Naming Facilitation Therapy: How many words can be treated this way?

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1. Abstract

Background: Anomia, a word-finding deficit, is the most common reported feature of aphasia and can result in deprived communication which may impact social relationships, well-being and quality of life (Kagan 1998). Facilitation therapy is one a strategy which has been demonstrated to help patients retrieve difficult to access information by strengthening the link between the semantic representations (i.e. meanings) and phonological representations (i.e. sounds) (Edmunson and McIntosh 1995; Nickels 2002a). There is a distinct lack of research into how many words can be treated however, and with an average of only 47 words being typically treated (Snell *et al* 2010).Emerging evidence has suggested that larger set sizes may be tolerated (Kelly and Franklin 2012). This is an exciting prospect given the limited functional gains a small set size offers. If larger sets of words can be treated this would suggest greater opportunity to improve quality of life and increase social participation for people suffering from this restrictive symptom of aphasia.

Aims: The purpose of this study was to investigate if the treatment of a large set of words can still result in significant improvements in word-finding abilities. Specifically, the following questions were posed: (1) Can the treatment of a large set of 500 items, through naming facilitation therapy, still result in a significant improvement in naming accuracy? (2) Is the facilitation effect through a priming mechanism, restoring the connection between meaning and word, or is it a case of re-learning?

Methods: This paper describes a case series of five participants with anomia. All participants were initially assessed to determine if their language and communication impairments and cognitive status met the criteria required to participate in the treatment phase of the study. Participant's received twice-weekly therapy sessions for five consecutive weeks in their own home. 100 items were treated per week. Participants were told the name in the presence of a picture which they had to then repeat. Each item received a total of four repetitions. Treated and untreated sets were retested after the five-week block of therapy. This paper will report on the group results and the results of two participants, POD and JMCC.

Results: Group and case level analysis revealed gains in naming abilities. At group level, raw scores revealed gains in naming accuracy on treated items. No statistically significant difference was found however between the gains made in treated and control sets. On an individual case level, both POD and JMCC made statistically significant improvements on their treated items, with no significant improvements on control items. No statistically significant differences in improvements between sets were found which indicated that there was no recency or primacy effect in the results.

Conclusions: This study suggests that people with aphasia can tolerate large set sizes. The study also indicates that improvements were item-specific with no generalization to untreated words. It also established that there was no primacy or recency effect. This would indicate that the facilitation effect is a priming mechanism and would suggest that there is no obvious upper limit to the number of words that can be improved since it is not a method of re-learning.

2. Introduction

Anomia, a difficulty in naming items, is one of the most common symptoms associated with aphasia (Goodglass and Wingfield 1997). It has been described as being one of the most frustrating and distressing aspects of aphasia (Nickels 2002a) and can impact speech, comprehension, writing and reading. It is said to affect 1/5 of chronic and 1/3 of acute stroke patients (Cummings 2008), with most people with aphasia experiencing at least some level of difficulty in retrieving or pronouncing words (Nickels 2001).

Naming facilitation therapy has been well demonstrated to improve word retrieval, benefits of which tend to be limited to the treated items only (Nickels 2002a).

Treatment of anomia tends to be limited to a very small set of items (Snell *et al* 2010). There is a distinct lack of research into how many words can be treated and with an average of only 47 words being typically treated (Snell *et al* 2010). Considering the size of the average adult lexicon, such small set sizes may have very limited functional gains.

This study examined the facilitation of word retrieval using repetition priming in the presence of a picture of the item. The first objective was to investigate if treating a large set of words [n=500] can still result in statistically significant improvements. The second objective was to investigate the mechanisms involved in the restoration of impaired access to semantic or phonological word-form. If shown to be through a priming mechanism, it would suggest that there would be no obvious upper limit to the number of items that can be treated. If it is a case of re-learning, through recruitment of episodic memory, we would expect to see a short-lasting primacy and recency effect which would suggest a limited capacity for set sizes (Baddeley and Hitch 1993).

2.1 Anomia Types and Language Models

A large number of research papers have examined the processes and stages involved in the production of spoken words which can then inform model-appropriate treatment (Nettleton and Lesser 1991). The underlying deficits experienced by people suffering from anomia will differ across individuals with breakdowns in different points in the complex process of word retrieval.

Cognitive neuropsychological models suggest that oral naming is a process of many steps, starting at a Semantic Level (i.e. concepts and meanings) and moving down to a Phonological Output Lexicon (i.e. a store of spoken word forms) before progressing to the Phonological Assembly which generates a phoneme string ready for the next step, Articulation (Whitworth *et al* 2005).

Assumptions regarding the stages and processes involved vary somewhat, such as, the amount of cascading and feedback in the system (Levelt *et al* 1999). They all however have the ability to account for the locus of breakdown in oral naming and this allows for treatment to be targeted more accurately (Nickels 2001). For example, phonological lexical system impairment tends to lead to word retrieval problems whereas semantic-lexical system impairments tend to lead to difficulties in both spoken naming and auditory comprehension of words (Raymer *et al* 2012).

2.2 Treatment Approaches

Studies have shown that anomia therapy is effective (Laganaro *et al* 2006). Anomic patients are not a heterogeneous group however and present with cognitive differences and anomia severity variances (Snell *et al* 2010). Cognitive neurological model of the lexical processing system serves as a basis for inferring the loci of impairment and treatments that rely on a cognitive analysis of the impairment can be guided by model-appropriate therapy e.g. conceptual-semantic impairments may be treated with semantic therapy (Nettleton and Lesser 1991). Howard (2000) has however highlighted the indistinguishability between semantic and phonological therapies, as they often both provide the meaning and phonology and therefore may inadvertently treat both. Three types of naming therapies are detailed below: Naming Facilitation Therapy; Semantic Naming Therapy; and Phonological Naming Therapies.

Naming Facilitation Therapy (Semantic & Phonological)

Naming facilitation can be achieved through various means e.g. telling a patient the name in the presence of a picture which they then repeat. This involves the task of matching meaning to the phonological word form (Howard *et al* 2006). The treatment is

suggested to work by priming the link between meaning and the word form (Hickin *et al* 2002). Wheeldon and Monsell (1992) demonstrated that repeated production of a word alone does not result in a persistent priming effect. The treatment must therefore involve repeated mapping of the meaning to its phonological word-form. The treatment has been shown to be effective for those with impairment at phonological-lexical level (Nickels 2002a) and has also been demonstrated to be effective for those with impairment at the lexical-semantic level (Coelho *et al* 2008) and some improvements in those with semantic specific impairments (Hickin *et al* 2002).

This is a form of errorless learning which has been shown to be as effective as errorful learning (Conroy *et al* 2009). It has also been suggested that errorless learning helps prevent the strengthening of naming errors, as each time a response is produced , whether correct or not, the chance of that same response happening again is increased (Fillingham *et al* 2006). Some studies have also shown that errorless techniques are preferred by clients as they tend to be less frustrating and effortful (Raymer *et al* 2012).

The duration of the beneficial effects of therapy is an unresolved area with more research warranted. The effect of naming facilitation therapy has been shown in certain cases to have long lasting effects however. In the cases of GMA and RBO (Miceli *et al* 1996), naming ability on treated items were significantly better than baseline, 17 months and 3 weeks post treatment respectively.

There is strong evidence that the benefits of facilitation therapy are item specific and that it doesn't generalise to untreated words (Laganaro *et al* 2006; Nickels 2002b; Nickels and Best 1996a; Wheeldon and Monsell 1992).

The facilitation effect is suggested to be through a priming mechanism as improvements in the case of TP (Kelly and Franklin 2012) were not subject to a primacy or recency effect. A short-lasting primacy and recency effect would have been expected if facilitation was a case of re-learning through information being retained in working memory (Schachter *et al*, cited in Eysenck and Keane 2005). Naming facilitation is therefore suggested to be a long lasting treatment as it does not rely on new learning. It

would also suggest that there is no obvious upper limit to the number of words that can be treated.

