Cross-Linguistic Generalization in Treatment of Bilingual Aphasia

For individuals who speak more than one language, aphasia following left-hemisphere stroke or focal brain injury impacts all of their languages to varying degrees. At this time, there is limited research regarding the most effective form of treatment for bilingual aphasia, specifically whether to target one or all languages. Some research has suggested that treating individuals with bilingual aphasia in their non-dominant language (L2) yields positive results in their dominant language (L1) (e.g., Edmonds & Kiran, 2006; Kiran & Roberts, 2010; Kohnert, 2004; Langanaro & Overton Venet, 2001; Marangolo et al., 2009). These findings derive from the mixed model of bilingual language distribution (de Groot, 1992) and the Complexity Account of Treatment Efficacy (CATE; Thompson et al., 2003). Per de Groot's model, there is one semantic system with separate lexicons for each language, and the lexicons have direct access both to the semantic system and one another. The strength of the connection between each lexicon and the semantic system, and between the lexicons themselves, depends upon the individual's proficiency level in each language. Thus, an individual more proficient in Spanish than English would have a weaker link between his/her English lexicon and the semantic system but a stronger link from the English to the Spanish lexicon. The act of speaking English could, therefore, be considered a more complex process than speaking Spanish, as the individual would rely more heavily on the link from the English to the Spanish lexicon to access the semantic system. According to CATE (Thompson, et al., 2003), training an individual on more complex tasks will yield generalization to less complex, related tasks; therefore training this individual in English (more complex process) should yield generalization to Spanish (less complex process).

Edmonds and Kiran (2006) found that treating English-dominant English/Spanish bilinguals in Spanish had positive effects on their English, and that treating an equally proficient Spanish/English bilingual in Spanish had positive effects in both languages. To our knowledge, no studies have specifically examined whether it is effective to treat bilingual individuals whose non-dominant language is *English* in English only. Considering that fewer than 6% of AHSA-certified SLPs speak a language other than English (ASHA, 2010) while the fastest growing U.S. subgroup is comprised of elderly Hispanic individuals (ASHA, 1991), it is reasonable to assume that monolingual SLPs will increasingly be called upon to treat bilingual individuals with aphasia. The purpose of this study was to determine whether treating Spanish/English bilinguals, whose non-dominant language is English, in *English* would improve both of their languages.

Methods

Participants

Two participants were recruited for this study. P1 was a 53-year-old female, equally proficient in Spanish and English, who was seven years post an unspecified right-hemisphere stroke and three years post a left temporo-parietal stroke, with characteristics consistent with conduction aphasia and right hemisphere disorder. P2, a 58-year-old Spanish-dominant male who learned English as an adult, was six months post a left fronto-parietal stroke with resultant Broca's aphasia. Following Edmonds and Kiran (2006), we implemented a single-subject multiple-baseline design to determine the effects of an English-only semantic naming treatment on participants' ability to name: (a) trained, (b) untrained, semantically related, and (c) untrained, unrelated stimuli in both English and Spanish.

Following IRB approval and informed consent, the participants underwent four aphasia assessments, two in English and two in Spanish (Tables 1 and 2) to determine post-stroke language proficiency.

Treatment Protocol

Participants received English-only semantic naming treatment for 60 minutes once per week. P1 received a total of 16 sessions across 24 weeks and P2 a total of 20 sessions across 20 weeks. Treatment stimuli consisted of ten object/animal pictures which participants were unable to name in either English or Spanish during baselines. Semantic features were developed with participants during the first treatment session, with an equivalent number of distractor features developed by the clinician.

During each session, participants were asked to: (a) name each target, (b) organize twelve semantic feature and distractor cards into "yes" and "no" piles, (c) answer twelve yes/no questions regarding the item, (d) name the item again, and (e) (if they were still unable to do so), repeat it five times following a model (Boyle & Coelho, 1995).

Probes

Confrontation naming probes, during which participants were asked to name trained stimuli and untrained, semantically related stimuli in English and Spanish, were completed at the beginning of every other treatment session. Stimulus presentation and target language order were pseudo-randomized across sessions.

Exposure stimuli, unrelated to either the trained or untrained stimuli, were developed and used as probes during baseline and post-treatment sessions to account for potential practice effects.

