to the original descriptions of SFA treatment by Ylvisaker and colleagues[3–5] and have required participants with aphasia to actively analyze a concept and to attempt to generate its semantic features. Other investigators who have called their treatment SFA treatment have not required participants with aphasia to analyze a concept to generate semantic features. Instead, these investigators have asked participants to select semantic features from distracters, to orally read the names of semantic features supplied by the investigators, or to verify that a semantic feature is related to a concept. These are different treatment tasks that require different levels of semantic processing than the feature generation task. An apt analogy is the difference between a test composed of essay questions, requiring test takers to retrieve and generate their knowledge about concepts, and a test composed of true-false and multiple-choice questions about concepts, requiring test takers to recognize whether a supplied fact is associated with the concept but not to generate the facts themselves. Each kind of test is a valid means of assessing knowledge; there is nothing inherently superior about either method. However, experienced test takers know that a test that consists entirely of essay questions requires a different level of preparation than a test that consists of true-false or multiple-choice questions. This difference stems from the fact that activating stored knowledge for retrieval and analysis entails different processing of that knowledge than activating it for recognition.

Raymer et al[15(pS270)] described the SFA treatment that requires participants to generate semantic features as eliciting "deeper semantic processing" than tasks that require participants to read the printed names of the features, to verify that a feature is associated with the target concept, or to choose which of several supplied features is a feature of the target. Calling all of these tasks semantic feature analysis treatment obscures these differences and complicates efforts to assess the effects of the same treatment task on many different aphasic participants.

Some support for differentiating between the different levels of semantic processing comes from the neuroplasticity literature. Kleim and Jones[16(pS229)] reported that specific kinds of experience are necessary to induce specific forms of neural-plasticity–related behavioral changes in animals, stating that "the implication for rehabilitation is that training in a specific modality may change a limited subset of the neural circuitry involved in the more general function." In other words, there is a greater chance of improving a particular behavior by training that specific behavior. In word retrieval, this might mean that if we want participants with aphasia to be able to independently activate semantic features associated with a target concept to retrieve the name of the concept, it might be important to give them opportunities to practice activating and generating those features themselves.

SFA Treatment for People With Aphasia

Seven published studies have applied SFA treatment to individuals with aphasia at the confrontation naming level for nouns. Outcomes of these studies have been generally promising, resulting in improved word retrieval of treated items for most participants, but they have been mixed regarding maintenance of improvement and generalization to untreated items. **Table 1** lists the studies that are reviewed in this article and outlines the variables of interest. These studies were selected because, with one exception, the authors stated that they used SFA as a treatment. The exception is the study by Edmonds and Kiran,[17] who described their treatment as being "semantically based" but not as SFA treatment. However, in a subsequent study, Kiran and Roberts[18(p243)] stated that the Edmonds and Kiran study used a "semantic feature analysis treatment method," indicating that Kiran believed that they were using SFA as a treatment in the earlier study. For that reason, the Edmonds and Kiran study is included here.

Only studies that used SFA treatment in a confrontation-naming treatment paradigm are included, and studies that added a different treatment to SFA treatment[19,20] were excluded. To simplify discussion, the label *semantic feature generation* (SFG) will be applied to investigations that have required the participants with aphasia to generate semantic features, and the label *semantic feature review* (SFR) will be applied to investigations that have required the participants with aphasia to recognize and respond to semantic features that were generated by investigators a priori. **Table 2** describes the treatment methods used in the studies.

Four[13,21–23] of the 7 studies that have used SFA treatment with aphasic participants to improve confrontation naming of nouns followed the SFG treatment paradigm in which the participants generated semantic features in every session. One study[24] required participants to generate all semantic features once before treatment began, then used those participant-generated features in the SFR treatment paradigm. That study will be labeled SFG+SFR. Two studies[17,18] followed the SFR paradigm: the clinician generated 5 semantic features for each stimulus item a priori, participants generated only 1 semantic feature (a personal association) for each target in only 1 early treatment session, and then that feature was used along with the clinician-generated semantic features in the SFR paradigm in all subsequent sessions. The 2 studies that used the SFR paradigm applied it only to participants who were bilingual, whereas the other 5 studies included only monolingual English speakers as participants.