This current study aims to further investigate if the facilitation effect is through a priming mechanism or if it is a case of episodic memory involvement and deliberate word learning.

Semantic Therapies for Naming

Many semantic based therapies have been shown to be effective in targeting impairments at semantic and conceptual-semantic levels e.g. Semantic Features Analysis (SFA) (Ylvisaki and Szekeres as cited in Boyle 2010) and Semantic Impairment Therapies (Hillis 1998). Such treatments do not focus on treating impairments at phonological-lexical level however. A Compensatory Approach has also been shown to be effective but this therapy is unsuitable for many clients due to the need for other skills (e.g. writing) to be intact (Nickels 2002a).

Phonological Therapies for Naming

Phonological therapy has been demonstrated to be effective in treating difficulties in retrieval of the phonological form (Nettleton and Lesser 1991; Nickels 2002a; Hicken *et al* 2002) as it is suggested that it helps activate the phonological word form (Wheeldon and Monsell 1992). Phonological therapies include: (1) Syllable counting; (2) Repetition (phonological word-form only); (3) Pointing to the letter that matches the phoneme; and (4) Phonological cueing (Nickels 2002a). Caution must be heeded when interpreting results of phonological therapies however, as they may unwittingly involve a semantic component e.g. a picture of the target item (Howard 2000). As a result, improvements may be somewhat a result of strengthening the semantics to the phonological word-form (Miceli *et al* 1996).

2.3 Generalisation

There is strong evidence that facilitation therapy doesn't generalise to untreated words (Laganaro *et al* 2006; Nickels 2002b; Nickels and Best 1996a; Wheeldon and Monsell 1992). In the case of GMA (Miceli *et al* 1996) a direct analysis of performance with a

control set of semantically related items indicated that no generalisation occurred as there was no significant improvement in these control set items.

Other naming therapies such as SFA suggest a generalisation effect. Lowell *et al* (1995) is one such study which showed that untreated items improved post therapy. This was reported as strong evidence of generalisation. Generalisation in SFA is a controversial area however. Generalisation from SFA has come into question in recent times, with suggestions that this 'generalisation' may just be the product of repeated exposure to untreated items such as during assessment (Nickels 2002a; Kelly and Franklin 2012) and hence could be argued to be a practice effect. Howard (2000) added to the body of evidence and reported that patients did not improve on their naming of an untreated control set when it was only presented once before and after therapy.

As recommend by Boyle (2010) and Howard (2000), this current study will ensure control items are reserved for just one use to get baselines and once again after treatment. This consideration allows for monitoring for efficacy of the treatment whilst also allowing scope for accurate conclusions on generalisation.

2.4 Set Size and Intensity

There is a gap in the literature in relation to the optimum number, or the upper limit of items to treat. Snell *et al*'s (2010) meta-analysis of anomia studies found that the average number of items provided in therapy was 47. Considering the size of a typical adult lexicon, this set size will have limited functional gains. Evidence in the literature suggests that anomic patients can tolerate larger sets of items for therapy, resulting in more positive outcomes (Kelly and Franklin 2012; Laganaro *et al* 2006; Sage *et al* 2011).

It would appear that the extent of the effect of therapy is determined more by the number of items treated than the number of repetitions per item (Franklin and Kelly 2012; Laganaro *et al* 2006; Wheeldon and Monsell 1991). Greater amounts of therapy, delivered as an intensive and long-lasting programme have however been shown to result in better outcomes when compared to less intense and shorter durations of therapy (Basso 2005). It is also suggested that aphasic patients and their care-givers need

to be more involved in therapy to promote continuous rehabilitation. Support from a trained person has been shown to have similar outcomes compared to SLT delivered anomia therapy which is encouraging for future research into the most appropriate model of service delivery (Greener *et al* 1999).

This current study will have a drill total of four repetitions for 500 items. This drill total is significantly smaller than typical treatment which typically involves many more drills per item for example, 30 facilitations per item (Snell *et al* 2010). The number of items targeted in this study will be significantly greater than the average 47 items treated (Snell *et al* 2010). This reduced drill total and larger set size will allow for conclusive examination of improvements due to a priming mechanism.

2.5 Significance of this Study

There is a distinct lack of research into how many words can be treated through naming facilitation. This current study aims to add significant evidence to the small body of literature on set size and investigate if there is any justification for treating smaller sets instead of larger sets. The study will also investigate the mechanisms involved in restoring impaired access to everyday nouns.

If treatment of a large set is shown to still be effective, this may open the prospect of greater functional outcomes for people with aphasia. It is envisaged that, if successful, this therapy may be delivered outside of the clinic e.g. carried out at home, which will be advantageous for anomic patients given the potential to target many more items than ever before thus improving their functional gains and all in the comfort of their own home.

3. Methodology

A distinct lack of research is available to suggest optimal or upper limits of how many items can be treated through naming facilitation therapy. This study aims to test if large sets can be treated this way and will also investigate if the facilitation effect is a priming mechanism or if it is a case of re-learning.

In undertaking this research project, the following hypothesis will be tested:

- H0: There will be no change between baseline and post-treatment for the 500 treated words.
- H0: There will be no change between baseline and post-treatment for the 100 untreated words.
- H0: There will be no significant differences post treatment between improvements in sets treated in the first and last week and the sets treated in the three weeks in between.
- H1: There will be a change between baseline and post-treatment for the 500 treated words.
- H2: There will be a change between baseline and post-treatment for the 100 untreated words.
- H3: There will be significant differences post treatment between improvements in sets treated in the first and last week and the sets treated in the three weeks in between.

3.1 Participant Selection

Following ethical approval by the HSE Mid-Western Regional Hospital Research Ethics Committee, eight participants were recruited using judgement sampling, sourced from HSE clinics through local community therapists. Three participants opted out of the research prior to commencement of data collection. The remaining five participants (2 Males and 3 Females) completed the full programme. The group consisted of 3 female and 2 male participants. Informed consent was obtained from all participants using an aphasia friendly consent form and information sheet.

Inclusionary Criteria:

(1) Confirmed diagnosis of anomia with naming accuracy of between 10-70% on the Boston Naming Test (Long Version, n=60) (Kaplan *et a*l 2001).

(2) No more than one known CVA and at least six months post-onset (time post CVA ranged from 1-10 years).

(3) No severe cognitive deficits and no significant visual or spatial dysfunction and neglect, as indicated by their results in the Ravens Matrices Set A The Ravens Coloured Progressive Matrices Set A (Raven *et al* 1998) and the Clock Drawing Test (Shulman *et al* 1993).

(4) No significant comprehension difficulties which would hinder their ability to process pictures in therapy as indicted by the Comprehension of Spoken Word to Picture subtest of the Comprehensive Aphasia Test (CAT) (Swinburn *et al* 2004).

(5) No phonologic assembly deficits which would impede their ability to repeat words in therapy as indicated by their performance in the Word Repetition sub-test of the Comprehensive Aphasia Test (CAT) (Swinburn *et al* 2004).

(6) Native speakers of English.

(7) Over 30 years old (age range was 70-90 yrs).

(8) Not receiving any other speech and language therapy.

(9) No difficulty with (corrected/assisted) hearing or eyesight.

3.2 Design

An item specific design was chosen as it allows for the identification of a treatment effect by contrasting the gains made in treated versus untreated items. If treatment is effective, significant improvements should be observed in the treated set only. The untreated set (n=100) will serve as a control to confirm if there is a treatment specific effect.

The Boston Naming Test (35 untreated items and 25 treated items) and the PALPA No. 54 Naming x Frequency test (20 untreated) items were chosen as related control tasks also. Any significant improvement in these untreated control tasks could indicate a generalisation effect (Franklin 1997).