Results

Within Treatment Performance

P1 and P2 showed statistically significant improvement on naming trained items in English ($p = 0.026$ and $p = 0.0375$, respectively) (Figures 1 and 3). All values were calculated using the C-statistic (Tryon, 1982).

Pre- and Post-Treatment Testing

P1 self-terminated study participation after 16 sessions, and thus did not complete post-treatment testing. P2's post-treatment testing revealed improvement in the naming and auditory comprehension subtests of the WAB (English) and improvement in the naming, semantic opposites, synonyms, and simple antonyms subtests of the Bilingual Aphasia Test (Spanish). P2's overall test scores did not change significantly from pre- to post-testing (Tables 1 and 2).

Probe Performance

Neither participant demonstrated statistically significant within- or cross-linguistic generalization in probes (Figures 2 and 4). However, although P2's performance was highly variable throughout probes, his results did indicate cross-linguistic generalization (using Edmonds and Kiran's (2006) criteria of 40% improvement across three consecutive sessions) to untrained, semantically related words in Spanish.

Conclusions

Our study suggests that semantic naming treatment in English can improve naming of trained words in English, even for individuals several years post-onset. Although treatment appeared to improve general naming abilities in both languages for one participant, no definitive evidence supported the notion of cross-linguistic generalization. Given the uniqueness of each aphasia case and the complex interplay of multiple variables affecting recovery prognosis, it is not possible or advisable to generalize these results. Instead, this study serves as an intermediate step in exploring best treatment options for bilingual individuals with aphasia. Further research is clearly needed to verify, at a minimum: (a) the most effective ways of assessing pre-morbid language proficiency, (b) the impact of brain injury on inhibitory mechanisms involved in switching between languages, (c) the extent to which such damage affects a bilingual individual's ability to access each language, and (d) how these factors impact treatment effectiveness.

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Table 1. Pre- and post-treatment performance on tests administered in Spanish only (BNT; Kaplan et al., 2001, and BAT; Paradis, 1989)

Tests	P1		P2	
	Pre	**Post**	**Pre**	**Post**
Boston Naming Test (BNT)	3%	N/A	22%	27%
Bilingual Aphasia Test (BAT) – Part B (Administered in Spanish only)				
Pointing (%)	100	N/A	100	100
Semi-complex Commands (%)	80		80	60
Complex Commands (%)	20		33	20
Verbal Auditory Discrimination (%)	100		94	94
Judgment of Words/Non-words (%)	70		83	90
Naming (%)	0		**44**	**72**
Word Repetition (%)	47		83	80
Semantic Categories (%)	80		80	40
Semantic Opposites (%)	0		**10**	**40**
Semantic Acceptability (%)	70		70	70
Synonyms (%)	20		**60**	**100**
Antonyms I (%)	0		**40**	**60**
Antonyms II (%)	0		80	60
Reading Words (%)	0		0	0
Reading Sentences (%)	0		0	0
BAT – Part C				
Recognition of words (%) (Spanish to English)	0		60	0
Recognition of words (%) (English to Spanish)	60		100	0
Translation of words (%) (Spanish to English)	10		40	0
Translation of words (%) (English to Spanish)	10		10	0

Note: Per Edmonds and Kiran (2006), positive changes in excess of 10% appear in bold. N/A = not administered.

Table 2. Pre- and post-treatment performance on tests administered in English only (WAB; Kertesz, 1982, and PALPA; Kay et al., 1992).

Test	P1 Pre	P1 Post	P2 Pre	P2 Post
Western Aphasia Battery (WAB)				
Spontaneous speech	13 (65%)	N/A	9 (45%)	4 (20%)
Auditory Comprehension	7.45 (70%)	N/A	**5 (50%)**	**7 (71%)**
Repetition	1.8 (18%)	N/A	2.6 (26%)	3 (30%)
Naming	1.4 (14%)	N/A	**1.5 (15%)**	**4.1(41%)**
Aphasia Quotient	47.3		36.2	36.2
PALPA				
Spoken Word-Picture Matching	80%	N/A	78%	80%
Written Word-Picture Matching	N/A		N/A	N/A
Auditory Synonym Judgments	27%	N/A	48%	50%
Written Synonym Judgments	N/A	N/A	N/A	N/A