Improvement in Naming Treated Nouns

The 7 investigations of SFA treatment reported results for 17 participants with aphasia. Sixteen of the 17 participants improved their ability to name pictured nouns that had served as treatment stimuli at the end of treatment whether the SFG, SFG+SFR, or SFR paradigm was used. These participants included a variety of classic fluent and nonfluent aphasia syndromes: Broca's aphasia,[13,18,23] transcortical motor aphasia,[23] Wernicke's aphasia,[18,22] anomic aphasia,[18,22,24] and conduction aphasia.[24] The sole participant whose

Table 1. Summary of investigations

Study	Aphasic individual	Task[a]	Monolingual or bilingual	Treated items improved?	Maintenance	Frequency of generalization probing	Generalization to untreated items?
Boyle & Coelho[13]	H.W.	SFG	Monolingual	Yes	Yes	1x/wk	Yes
Coelho et al[21]	T.H.	SFG	Monolingual	Yes	Yes	1x/wk	Yes
Boyle[22]	P1	SFG	Monolingual	Yes	Yes	1x/wk	Yes
	P2	SFG	Monolingual	Yes	Unavailable	1x/wk	Yes
Rider et al[23]	P1	SFG	Monolingual	Yes	Yes	End of tx	No
	P2	SFG	Monolingual	Yes	Yes	End of tx	No
	P3	SFG	Monolingual	Yes	No	End of tx	No
Lowell et al[24]	B.B.	SFG+SFR	Monolingual	Yes	Yes	Every session; end of tx	Yes
	B.G.	SFG+SFR	Monolingual	Yes	Yes	Every session; end of tx	Yes
	S.B.	SFG+SFR	Monolingual	No	NA	Every session; end of tx	NA
Edmonds & Kiran[17]	P1	SFR	Bilingual	Yes	Yes	1x/wk & 1x/ every 3rd session	Variable
	P2	SFR	Bilingual	Yes	Variable	1x/wk	Variable
	P3	SFR	Bilingual	Yes	Yes	1x/wk	Variable
Kiran & Roberts[18]	P1	SFR	Bilingual	Yes	No	1x/wk	Variable
	P2	SFR	Bilingual	Yes	Variable	1x/wk	Variable
	P3	SFR	Bilingual	Yes	No	1x/wk	Variable
	P4	SFR	Bilingual	Yes	Yes	1x/wk	Variable

Note: SFG = semantic feature generation treatment; SFR = semantic feature review treatment; tx = treatment
[a]See **Table 2** for description of treatment task(s).

ability to name treated nouns did not improve was S.B., an individual with conduction aphasia who participated in the SFG+SFR study by Lowell and associates.[24] These authors attributed S.B.'s lack of improvement to the fact that his aphasia was the most severe of their 3 participants and to the fact that he was the only participant in their study with concomitant nonverbal cognitive impairments.

These outcomes indicate that treatments that involve SFA improve naming of treated items for most participants whether the treatments require participants to generate the features themselves or whether they require participants to analyze features that have been generated by others. The lack of improvement by S.B. from the Lowell et al[24] study suggests that this treatment might not be effective for individuals with more severe aphasia or for individuals with nonverbal cognitive impairments. However, S.B.'s aphasia was not more severe than that of participants from some of the other studies. S.B. achieved a severity rating at the 55th percentile on the Aphasia Diagnostic Profiles.[25] T.H., the participant from the SFG investigation by Coelho et al,[21] achieved a Western Aphasia Battery Aphasia Quotient (WAB-AQ)[26] of 56.6, which indicates a similar level of aphasia severity to S.B., yet T.H. improved with treatment. P2, a participant in the SFR treatment study by Edmonds and Kiran,[17] achieved a WAB-AQ of 27, which indicates a more severe aphasia than that of S.B. The improvement achieved by T.H.[21] and P2[17] suggests that it was S.B.'s concomitant nonverbal cognitive impairment rather than the severity of his aphasia that resulted in his lack of improvement with treatment. Although it is impossible to form sound conclusions on the basis of 3 participants, this suggests that individuals with moderately severe aphasia can benefit from SFA treatment whereas individuals with concomitant nonverbal cognitive impairments may not be good candidates for this treatment. This speculation needs to be investigated empirically. It is also important to note that P2 from the Edmonds and Kiran[17] investigation was the only participant in any of the studies with severe aphasia; all other participants demonstrated mild or moderate aphasia. Thus, it