This study investigated the treatment effects of the entire group, and then each researcher chose two participants for single subject analysis. In this paper, I will elaborate on two individual cases, MOB and JMCC, along with reporting of the group data.

3.3 Reliability

All assessment and treatment sessions were audiotaped to allow for verifying transcription accuracy. An independent rater cross-checked the scoring of assessments to ensure accuracy and consistency. Assessment and therapy protocols were strictly adhered to, to ensure consistency in scoring, cueing, timing and feedback for all participants. Outcome assessors were not aware of participant's baseline scores or performance during therapy. This was done to help reduce assessment bias as assessors did not have an expectancy bias for words they felt the participants should accurately name, based on prior performance. Treatment and control sets were matched for word-frequency, word-length and naming agreement to ensure they were balanced. Assessments were not at ceiling or floor level, indicating that improvements are as likely to be achieved in each task (Franklin 1997).

3.4 Assessments

Language Assessments

Naming: The long version (n=60) of the Boston Naming Test (Kaplan *et al* 2001) was used to measure confrontational word retrieval, which provides an indicator of anomia severity. PALPA No. 54 Naming x Frequency test (Kay *et al* 2007) was also used to measure confrontational word retrieval with the potential to identify the effect of frequency on word retrieval. Baseline naming abilities on the 500 treated items and 100 control items was also captured in order to measure gains made across treated and control sets post-therapy.

Word Comprehension Test: The Spoken Word to Picture, sub-test No. 7 of the Comprehensive Aphasia Test (CAT) (Swinburn *et al* 2004) was used to detect any comprehension difficulties and also probed for any potential auditory comprehension deficits as indicated by semantic or phonological errors.

Input & Output Phonology: Repetition abilities were tested using the Repetition of Words, No.12 sub-test of the Comprehensive Aphasia Test (CAT) (Swinburn *et al* 2004).

This also examined the effect of word length, frequency and imaginability on auditory word repetition.

Other Assessments

Executive / Visuospatial Functioning: The Clock Drawing Test (Shulman *et al* 1993) was used to detect any executive function difficulties. It was also used to detect any visuospatial neglect.

Cognitive Ability: The Ravens Coloured Progressive Matrices Set A (Raven *et al* 1998) was used to detect any general intelligence and educative difficulties.

Results of assessments are summarized in Table 1.

3.5 Participants

This study investigated the treatment outcomes for the group and individual participants. All participants met the inclusionary criteria as outlined in 3.1. A detailed profile of participants POD and JMCC are provided below. Participant's background information and pre-treatment assessment results are summarized in Table 1. This paper will describe the analysis and interpretation of POD and JMCC's results along with reporting of the group outcomes.

POD:

POD was a 76-year-old man who lived with his wife. He had a CVA 10 years prior to the study which left him with right-sided hemiplegia. His speech was non-fluent with marked word-finding difficulties. He required help with transfers, personal care and meals. He was a keen musician prior to his CVA. He rarely left the house but enjoyed the regular visits of his neighbours, family and friends. He enjoyed watching Gaelic football and horse racing on the television. He had limited spontaneous speech, producing single words mostly. He had relatively good comprehension of everyday conversations. Hearing was not formally tested but problems were evident at higher frequencies. Hearing was reported to be worse in his right ear. Eyesight was not recently tested but some problems were evident. As a result, adaptations were made during the study to ensure POD could effectively engage in the study (e.g. optimal seating position, increased

volume of the therapist, improved lighting and presenting images closer to participant with the use of a magnifying sheet where necessary).

Result on the Boston Naming Test was 15/60 indicating severe word-finding difficulties. Semantic cueing was largely ineffective and phonemic cueing was completely ineffective. The PALPA No. 54 Naming x Frequency showed mild frequency effects (Low Frequency 18/20, Medium Frequency 10/20 and High Frequency 6/20). Naming errors were predominantly semantic in nature. The CAT Real Word Repetition test score was 26/32 which is within the norm for non-aphasiac subjects. The CAT Comprehension of Spoken Words was more impaired, with a score of 21/30. A score of 8/12 on the Ravens Coloured Progressive Matrices and 2 on the Clock Test indicated no serious Cognitive, Visuospatial or Executive Function which would hinder POD's ability to participate in the treatment phase of the study.

Analysis of the data implies that impairment may lie at the level of the phonological output lexicon or access to it via the semantic system (See Appendix 1).

JMCC:

JMCC was a 90-year-old man who lived on his own. He had a CVA 10 years prior to the study. His speech was fluent with word-finding difficulties. He was a retired CEO and was very physically and socially active, both pre and post CVA. He described his word-finding problems as being very frustrating in social situations as he really enjoys talking to others and was always the centre of conversations prior to his CVA. He had good comprehension of everyday conversations. He used circumlocution along with gesture to get his message across. His wife passed away five months prior to the study. He receives regular visits from family and friends and enjoys his frequent visits to the local pub and social outings such as race meetings.

Result on the Boston Naming Test was 12/60 indicating severe word-finding difficulties. Semantic cueing was largely ineffective and phonemic cueing was more effective. The PALPA No. 54 Naming x Frequency indicated no frequency effect (Low Frequency 8/20, Medium Frequency 7/20 and High Frequency 7/20). Naming errors were predominantly

semantic in nature and circumlocutions. The CAT Real Word Repetition test score was 31/32 which is within the norm for non-aphasiac subjects. The CAT Comprehension of Spoken Words was more impaired, with a score of 20/30. Error types were mostly phonological distractors, with one instance of a semantic distractor error. A score of 9/12 on the Ravens Coloured Progressive Matrices and 2 on the Clock Test indicated no serious Cognitive, Visuospatial or Executive Function which would hinder JMCC's ability to participate in the treatment phase of the study.

Analysis of the data implies that impairment may lie at the level of the phonological output lexicon or access to it via the semantic system (See Appendix 1).

Table 1 – Participant Background Information and Pre-Treatment Assessment Results

	POD	JMCC	MOB	GM	AB
Age	76	90	78	70	75
Gender	M	M	F	F	F
Time Post Onset (months)	120	120	36	30	12
Boston Naming Test *Long Version (n=60)*	15/60	12/60	20/60	26/60	15/60
PALPA No. 54 *(Picture Naming x Word Frequency)* (n=60)	34/60	22/60	39/60	41/60	38/60
CAT *(No. 7 Comprehension of Spoken Word to Picture)*	21/30	20/30	27/30	28/30	26/30
CAT *(No.12 Repetition of Words)*	26/32	31/32	29/30	27/30	30/30
The Clock Drawing Test	2	2	3	3	1
The Ravens Coloured Progressive Matrices *(Set A)*	8/12	9/12	11/12	12/12	10/12
Treatment Items (500)	109/500	73/500	227/500	229/500	152/500
Untreated (Control) Items (100)	22/100	20/100	50/100	68/100	35/100

Boston Naming Test (Kaplan *et al* 2001). **Psycholinguistic Assessment of Language Processing (**PALPA) No. 54 Naming x Frequency Test (Kay *et al* 2007). **Comprehensive Aphasia Test** (CAT) (Swinburn *et al* 2004). **The Clock Drawing Test** (Shulman *et al* 1993). **The Ravens Coloured Progressive Matrices Set A** (Raven *et al* 1998)

3.6 Materials

A total of 600 pictures representing nouns were used in a slide show format (500 treated, 100 control). The items chosen were based on the Snodgrass pictures (Snodgrass and

Vanderwart 1980) and were previously used in Kelly and Franklin's study (2012) (See Appendix 2).

The items were divided into 6 sets, comprising of 1 control (untreated) set and 5 treatment sets. Each set was balanced for naming agreement, frequency and syllable length as follows:

- The 600 pictures had at least 80% naming agreement (Kelly and Franklin 2012)
- Sets were balanced for frequency according to the CELEX database (Baayen *et al* 1995; Kelly and Franklin 2012). The mean log frequency for the selected words was calculated as 2.63 (SD .70, range 48-4.17) (Kelly and Franklin 2012).
- Sets were balanced for syllable length. The mean syllable length was 1.72 (S.D.74, range 1-4) (Kelly and Franklin 2012).

