Familiarity depends on several factors including age of acquisition (AoA), word frequency in one's language, and frequency with which an individual personally uses a word, referred to as subjective familiarity (Davis, 2007; Funnell & Sheridan, 1992; Nickels & Howard, 1995; Noble, 1953; Snodgrass & Vanderwart, 1980). Some words are more rapidly retrieved because the word is more familiar; however, research is limited relative to how stimulus familiarity affects retrieval skills in aphasia. Word retrieval treatments often do not address stimulus familiarity. Familiarity affects retrieval (Davis, 2007; Goodglass, 1993; Goodglass, et al., 2001); thus, how this factor impacts improvement in aphasia treatment is important, regardless of basis of retrieval deficit.

The present study is part of a larger investigation examining influence of stimulus familiarity and treatment approach on retrieval skills in aphasia. Effect of subjective familiarity and ability to improve retrieval skills in short, intensive treatment, using Semantic Feature Analysis (SFA) and Phonological Components Analysis (PCA) was examined in two adults with fluent aphasia

Method

RR and RM participated (Table 1). Both were aphasic due to LH CVA, native English speakers, right-handed, passed a modified hearing screening through speech frequencies, and had chronic aphasia.

Each participant rated stimuli familiarity rating and underwent treatment. Participants had to individually demonstrate understanding of familiarity by reliably rating stimuli using a participant-friendly scale (Fratalli, et al., 1995; Noble, 1953; Paul et al., 2003 (*QCL*)). Degree of familiarity corresponded to number, color, and expression of faces. Participants then rated familiarity of the 260 Rossion and Portois (2004) colorized pictures.

At separate sessions after rating stimuli, participants named all 260 stimuli on 3 different occasions. Pictures that participants failed to name on minimally2 of three trials were selected as potential treatment and probe stimuli. From these, 80 familiar and 80 unfamiliar stimuli were identified, specific to each participant. Stimuli were randomly divided into two groups of forty (20 familiar, 20 unfamiliar) for Treatment 1 and forty (20 familiar, 20 unfamiliar) for Treatment 2. Of the 80 familiar and unfamiliar stimuli for each treatment, 40 (20 familiar, 20 unfamiliar) were identified as treatment and 40 (20 familiar, 20 unfamiliar) as probes (untreated) for examining generalization.

In an alternating treatment design, each participant initially underwent PCA treatment involving 3 baseline sessions and 5 two-hour treatment sessions, followed by standardized testing, and then the same procedure for SFA. Accuracy and reaction time were obtained for all stimuli at baseline and at each session. SuperLab Pro on a Dell laptop computer determined reaction times (RT) for retrieval at baseline and throughout treatment. The *Test of Adolescent/Adult Word Finding (TAWF*) (German, 1990) and the *Western Aphasia Battery-Revised (WAB-R)* AQ (Kertesz, 2007) were administered at beginning and end of each treatment phase for each participant.

Results

Effect of familiarity for all stimuli at baseline was examined. Fisher's Exact Tests were conducted on accuracy data relative to familiar and unfamiliar stimuli. Significant findings were observed for RR, showing significantly more accurate for familiar stimuli ($p = .005$). No significant findings were observed for RM ($p > .05$). (Table 2) Independent sample t-tests conducted on RT revealed significant findings for RM (CI= .235 to 1.20 seconds; $t = 2.923$; $p=$

.004), responding significantly faster for unfamiliar than familiar words. No significant findings for RR (p >.05) (Table 3).

Effect of familiarity for treatment type was examined. Fisher's Exact Tests revealed no significant findings for either treatment type for either participant (p >.05) (Figures 1, 2). Familiarity and treatment type also were examined by comparing mean baseline accuracy to last treatment session accuracy (Table 4). Performance increases were apparent for familiar and unfamiliar stimuli for both treatments for RR. RM showed increases for unfamiliar stimuli in SFA. Independent sample t-tests conducted on RT data yielded significant findings for RM during PCA (CI=.188 to 1.65 seconds; t *(df*=97.8*)* = 2.492; p= .014) and SFA (CI=.080 to 1.93 seconds; t *(df*=80.5*)* = 2.163; p=.034), significantly slower for familiar stimuli during both treatments. No significant findings for RR (p >.05) (Figures 3, 4). Both RM and RR showed noticeable decreases in RT for familiar and unfamiliar stimuli during PCA (Table 5).