Note: Per Edmonds and Kiran (2006), positive changes in excess of 10% appear in bold. N/A = not administered

Participant 1 Results

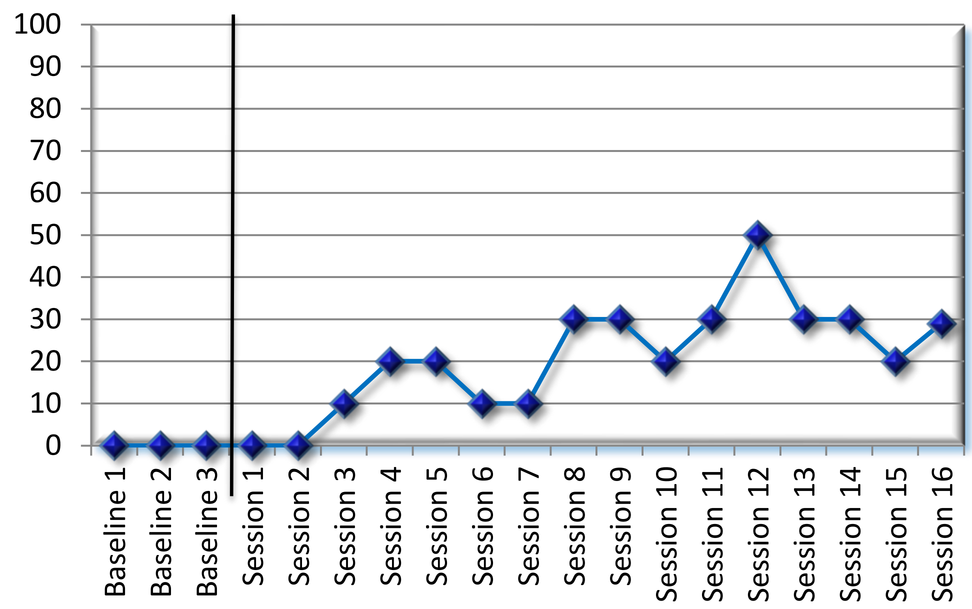

Figure 1. Participant 1 Naming Accuracy During Treatment