3.7 Therapy Sets

The 500 treatment words were divided into 5 sets. A different set of 100 words was treated each week. No set was significantly different in terms of frequency, syllable-length and baseline naming ability (Franklin 1997; Kelly and Franklin 2012). Coloured images from the internet were randomly presented in slide show format within their designated treatment set. Arrows were provided in pictures where the target was difficult to depict. Each participant was assigned a different treatment set every week. This ensured that any differences between treatment sets are attributable to the week that they were treated, rather than the words in the treatment set.

Table 2 – Treatment Sets

POD	
Treatment Week	**Set Treated**
1	No. 4 (n=100)
2	No. 5 (n=100)
3	No. 1 (n=100)
4	No. 2 (n=100)
5	No. 3 (n=100)

JMCC	
Treatment Week	**Set Treated**
1	No. 1 (n=100)
2	No. 2 (n=100)
3	No. 3 (n=100)
4	No. 4 (n=100)
5	No. 5 (n=100)

3.8 Method of Therapy

The study comprised of a 5-week block of therapy with assessments pre and post therapy (See Appendix 3). Baselines were established prior to therapy over the course of two sessions, one session per week over a period of two weeks. In week one, 50 control words and 250 treated words were assessed. The remaining 50 control words and 250 treated words were assessed in week two. The eighth and final week involved post-treatment assessments which were carried out over two sessions in the week (i.e. 2 x 60 minute sessions). In this eighth week, a blind-assessor obtained post-treatment outcomes of the treated 500 treated words and 100 control words. They also re-assessed the related control tasks: 1) untreated and treated words from the BNT (n=35, n =25 respectively) and 2) untreated words from the PALPA No. 54 (n=20). The employment of a blind assessor reduced expectancy bias from a familiar assessor, which could impact the reliability of the results.

Phonological errors were not accepted in assessment but distortions were accepted if they did not represent a phonological substitution. Each client had demonstrated the ability to repeat words during the initial assessment process, and therefore would be expected to accurately repeat the words during therapy.

The treatment phase took place over five consecutive weeks, with two, 30-minute sessions occurring each week (i.e. 10 x 30 minute therapy sessions in total). Treatment consisted of showing the participant the picture whilst simultaneously naming the item and asking them to repeat it. Four facilitations were provided for each item in total. This is a form of errorless learning and is therefore expected to reduce the chance of activating incorrect semantic or phonological forms of the target word in order to ensure accurate phonological and semantic priming (Fillingham *et al* 2006). No other practice on items outside of therapy sessions was recommended. Therapy was carried out in each client's home for the entire duration of the study, with the exception of POD, who during week 1 of therapy and for post therapy assessment was seen in a hospital setting. POD was was staying as an in-patient for respite care on these occasions.

4. Results

In this section, results are separated into two sections: (1) Group results and, (2) Individual case results of two of the five participants POD and JMCC. Parametric statistical tests such as ANOVAs could not be carried out on this data as exploration of the data revealed that it was not normally distributed (skewness > -1 and kurtosis <0). The data was therefore analysed using non-parametric statistical tests.

4.1 Group Results

500 Treated Set

Raw scores revealed that the 5-week therapy programme improved the group's naming accuracy for the treated items (See Figure 1 and Table 3). A paired-samples t-test was conducted to compare the naming accuracy for the treated set pre and post therapy. There was not a significant difference in the scores for pre therapy (M=34.4, SD=18.25) and post therapy however (M=44.04, SD=18.47) conditions; t(4)=-2.154, p=.098.

100 Untreated (Control) Set

Raw scores reveal that there was no improvement in untreated items, which as expected, would indicate that benefits are item specific with no generalization to untreated items. A paired-samples t-test was conducted to compare the naming accuracy for the untreated set pre and post therapy. There was not a significant difference in the scores for pre therapy (M=39, SD=20.17) and post therapy (M=39.4, SD=21.52) conditions; t(4)=-.073, p=.945.

Figure 1 – Group Results: Naming Accuracy (Treated and Untreated Set)

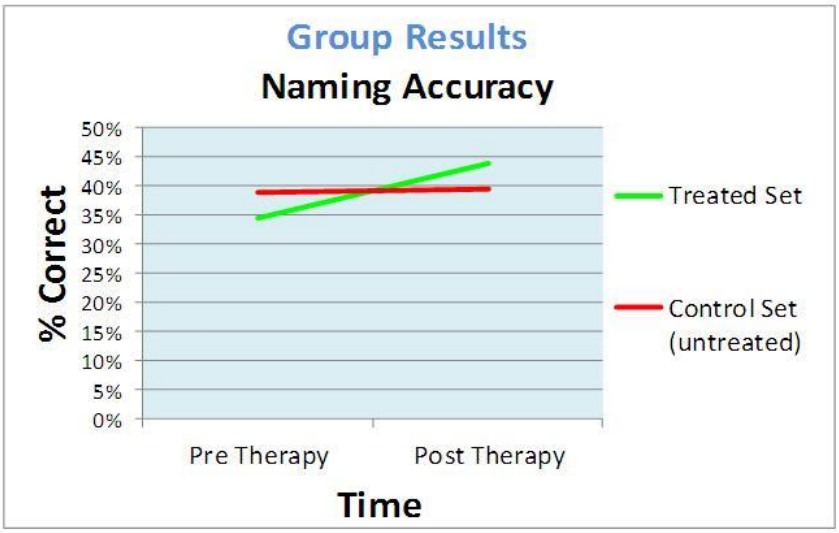


Table 3 – Group Results: Naming Accuracy (Treated & Untreated Set)

	Group Results	
Set Type	**Pre Therapy Mean Score**	**Post Therapy Mean Score**
Control Set *(n=100)*	39	39.4
Treated Set *(n=500)*	172	220

Control Task Analysis

Raw scores of two related control tasks, the untreated BNT and PALPA No. 54 Naming x Frequency indicate no/minimal improvements (See Table 4 and 5). Paired-samples t-tests were conducted to compare the naming accuracy for the related control items pre and post therapy.

Untreated BNT items: There was no significant difference in the scores for pre therapy (M=19.42, SD=6.54) and post therapy (M=18.86, SD=7.47) conditions; t(4)=.152, p=.886.

Untreated PALPA items: There was no significant difference in the scores for pre therapy (M=52, SD=18.91) and post therapy (M=60, SD=12.24) conditions; t(4)=-1.281, p=.269.

Outcomes for both the untreated BNT items and untreated PALPA items would support the case for a treatment effect.

Raw scores revealed that the BNT treated items improved (See Table 4 and Figure 2). There was not a significant difference however in the scores pre therapy (M=40.8, SD=16.35) and post therapy (M=50.4, SD=15.90) conditions; t(4)=-1.760, p=.153.