Treatment type effects were determined by comparing baseline to day 5 treatment performance. McNemar Tests revealed significant findings for RR after PCA (p=.0312) and SFA (p=.0312). For RM, significant findings were observed for SFA (p=.0312); no significant findings for PCA (p >.05). Paired sample t-tests on RT revealed significantly faster retrieval after SFA (CI= .327 to 2.38 seconds; t *(df=19)* = 2.760; p= .012) for RR, with no significant PCA findings (p >.05). RM exhibited significantly faster retrieval after SFA (CI= -1.67 to -.203 seconds; t *(df=19)* = 4.606; p= .000), but significantly slower retrieval after PCA (CI= -1.67 to -.203 seconds; t *(df=19)* = -2.673; p= .015).

McNemar Tests and paired sample t-tests conducted on probe accuracy and RT, respectively, yielded no generalization effects for either participant for either treatment (p>05) (Figures 5, 6). However, both participants exhibited improvement on the *WAB-R-AQ* and *TAWF* raw scores (Tables 6, 7). Improvement in spontaneous speech on the *WAB-R* and in noun retrieval on the *TAWF* after both treatments was evident.

Discussion

The current findings suggest that familiarity may be an influential factor relative to more accurate retrieval for some aphasic individuals. Subjective familiarity appeared to be less influential on RM than RR's retrieval abilities. Results are congruent with other investigations examining familiarity focused on AoA and word frequency; specifically, familiarity is more or less influential on word retrieval abilities based on the individual participant (Brown & Watson, 1987; Hirsch & Ellis, 1994; Gilhooly & Watson, 1981; Morrison & Ellis, 1992).

No distinct relationship was observed between accuracy and reaction time for familiar versus unfamiliar stimuli within either treatment type for either participant. Thus, it is possible that application of either SFA, theorized to strengthen semantic associations between concepts (Boyle, 2004, Boyle & Coelho, 1995; Conley & Coelho, 2003; Lowell et al., 1995), and PCA, proposed to strengthen phonemic associations with lemmas (Leonard, et al., 2008), led to more accurate word retrieval, masking effects of subjective familiarity on retrieval performance.

Interestingly, RM was significantly faster for unfamiliar word retrieval. There may be different activation levels for familiar and unfamiliar stimuli; higher activation levels yield faster retrieval. RM's low accuracy, yet faster unfamiliar word retrieval may result from conceptual dissociation as well as a category-specific deficit for familiar stimuli (Davis, 2007; Caramazza & Hillis, 1991; Funnell & Sheridan, 1992; Warrington & McCarthy, 1987).

To date, no treatment study incorporating SFA or PCA methodology has included RT relative to word retrieval. RT was examined to accuracy-time trade-off. Treatment effects analysis revealed that RM displayed significantly increased accuracy after SFA. RR

demonstrated significantly increased accuracy after both treatments. Both participants showed significantly faster retrieval after SFA. Thus, direct relationships for accuracy and RT was observed for both participants, specific to SFA: increased accuracy accompanied by significantly faster retrieval. No generalization findings for both participants for either treatment may be due to minimal opportunities to generalize new skills.

The present investigation examined effects of subjective familiarity on retrieval, affirming varied effectiveness of SFA and PCA with two individuals with fluent aphasia. Subjective familiarity influenced accuracy and speed of retrieval under some conditions, motivating further exploration.

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Table 1

Participant Demographic Information

Participant	**Age**	**Gender**	**Years Education**	**Months post-stroke**	**Aphasia Type**
RR	58	Male	20	54	Conduction
RM	64	Female	17	84	Anomic

Table 2 Accuracy: Effect of Familiarity on Word Retrieval at Baseline

Stimuli Type	Range (%) min- max (range)	M (%)	SD (%)
RR			
FAMILIAR	10-60 (50)	35.00	13.817
UNFAMILIAR	0-50 (50)	19.17	13.114
RM			
FAMILIAR			
UNFAMILIAR			

Table 3. Reaction Time: Effect of Familiarity on Word Retrieval at Baseline

Stimuli Type	Range (ms) min- max (range)	M (ms)	SD (ms)
RR			
FAMILIAR	64-9995 (9931)	2711.68	2146.817
UNFAMILIAR	63-9732 (9669)	2803.30	1692.270
RM			
FAMILIAR	63-9881 (9818)	3922.86	1852.124
UNFAMILIAR	63-9128 (9065)	3203.00	1958.580