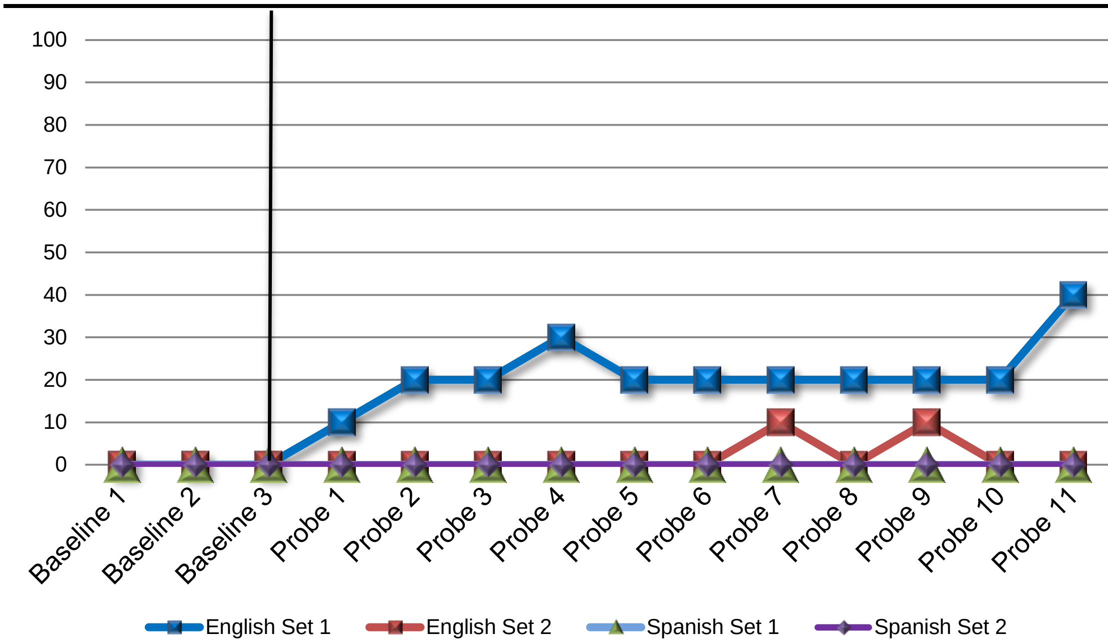

Figure 2. Participant 1 Probes

Participant 2 Results

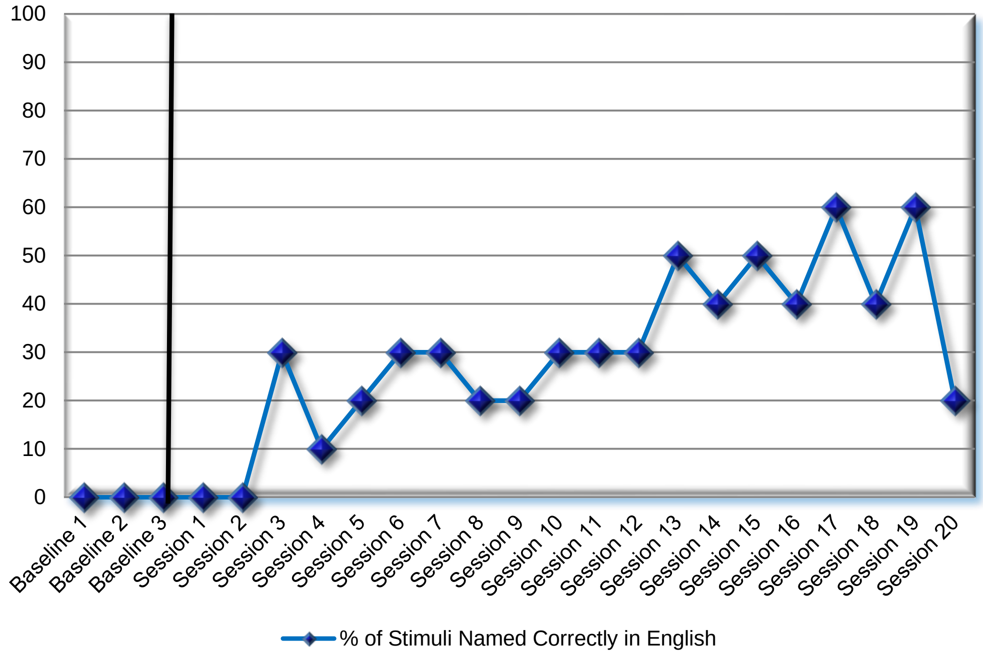

Figure 3. Participant 2 Naming Accuracy During Treatment

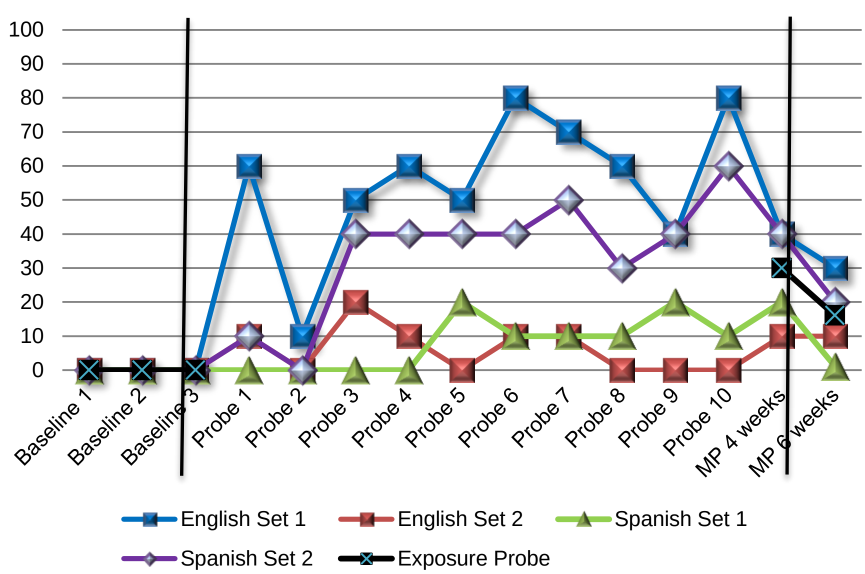

Figure 4. Participant 2 Probes