Figure 2 – Group Results: Boston Naming Test (Long Version)

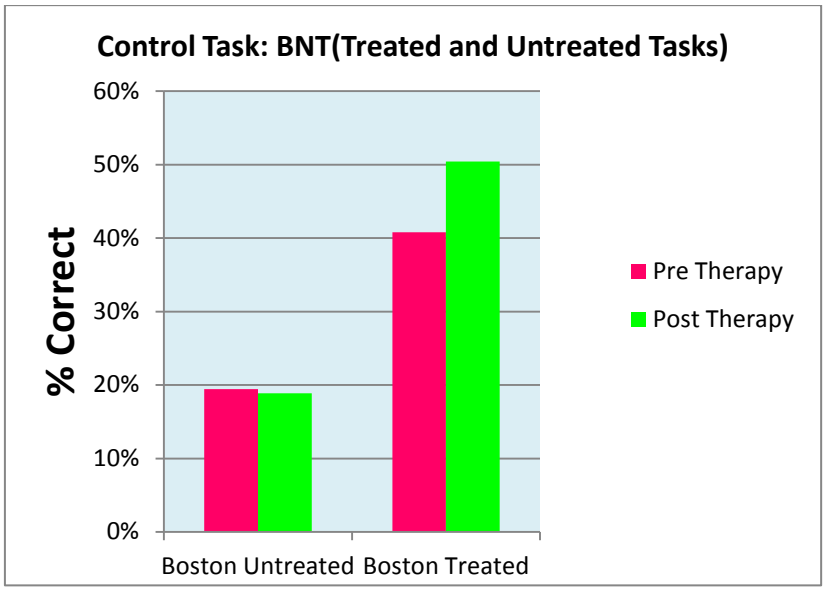


Table 4 – Group Results: Boston Naming Test (Long Version)

	Group Results	
Set Type	**Pre Therapy Mean Score**	**Post Therapy Mean Score**
Untreated Items *(n=35)*	6.8	6.6
Treated Set *(n=25)*	10.2	12.6

Figure 3 – Group Results: PALPA No. 54 (Picture Naming x Word Frequency)

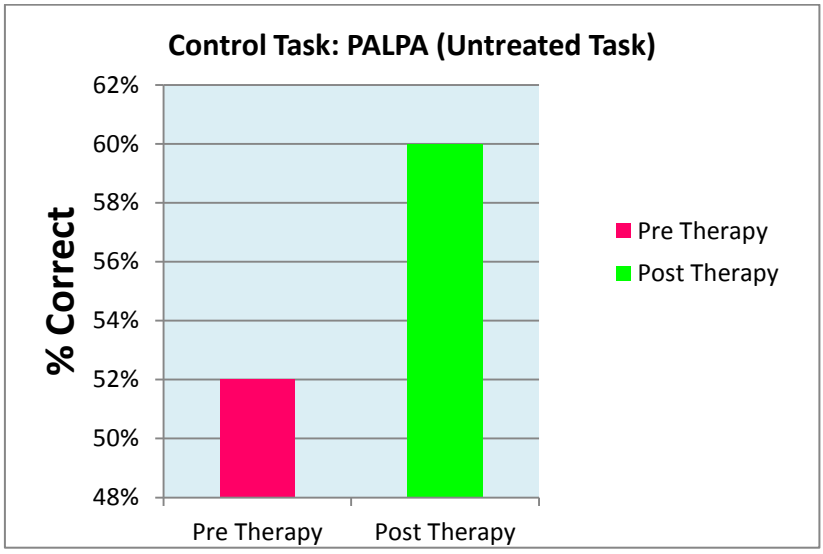


Table 5 – Group Results: PALPA No. 54 (Picture Naming x Word Frequency)

	Group Results	
Set Type	**Pre Therapy Mean Score**	**Post Therapy Mean Score**
Untreated Items *(n=20)*	10.4	12

4.2 Individual Results

POD

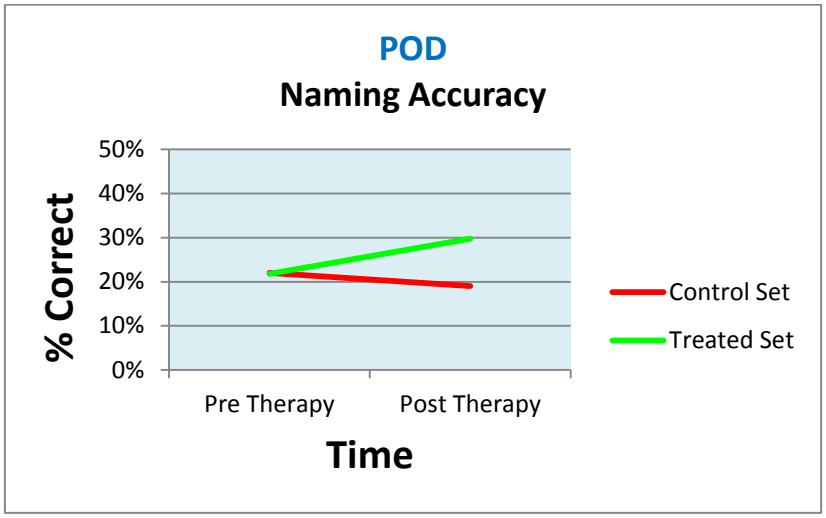
500 Treated Set

Statistical analysis found a significant improvement between pre and post therapy scores (McNemars test, p <.001) (See Figure 4 and Table 6).

100 Untreated (Control) Set

Statistical analysis found no significant improvement between pre and post therapy scores (McNemars test, p= .678), this, as expected, would indicate a treatment effect and also suggest that benefits are item specific with no generalization to untreated items.

Figure 4 - POD: Naming Accuracy (Treated and Untreated Set)



Control Task Analysis

Two related control tasks, the untreated BNT and PALPA No. 54 Naming x Frequency items were statistically analysed. The analysis of untreated BNT items found no significant improvement between pre and post therapy scores (McNemars test, p=.289). The analysis of untreated PALPA items also found no significant improvement between pre and post therapy scores (McNemars test, p= 1.000). This would support the case for a treatment effect. (See Tables 7 and 8 & Figures 4 and 5)

Raw scores revealed that the BNT treated items improved (See Table 7 and Figure 5). A statistical analysis of the treated items from the BNT however found no significant improvement between pre and post therapy scores (McNemars test, p= .125).

Figure 5 - POD: Boston Naming Test (Long Version)

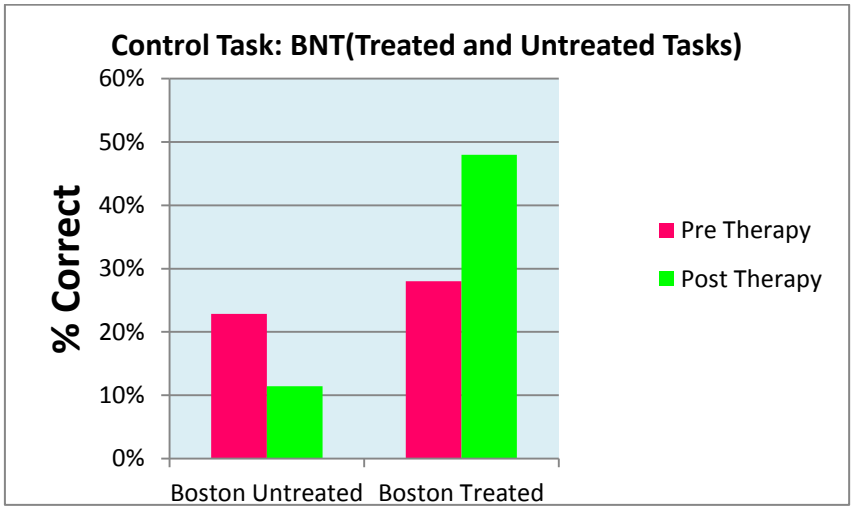
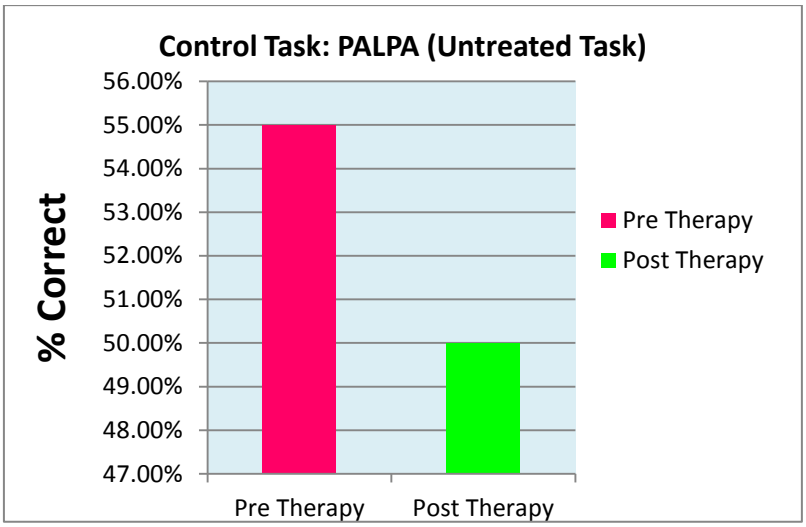