Table 2. Treatment tasks used in semantic feature analysis studies

Boyle & Coelho;[13] Coelho et al;[21] Boyle;[22] Rider et al[23]	Lowell et al[24]	Edmonds & Kiran[17]	Kiran & Roberts[18]
SFG in each session	SFG once before treatment, SFR in each session (SFG + SFR)	SFR in each session, personal association feature generated once at start of treatment and subsequently reviewed (SFR)	SFR in each session, personal association feature generated once at start of treatment and subsequently reviewed (SFR)
1. The clinician asked the participant to name a target picture placed on the feature chart (**Figure 1**).	1. Before treatment, the participant and clinician generated semantic features for each target, and the participant chose the 4 most meaningful for the clinician to write on index cards.	1. Before treatment, the clinician chose 5 semantic features and distracters for each target. The participant chose 1 semantic feature (personal association) for each target during the first few weeks of treatment. The clinician wrote the features and distracters on index cards.	1. Before treatment, the clinician chose 5 semantic features and distracters for each target. The participant chose 1 semantic feature (personal association) for each target during the first few sessions. The clinician wrote the features and distracters on index cards.
2. Regardless of success in naming the target, the clinician guided the participant in producing its semantic features. a. To elicit features, the clinician asked questions or provided sentence completion cues, such as "What category does it belong to?" (see **Figure 1**). Through prompts and questions, the clinician guided the participant to include the distinguishing features of a target to strengthen its activation by distinguishing it from similar items in the same semantic category. b. The clinician wrote the features on the chart as they were named. More than 1 word could be written in a feature box. For example, the box for *physical properties* typically had several entries, whereas the box for *category* typically had 1 entry. c. When the participant was unable to produce a feature, the clinician said it and wrote it on the chart, but only after first encouraging the participant to do the semantic processing independently. d. If the participant said the target word as the features were being elicited, the success was acknowledged but listing of features continued until complete. e. If the participant failed to retrieve the target word even after all the features were listed, the clinician said the word, then the participant repeated it and reviewed all of its features.	2. A target picture was placed on the feature chart, and the participant and clinician read the previously generated features aloud.	2. The clinician asked the participant to name the target.	2. The clinician asked the participant to name the target and provided feedback about accuracy.
	3. The participant attempted to name the target. a. When an error was made, corrective written feedback was given.	3. Regardless of success in naming the target, the clinician said the name of the object and then set a card with the written form below the picture.	3. Regardless of success in naming the target, the clinician said the name of the object and then set a card with the written form below the picture.

Table 2. *Continued*

Boyle & Coelho;[13] Coelho et al;[21] Boyle;[22] Rider et al[23]	Lowell et al[24]	Edmonds & Kiran[17]	Kiran & Roberts[18]
		4. The participant was provided with a set of 6 written semantic features and 6 written distracters for each target and was instructed to select the semantic features for each target. a. For each correct semantic feature, the clinician reinforced whether the selection belonged to the 6 attribute types (eg superordinate label, function, characteristic). b. If the participant did not understand the instructions or terminology, the clinician provided additional information or modeled what was expected. c. Over time, the participant was encouraged to respond more independently.	4. The participant read 12 short sentences or phrases about the target (6 semantic features and 6 distracters).
		5. The participant was asked 12 yes-no questions regarding the features (eg, "Is it a fruit?" or "Is it found on the roof?") and was required to accept or reject the features.	5. The participant sorted the written features and distracters into piles of correct and incorrect features.
		6. The picture was presented again, and the participant was required to name it.	6. The participant was asked yes-no questions using the same features and distracters as in step 5.
		7. The participant named all target items a third time at the end of the session.	7. The participant named the picture again.

Note: SFG = semantic feature generation treatment; SFR = semantic feature review treatment.

will be important to investigate the outcome of these SFA treatments in individuals with severe aphasia in future studies.

Maintenance of Treatment Effects

Maintenance of the treatment-related improvement was assessed for 15 of the 16 participants who improved with treatment. (One participant in Boyle's study[22] was not available for follow-up because he had relocated.) Ten of these 15 participants maintained performance above baseline levels at the follow-up assessments. Maintenance outcomes for the different treatment paradigms will be considered separately.

Seven of the 8 participants who improved with SFG or SFG+SFR treatment and who were available for follow-up assessment maintained treatment gains. The investigation protocols differed in the timing of assessment for maintenance effects. Lowell and colleagues[24] assessed maintenance of treatment gains 1 week after treatment ended with no other follow-up assessment. Most of the other investigations assessed maintenance 1 month after treatment ended,[13,21–23] with 2 studies[13,21] assessing maintenance again 2 months after treatment stopped.