Table 4. *Treatment Effectiveness Relative to Accuracy (%) of Retrieval of Familiar and Unfamiliar Stimuli*

Participant And Testing Period	SFA Baseline	SFA Day 5 (Post-Tx)	PCA Baseline	PCA Day 5 (Post-Tx)
RR				
Familiar	27	60	30	60
Unfamiliar	33	70	10	50
RM				
Familiar	18	20	3	0
Unfamiliar	7	40	7	0

Table 5. *Treatment Effectiveness Relative to Reaction Time (ms) of Familiar and Unfamiliar Stimuli*

Participant And Testing Period	SFA Baseline	SFA Day 5 (Post-Tx)	PCA Baseline	PCA Day 5 (Post-Tx)
RR				
Familiar	2521	2465	3242	2446
Unfamiliar	2419	2919	3069	1458
RM				
Familiar	3840	5277	4266	2920
Unfamiliar	3241	3675	3323	2253

Table 6

Western Aphasia Battery-Revised AQ Scores throughout the treatment protocol for each participant

Participant Testing Time	Aphasia Quotient Max=100	Spontaneous Speech Max=20	Auditory Verbal Comprehension Max=10	Repetition Max=10	Naming and Word Finding Max=10
RR					
Pre-Tx	71.0	13	9	7.2	6.3
Post-PCA	70.4	13	9.5	7.1	5.6
Post-SFA	73.2	13	9.2	7	7.4
RM					
Pre-Tx	44.4	7	7.4	2.8	5
Post-PCA	56.0	11	8.8	4.1	4.1
Post-SFA	59.2	11	7.8	6.4	4.4

Table 7

Test of Adolescent/Adult Word Finding Scores

Participant Testing Time	TOTAL RAW SCORE Max= 107	TOTAL SS Max >115	% Rank Max=99.9	PN: Nouns Max=37	PN: Verbs Max=21	Sentence Completion Max=16	Description Naming Max=12	Category Naming Max=21
<u>RR</u>								
Pre-Tx	15	<58	<0.1	3	7	1	2	2
Post-PCA	32	<58	<0.1	9	11	3	4	5
Post-SFA	35	<58	<0.1	11	12	3	2	7
<u>RM</u>								
Pre-Tx	10	<70	<1	2	1	5	0	2
Post-PCA	15	<70	<1	6	0	6	2	1
Post-SFA	12	<70	<1	4	1	5	1	1