Figure 6 - POD: PALPA No. 54 (Picture Naming x Word Frequency)



JMCC

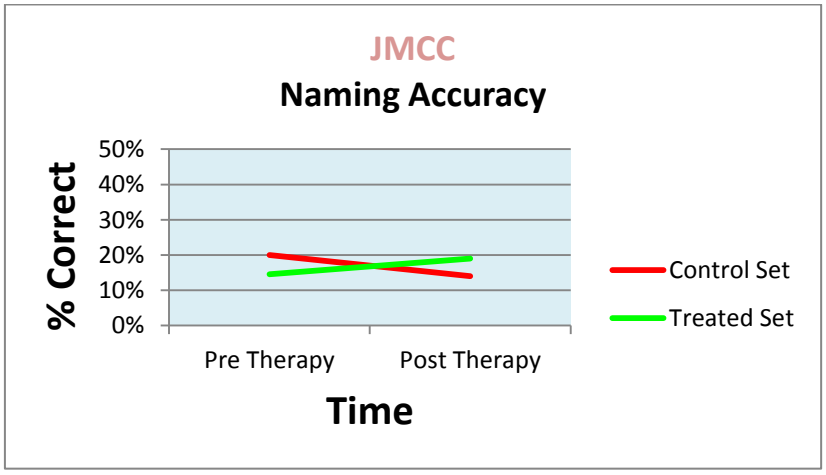
500 Treated Set

Statistical analysis found a significant improvement between pre and post therapy scores (McNemars test, p= .047) (See Figure 7 and Table 6).

100 Untreated (Control) Set

Statistical analysis found no significant improvement between pre and post therapy scores (McNemars test, p= .263). This, as expected, would indicate a treatment effect and also suggest that benefits are item specific with no generalization to untreated items.

Figure 7 - JMCC: Naming Accuracy (Treated and Untreated Set)



Control Task Analysis

Two related control tasks, the untreated BNT and PALPA No. 54 Naming x Frequency items were statistically analysed. The analysis of untreated BNT items found no significant improvement between pre and post therapy scores (McNemars test, p= .375). The analysis of untreated PALPA items also found no significant improvement between pre and post therapy scores (McNemars test, p= .727). This would support the case for a treatment effect. (See Tables 7 and 8 & Figures 8 and 9).

Raw scores revealed that the BNT treated items did not improve (See Table 7 and Figure 8). A statistical analysis of the treated items from the BNT also found no significant improvement between pre and post therapy scores (McNemars test exact, p= 1.000).

Figure 8 - JMCC: Boston Naming Test (Long Version)

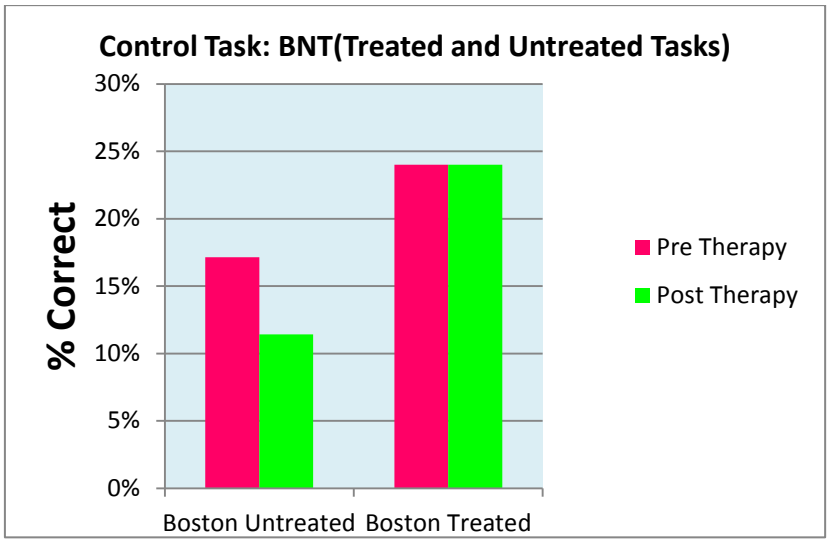


Figure 9 - JMCC: PALPA No. 54 (Picture Naming x Word Frequency)

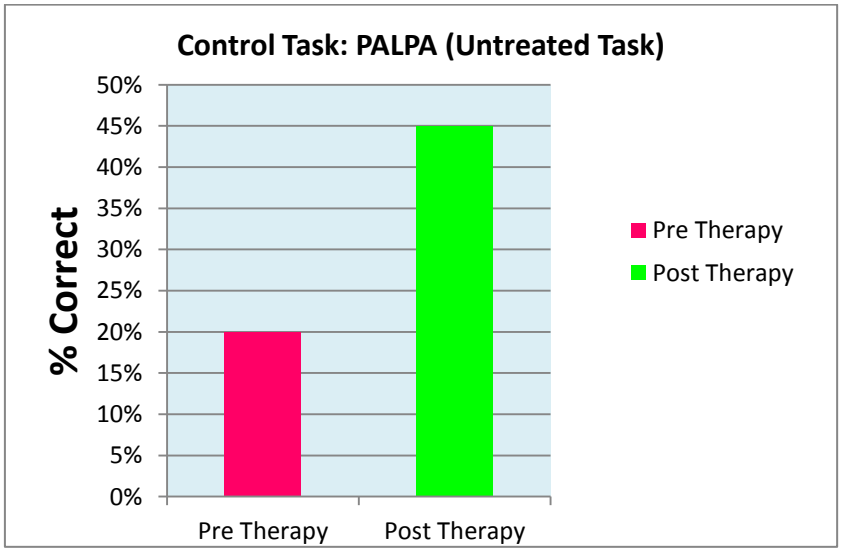


Table 6 – POD & JMCC: Naming Accuracy (Treated & Untreated Set)

	POD		JMCC	
Set Type	**Pre Therapy Score**	**Post Therapy Score**	**Pre Therapy Score**	**Post Therapy Score**
Control Set *(n=100)*	22	19	20	14
Treated Set *(n=500)*	109	149	73	95

Table 7 – POD & JMCC: Boston Naming Test (Long Version)

	POD		JMCC	
Set Type	**Pre Therapy Score**	**Post Therapy Score**	**Pre Therapy Score**	**Post Therapy Score**
Untreated Items *(n=35)*	8	4	6	4
Treated Set *(n=25)*	7	12	6	6

Table 8 – POD & JMCC: PALPA No. 54 (Picture Naming x Word Frequency)

	POD		JMCC	
Set Type	**Pre Therapy Score**	**Post Therapy Score**	**Pre Therapy Score**	**Post Therapy Score**
Untreated Items *(n=20)*	11	10	4	9

4.3 Recency Effect

A recency effect was considered on the basis that a set of 100 items was treated per week for a period of 5 consecutive weeks. If improvements were a result of re-learning through recruitment of episodic memory, we would expect to see a short-lasting primacy and recency effect and would see greater improvements in the sets treated in week 1 and 5, relative to improvements in the sets treated in the weeks in between.

Chi Square tests were conducted to compare performance over the five different treatment times for participants POD and JMCC (See Figures 10 and 11). No significant differences in improvements between sets were found. This indicates that there was no recency or primacy effect in the results and would suggest that the facilitation effect is through a priming mechanism as opposed to a form of re-learning.