It is interesting to examine the relationship between maintenance and quantity of treatment (**Table 3**). Quantity of treatment refers to the number of opportunities for practicing the treated behavior. Citing the neuroplasticity literature, Raymer et al[15] noted that individuals may need training that extends beyond the acquisition of the behavior if changes are to be lasting. The sole participant who failed to maintain treatment gains

Table 3. Quantity of treatment

Study	Aphasic individual	Task[a]	Monolingual or bilingual	Treatment intensity	Total hours	Total weeks	Attempts to name	Attempts to generate features	Reading of preselected features	Sorting of features	Yes/no questions about features
Boyle & Coelho[13]	H.W.	SFG	Monolingual	3 60-min sessions/wk	16	6	130	780	NA	NA	NA
Coelho et al[21]	T.H.	SFG	Monolingual	3 60-min sessions/wk	20	7	200	1,200	NA	NA	NA
Boyle[22]	P1	SFG	Monolingual	3 50-min sessions/wk	10	4	156	936	NA	NA	NA
	P2	SFG	Monolingual	3 75-min sessions/wk	30	8	480	2,880	NA	NA	NA
Rider et al[23]	P1	SFG	Monolingual	2 to 3 60-min sessions/wk	18	NR	360	2,160	NA	NA	NA
	P2	SFG	Monolingual	2 to 3 60-min sessions/wk	12	NR	240	1,440	NA	NA	NA
	P3	SFG	Monolingual	2 to 3 60-min sessions/wk	29	NR	580	3,480	NA	NA	NA
Lowell et al[24]	B.B.	SFG+SFR	Monolingual	*	**	NR	**	84	**	NA	NA
	B.G.	SFG+SFR	Monolingual	*	**	NR	**	84	**	NA	NA
	S.B.	SFG+SFR	Monolingual	*	**	NR	**	84	**	NA	NA
Edmonds & Kiran[17]	P1	SFR	Bilingual	2 120-min sessions/wk	52	13	**	10	**	**	**
	P2	SFR	Bilingual	2 120-min sessions/wk	132	33	**	20	**	**	**
	P3	SFR	Bilingual	2 120-min sessions/wk	28	7	**	10	**	**	**
Kiran & Roberts[18]	P1	SFR	Bilingual	*	**	10	600	15	3,600	3,600	3,600
	P2	SFR	Bilingual	*	**	19	2,280	30	13,680	13,680	13,680
	P3	SFR	Bilingual	*	**	4	320	20	1,920	1,920	1,920
	P4	SFR	Bilingual	*	**	4	320	20	1,920	1,920	1,920

Note: SFG = semantic feature generation treatment; SFR = semantic feature review treatment; NA = not applicable; NR = not reported.
[a]See **Table** 2 for description of treatment task(s).
*Length of session not reported. **Unable to calculate.

in the SFG or the SFG+SFR paradigms, P3 from the Rider et al[23] investigation, had more treatment hours, more attempts at target naming, and more attempts at feature generation than any of the other participants. This suggests that a greater quantity of SFG or SFG+SFR treatment during acquisition does not necessarily result in gains that are maintained after treatment ends. In fact, it may be that individuals who take a longer time than other participants to improve might also need additional practice beyond achievement of the target behavior, as Raymer and colleagues[15] suggested, to maintain the improved performance. The other participants in the SFG and SFG+SFR paradigms, whose naming improved more quickly than P3's,[23] were able to maintain performance above baseline measure up to 2 months after treatment ended with no additional intervention.

It is not clear why P3[23] improved at a slow rate and did not maintain improved naming ability after treatment ended. This difference cannot be attributed to severity of aphasia. Participant T.H. from Coelho et al[21] with a WAB-AQ of 56.6 and participant P2 from Boyle[22] with a WAB-AQ of 61.2 were more severe than P3, whose WAB-AQ was 65.8, yet both of the former participants maintained improvement up to 1 month after treatment ended. All 3 participants received the SFG treatment paradigm. Likewise, the source of the different outcome for P3 cannot be type of aphasia because both P3 and H.W.[21] exhibited Broca's aphasia. P3 did not maintain improved naming at 1 month post treatment, but H.W. maintained the treatment effect for 2 months post treatment. Rider and colleagues[23] suggested that the difference in outcome for P3 could have been a reduced level of spousal support for P3 in comparison with that available to their other 2 participants. It is possible that variables such as social support during treatment can influence treatment outcomes. This suggests that investigators might need to be more careful about reporting such variables to help explain outcome differences among participants who appear similar on linguistic and cognitive variables.