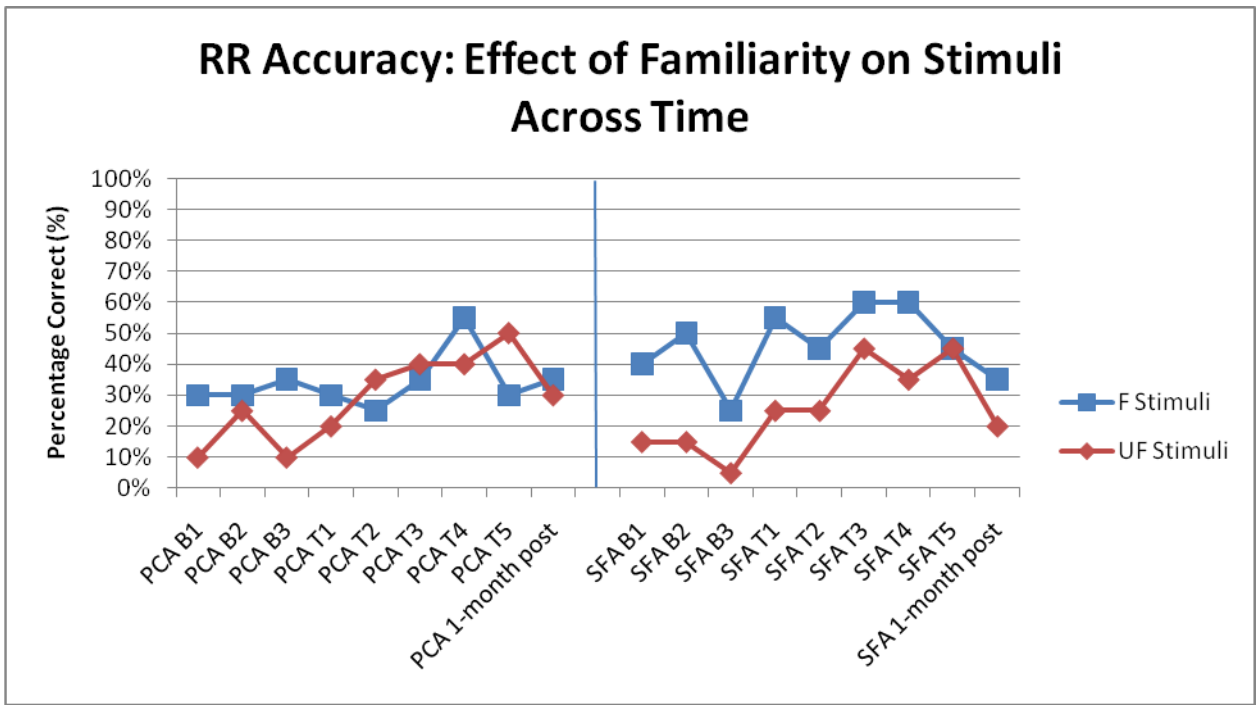

Figure 1

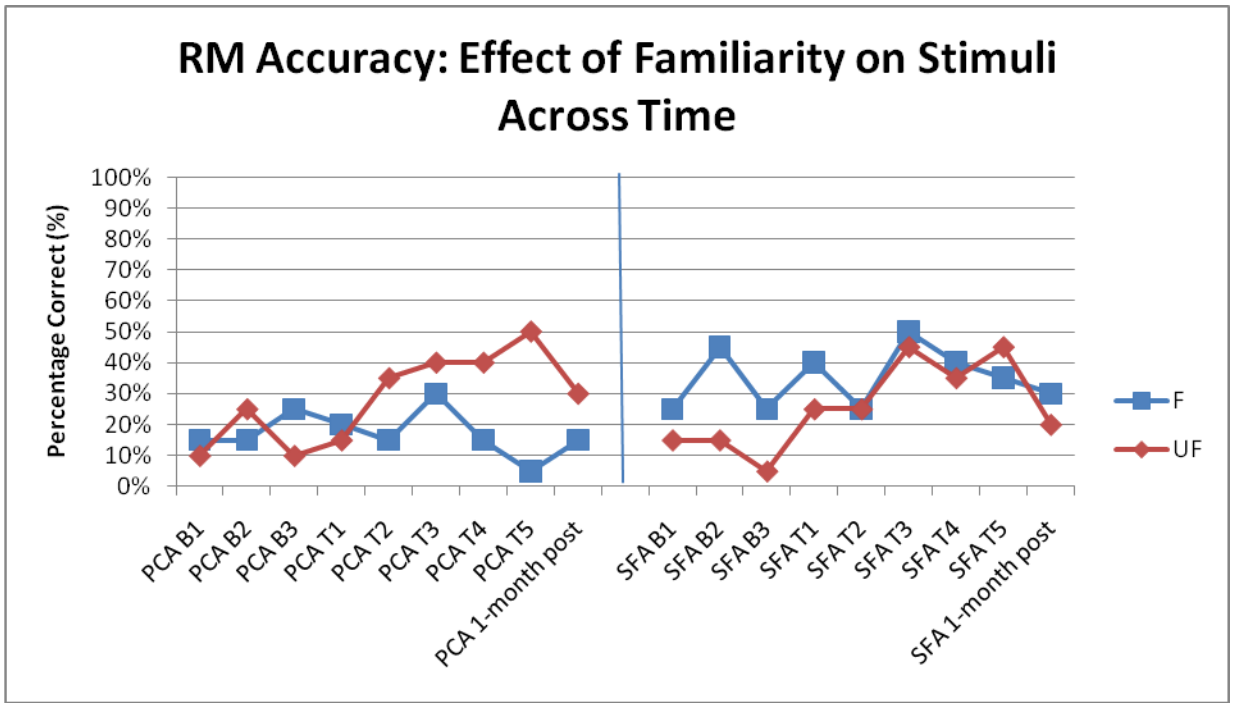

Figure 2