Figure 10 - POD: Naming Accuracy Per Set (Treated Items)

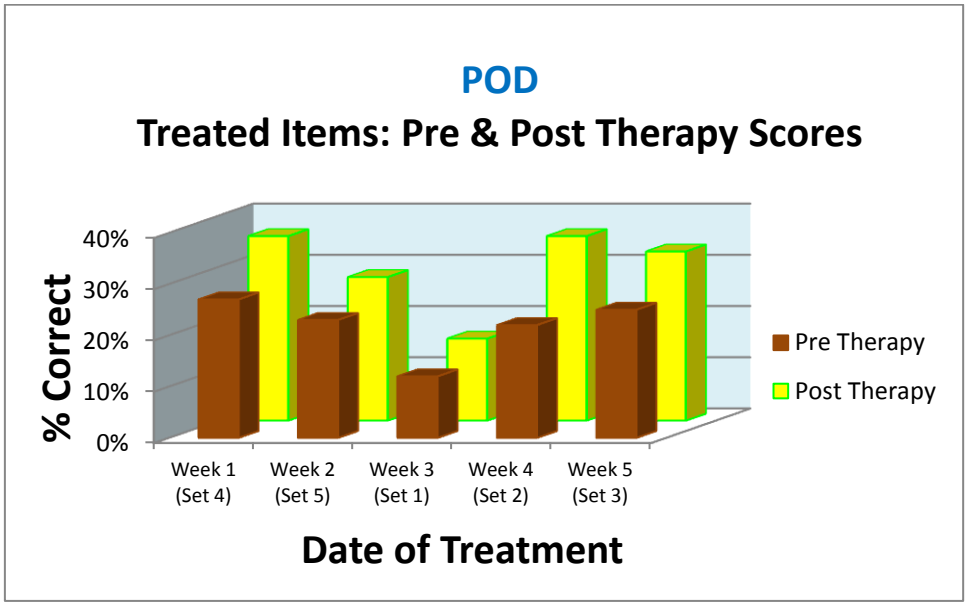
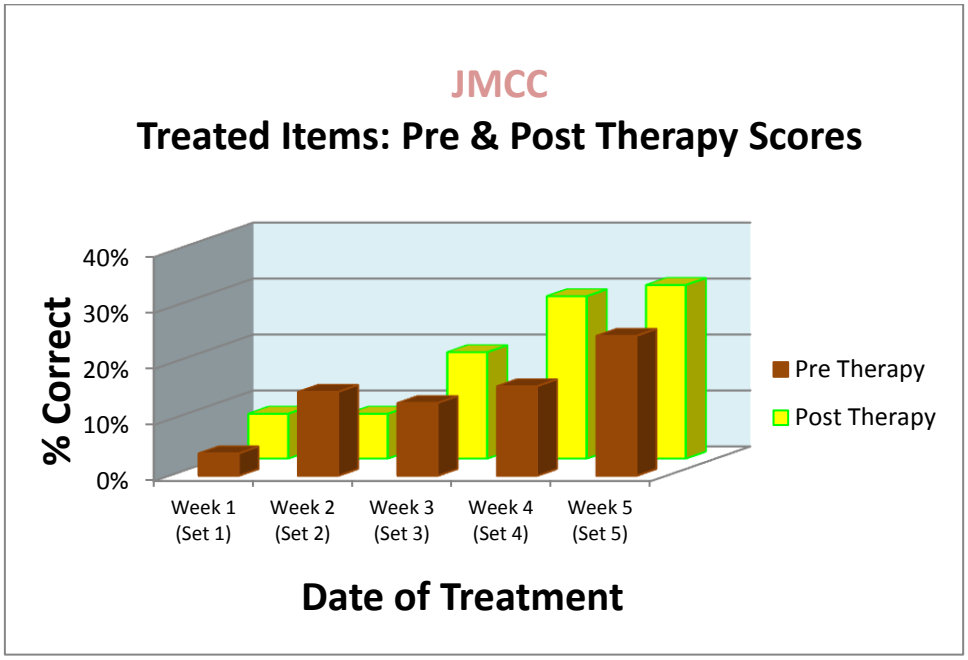


Figure 11 - JMCC: Naming Accuracy Per Set (Treated Items)



5 Discussion

This study investigated: (1) if the treatment of large set sizes through naming facilitation therapy can still result in significant improvements for people with anomia and (2) if the naming facilitation effect is through a priming mechanism or is a case of re-learning.

Group raw scores indicated improvements in naming accuracy of treated items, albeit not statistically significant. Individual participants POD and JMCC made statistically significant improvements on treated items with no significant improvements on untreated items. Somewhat unexpectedly, BNT Treated Items did not return the same levels of improvement as the large set.

No significant differences in improvements between sets were found and there was no evidence of a primacy or recency effect. This would suggest that the facilitation effect is through a priming mechanism.

5.1 Set Size

Set sizes are typically very small with an average of only 47 words being typically treated (Snell *et al* 2010). Such small set sizes would appear to have very limited functional gains. Emerging evidence has suggested that larger set sizes may be tolerated (Kelly and Franklin, 2012) and this finding is reflected in the current study. Raw scores indicated that the group of five participants showed improvements in naming accuracy following the treatment of 500 items. The results of individual cases POD and JMCC indicated statistically significant improvements in treated items. No significant improvements were observed in untreated items which supports a treatment effect.

The suggestion that people with anomia can tolerate larger sets is very encouraging given the greater scope to increase function gains. Treating larger sets may contribute to a reduction in the level of disability (Hillis 1998) and can significantly increase quality of life, social participation and communicative prospects.

Variability in improvements between participants was observed. Whilst naming facilitation therapy has been well demonstrated to improve word retrieval (Nickels 2002a) there is much less research on predicting outcomes of anomia therapy in terms of who might benefit the most or the size of therapy gain (Lambon Ralph *et al* 2010; Robey 1998) (See Recommendations for further research).

5.2 Naming Facilitation & Priming

Performance over the five different treatment times for participants POD and JMCC indicated that there was no significant difference in improvements between sets and that there was no recency or primacy effect. This would suggest that the facilitation effect is through a priming mechanism as opposed to a form of re-learning. This would further suggest that there would be no obvious upper limit to the number of items that can be treated.

5.3 Generalisation

Improvements in treated items was predicted but generalisation to untreated items was not anticipated as there is strong evidence that facilitation therapy does not generalise to untreated words (Laganaro *et al* 2006; Nickels 2002b; Nickels and Best 1996a; Wheeldon and Monsell 1992). This finding is reflected in the current study as no significant improvements were observed in untreated items.

5.4 Practice Effect

Improvements in control items have been highlighted in the literature as a possible practice effect (Franklin 1997; Kelly and Franklin 2012). That is, an attempt to name a control picture may make it easier to name the picture on a subsequent attempt. Instances of practice effect may therefore be mistaken as generalisation. As recommend by Boyle (2010) and Howard (2000), this study ensured that control items were reserved for just one use to get baselines and once again after treatment. This consideration allowed for monitoring for efficacy of the treatment whilst also allowing scope for accurate conclusions on generalisation or practice effect. No statistically significant improvements in untreated items were observed, therefore no generalisation or practice effect was indicated.

5.5 Generalisation to BNT Treated Items

Group raw scores indicated that improvements in naming accuracy on BNT treated items (n=25) were not as large as the improvements in naming accuracy on the large set. Looking at individual participants, JMCC's naming accuracy on the BNT treated items (n=25) remained stable at 24% pre and post therapy. This result was not expected given that JMCC's large set showed statistically significant improvements.

Two possibilities were considered here:

(1) Generalisation of a treated word to an untreated illustration did not occur (e.g. the image used to depict 'bed' in the large set differed to the image depicting 'bed' in the BNT).

(2) Performance on the BNT treated items (n=25) correlated to the performance of the same 25 items in the large set. The lack of significant improvement in these items being due to a number of possible variables e.g. lower frequency, longer syllable length, lower imaginability or unfamiliar word pre CVA.