In the SFR treatment paradigm, maintenance outcomes were more variable than in the SFG or SFG+SFR paradigms. Only 3 of the 7 participants in these studies (P1 and P3 from Edmonds & Kiran[17] and P4 from Kiran & Roberts[18]) demonstrated maintenance of treatment gains. The participants in the SFR paradigm, who were all bilingual, received treatment first in one language, then in the other, with the order counterbalanced across participants in each investigation. In the Edmonds and Kiran[17] investigation, P2 had variable maintenance results at follow-up: improvements were maintained for words treated in English 1 month and 4 months after treatment ended, whereas improvements for words treated in Spanish were only maintained for 1 month and were no longer evident 4 months after treatment. Kiran and Roberts[18] appear to have assessed for maintenance effects at different times for different participants. For P1 and P2, the authors did not provide information about when maintenance testing was conducted. P1 did not maintain treatment-related improvements at follow-up. P2 maintained improvements only for the words that had been treated in English, not for words treated in Spanish. P3 was assessed for maintenance 5 weeks after treatment and did not maintain any treatment-related improvements in either language. Although these outcomes were more variable than those obtained for the SFG and the SFG+SFR studies, it is not possible to assess whether this variability is associated with the different treatment protocols or with the bilingualism of the participants in the SFR studies. This emphasizes the importance of differentiating among different treatment paradigms by using different names for them, especially when additional variables like bilingualism are being studied. It is not known whether bilingual individuals would exhibit similarly variable maintenance effects in the SFG treatment paradigm, because that paradigm has only included monolingual participants. By describing their treatment as SFA treatment, Edmonds and Kiran[17] and Kiran and Roberts[18] create a confound between these important methodological and participant-selection differences.

Generalization of Improvement to Untreated Items

Howard[27] and Nickels[1] have raised important questions about reports of generalization to untreated items in naming treatment studies. Howard suggested that many outcomes that have been interpreted as generalization to untreated items might instead be the result of repeated attempts to name the generalization probes throughout the treatment period. He cited a study of his own[27] as support for this observation. In that study, he divided his generalization probes into 2 sets. One set was used to probe for generalization at the beginning of each treatment session, and one set was only presented twice: once before treatment began, and once after treatment ended. Howard reported that the participants with aphasia improved in their ability to name the repeatedly exposed control items but did not improve in their ability to name the set of control items that were only presented a single time before and after treatment.

Nickels[1] tested Howard's observation with a case study. She instructed a man with aphasia to independently attempt to name a set of pictures, practicing daily at home with no feedback regarding performance. She reported that her participant's ability to name the items did indeed improve after 6 days of independent attempted naming and that this improvement was maintained for 6 weeks with no further attempts at naming the items, but that the improvement was confined to the spoken naming of the practiced items without generalization to written naming of the practiced items or to spoken naming of other items. Nickels concluded that repeated attempts to name pictured items without feedback can result in improved naming ability, calling into question the generalization outcomes that have been reported in many studies.

Reports of generalization outcomes in SFA treatment studies need to be examined in light of the questions that Howard[27] and Nickels[1] raised. Could these results have been the effect of repeated exposure to generalization probes throughout the study rather than true generalization to untreated items? None of the SFG treatment studies exposed the participants to generalization probes in every session as Howard and Nickels did with their participants. Boyle and Coelho,[13] Coelho et al,[21] and Boyle[22] probed for generalization to untreated items once per week (ie, in every other session). However, even this reduced generalization-probe exposure schedule could account for the improved performance on untreated items that these investigations reported. Rider and colleagues[23] limited generalization probing to once before treatment and once after treatment. Like Howard,[27] they did not find generalization to untreated items with this limited exposure probe schedule. Thus, the reports of generalization to untreated items reported by Boyle and colleagues[13,21,22] must be questioned.

In contrast, in their SFG+SFR study, Lowell et al[24] used 2 sets of generalization probes as Howard[27] had done. Participants attempted to name 1 set of generalization probes in every session, whereas participants only attempted to name the second set of generalization probes once before treatment and once after treatment. In this case, when repeated exposure could not account for improvement on the limited-exposure set of probe items, 2 participants' ability to name these unexposed, untreated items improved. This outcome is strong evidence that generalization to untreated items did, in fact, occur in the Lowell et al study.