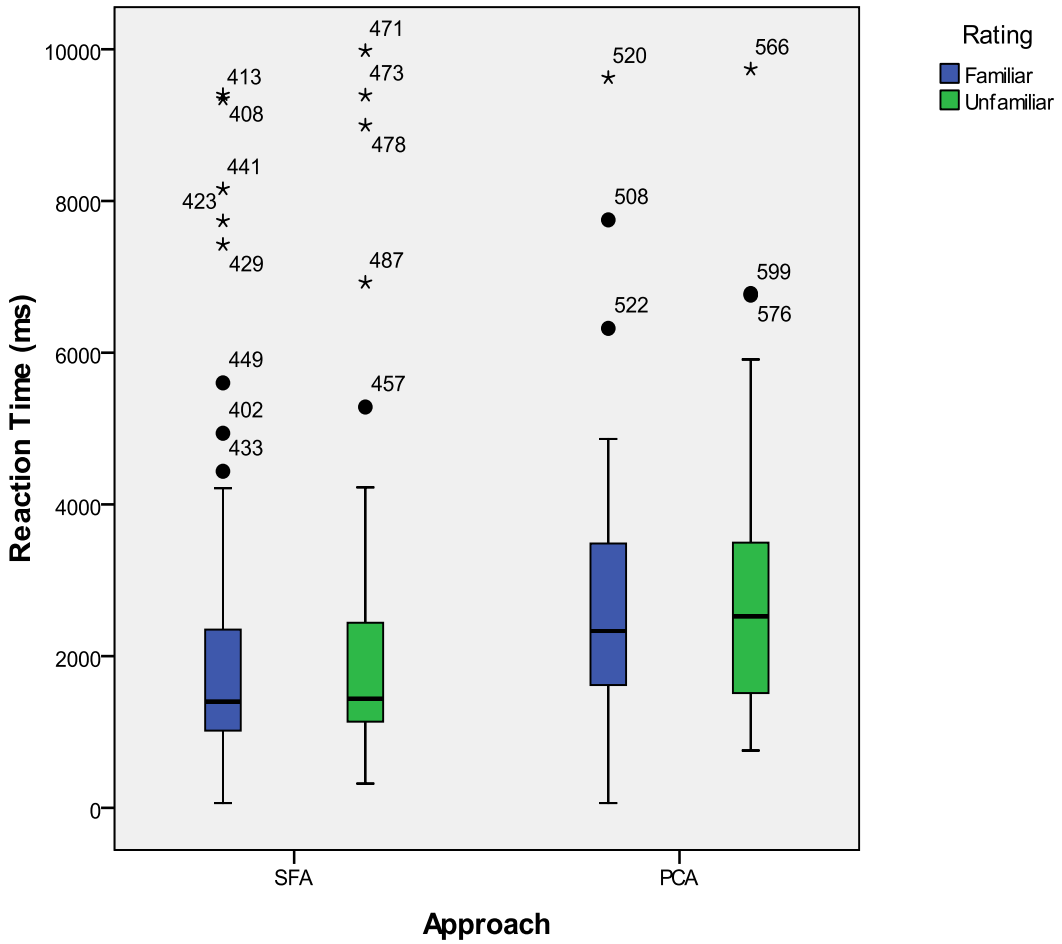

Figure 3

RR Reaction Time: Effect of Familiarity for Treated Stimuli