As with the maintenance outcomes, the generalization outcomes for the bilingual participants in the SFR investigations[17,18] were variable. Each of the 7 participants in the 2 investigations demonstrated a different generalization pattern to untreated words, whether the untreated words were translations of the treated words in the untreated language, semantically related words in both languages, or semantically unrelated words in both languages. The 2 SFR investigations probed for generalization to untreated items in every second or third session, raising the question of whether any positive outcomes were truly the result of generalization or whether they resulted from repeated exposure to the generalization probes as Howard[27] and Nickels[1] suggested.

In summary, the investigation by Lowell et al,[24] which used the SFG+SFR paradigm, resulted in generalization to untreated items that cannot be attributed to repeated exposure to generalization probes. Reports of generalization to untreated items in SFG and SFR studies[13,17,18,21,22] are questionable, because they could be the result of repeated exposure to the generalization probes throughout the treatment studies. Future investigations of naming treatment must ensure that some stimuli that are used to probe for generalization to untreated items are reserved for use once prior to treatment and again only after treatment has ended. This practice will improve the validity of their outcomes regarding generalization of treatment effects to untreated items.

Summary and Future Directions

All 3 treatment paradigms that have been called semantic feature analysis treatment – SFG, SFG+SFR, and SFR – have resulted in improved noun naming in individuals with anomic, conduction, Wernicke's, Broca's, and transcortical motor aphasia, as well as individuals with aphasia secondary to traumatic brain injury.[21] Most participants included in the studies had mild or moderate aphasia. Only 1 participant[17] had severe aphasia. More data regarding the outcome of SFG, SFG+SFR, and SFR treatments for severe aphasia are needed. Until such data are available, clinicians should be cautious in applying these treatments to individuals with severe aphasia.

The only participant who demonstrated a nonlanguage cognitive impairment in addition to aphasia was the only participant whose naming ability did not improve in any of the treatment paradigms. This suggests that individuals with concomitant nonverbal cognitive impairments may not be good candidates for these treatments.

Most participants in the SFG and SFG+SFR treatment paradigms maintained improvements after treatment ended. In contrast, only 3 of 7 participants in the SFR treatment paradigm showed robust maintenance of treatment effects after treatment ended. However, because all participants in the SFG and SFG+SFR treatment paradigms were monolingual whereas all participants in the SFR treatment paradigm were bilingual, it is impossible to ascertain whether this difference in maintenance outcomes is related to the different treatment paradigms, to the bilingualism of the participants in the SFR investigations, or both.

The SFG+SFR treatment study by Lowell et al[24] resulted in generalization of naming improvement to untreated items for limited-exposure generalization probes. Participants in the only SFG investigation that limited exposure of generalization probes[23] did not improve on untreated items. The remaining SFG investigations[13,21,22] and the SFR investigations[17,18] exposed their generalization probes to participants repeatedly throughout treatment. This weakens their claim of improvement to untreated items, because participants' ability to name the generalization probes might have resulted from their repeated attempts to name them during the treatment period, as suggested by Howard[27] and Nickels.[1] Future investigations should include a set of limited-exposure generalization probes to provide more data on this question.

Although all 3 treatment paradigms resulted in improved naming abilities, it is possible that each paradigm did so by changing different aspects of semantic processing. The treatment paradigms produced different outcomes for maintenance of treatment effects, which could be a result of differential effects on semantic processing. For example, if SFG requires a deeper level of semantic processing, as Raymer et al[15] contend, perhaps this deeper processing causes longer lasting changes in the system than the SFR paradigm does. This might explain the more variable maintenance outcomes in the SFR investigations. However, the SFR paradigm was only applied to bilingual individuals, so a direct comparison of outcomes is not possible. More confusing still, by changing the SFA treatment paradigm in a major way and still calling it SFA treatment, the authors of the SFR investigations have made it difficult for readers to appreciate the differences among the investigations.

Nickels[1] recommended that investigators use the same treatment task to study many individuals with aphasia to understand which treatments are best for which naming impairments. Using a single name for markedly different treatment tasks will not move us closer to this goal. It is premature to draw conclusions regarding any possible superiority of the SFG, SFG+SFR, or SFR treatment paradigms. However, as research on each of these paradigms proceeds, additional important differences in outcomes may emerge. These differences will only be recognized and subjected to direct comparison if the differences in the treatment paradigms are explicit, which can best be achieved by using different names for each treatment paradigm.

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