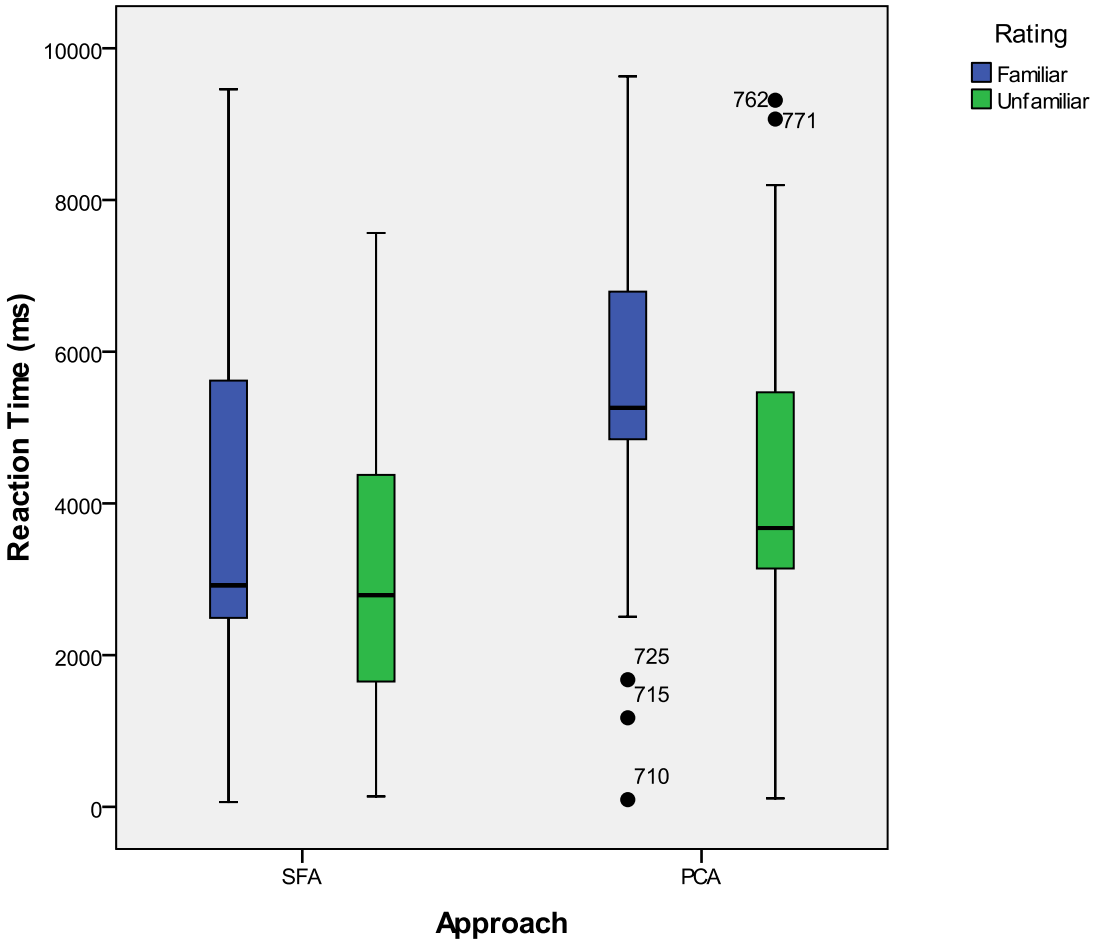

Figure 4

RM Reaction Time: Effect of Familiarity for Treated Stimuli

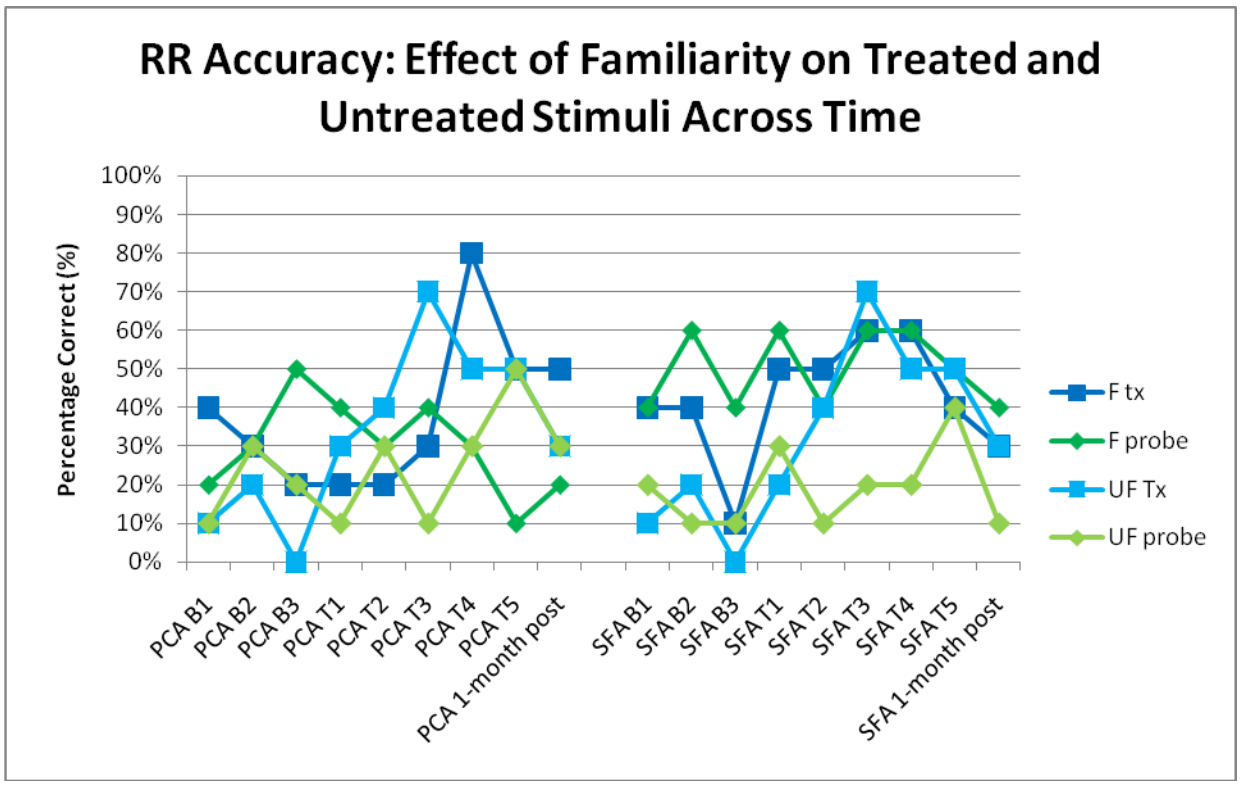

Figure 5

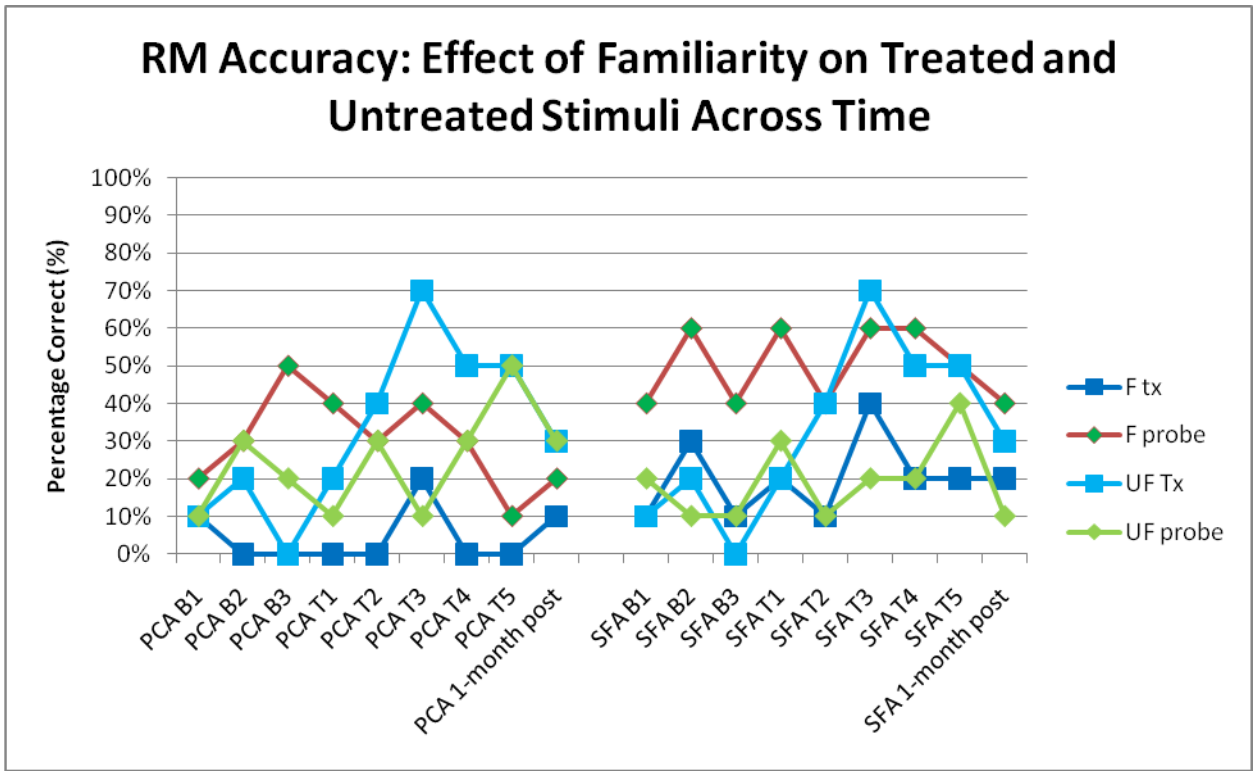

Figure 6