It was apparent that JMCC's performance on these 25 BNT treated items was similar to his performance on the same 25 items in the large set (Pre Therapy: 20%, Post Therapy: 20%). This would therefore suggest that it is not a case of a lack of generalisation to the untreated illustration but would suggest that the items in question may have differed in complexity compared to the average word complexity in the large set. As suggested by Kiran (2009) outcomes based on word complexity is an area requiring further research (See Recommendations for further research suggestions).

5.6 Intensity

There is no consistent definition as to what constitutes intensive aphasia therapy. Classifications of 'intensive' or 'non-intensive' vary wildly in the literature in terms of how many hours of therapy per week and how many weeks (Sage *et al* 2011). Greater amounts of therapy, delivered as an intensive and long-lasting programme have however been shown to result in better outcomes when compared to less intense and shorter durations of therapy (Basso 2005).

In the current study, a total of ten therapy sessions were carried out over a period of five consecutive weeks. Each word received a total of four repetitions. This drill total is significantly smaller than typical treatment which typically involves many more drills per item for example, 30 facilitations per item (Snell *et al* 2010). This level of intensity did however result in improvements across the group with statistically significant improvements observed in POD and JMCC. Optimal intensity is still uncertain however (See Recommendations for further research suggestions).

5.7 Recommendations

All participants in this study made improvements on treated items to varying degrees. Variability in therapy gains was not investigated in this current study. Variables such as age, time post CVA onset, severity, level of impairment, cognitive status and medication are examples of what can be considered when predicting therapy outcomes. Whilst it is evident that no group of people with aphasia will be completely homogenous, more research is required to help predict outcomes of anomia therapy in terms of who might benefit the most or the size of therapy gain (Lambon Ralph *et al* 2010).

Sets treated were balanced for frequency and syllable length and therefore conclusions were not drawn on the effect these variables can have on outcomes. This was out of the scope of the current study but future research should consider the effects of word complexity on outcomes.

More intensive therapy has been shown to result in better outcomes (Basso 2005). In this current study each item was treated only four times. Whilst this drill total is significantly smaller than a typical 30 facilitations per item (Snell *et al* 2010), it still resulted in significant improvements for POD and JMCC. It is anticipated that more repetitions would have resulted in greater gains. Further research is required to determine optimal intensity.

A weakness of the study was the lack of follow up to assess for maintenance of the gains in the large set. Follow up testing on the 500 items would be desirable to further inform

on the endurance of the facilitation effect. This was outside the scope of the current study but is recommended for consideration in future studies.

5.8 Conclusions

The results of the current study have demonstrated that a group of five participants improved in naming accuracy with a large set of words (n=500) following naming facilitation therapy. The two participants detailed in this paper (POD and JMCC) made statistically significant improvements in treated items.

The study also indicates that improvements were item-specific with no generalization to untreated words as untreated items showed no significant improvements.

No statistically significant difference in improvements between sets was found. This indicates that there was no recency or primacy effect and would suggest that the facilitation effect is through a longer lasting priming mechanism as opposed to a case of re-learning. Furthermore, significant improvements as seen in POD and JMCC followed only four repetitions per item. This would suggest that there is no obvious upper limit to the number of words that can be improved since it is not a method of re-learning.

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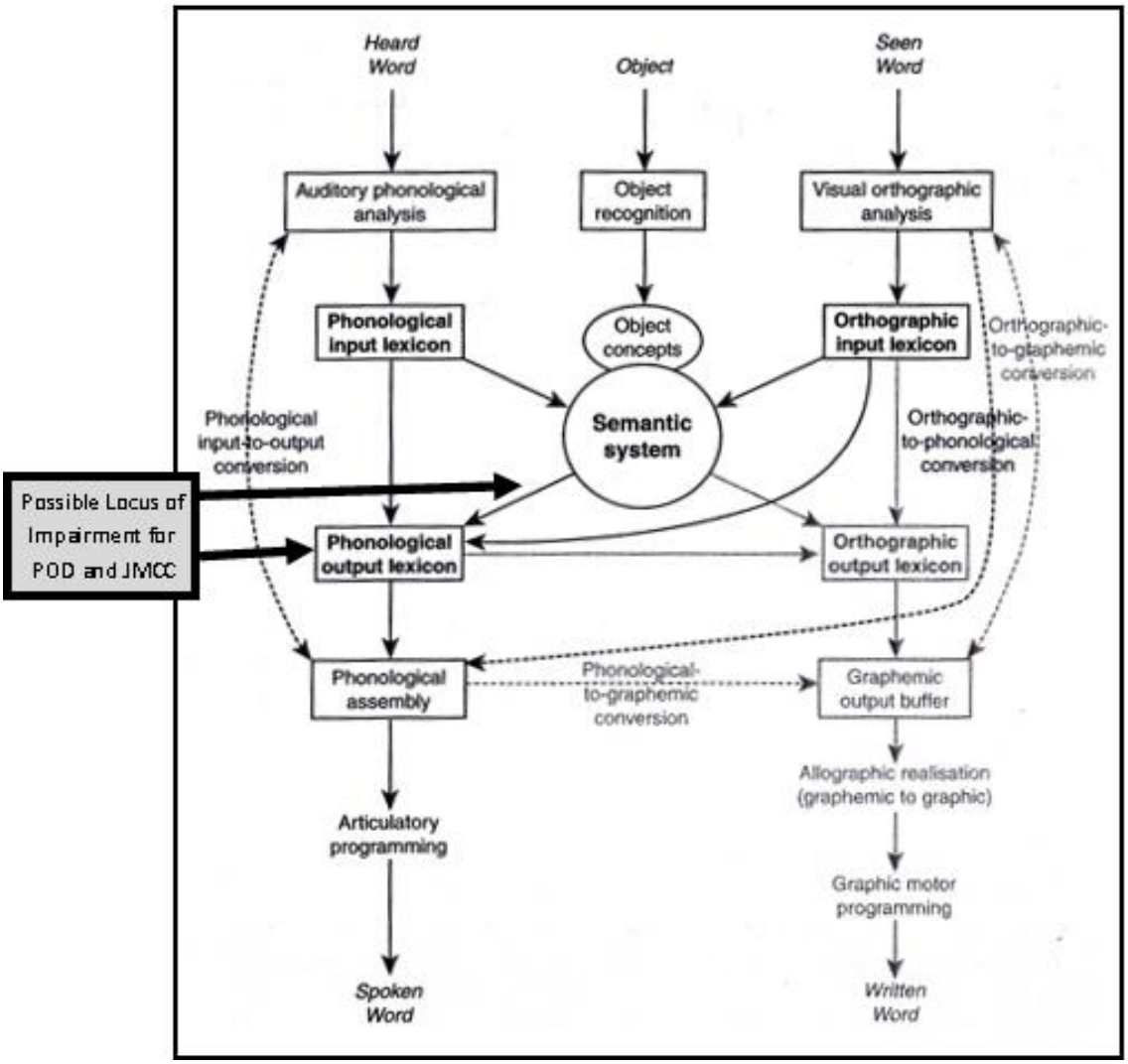
Appendices

Appendix 1
Language Processing Model



Language Processing Model – Spoken Naming with Reading & Repetition
(Whitworth *et al* 2005, p.47)

Appendix 2

Target Words and % Naming Agreement
(Includes Treated Set (n=500) and Untreated (Control) Set (n=100))

Target	% Agree	Target	% Agree	Target	% Agree	Target	% Agree
Plough	100	tea	81	tambourine	100	Ballerina	81
Corkscrew	100	Hat	100	Antlers	100	tyre	100
Giraffe	100	Foot	100	yawn	100	Bridesmaid	86
Crocodile	90	Nose	100	Horseshoe	100	unicorn	100
Jug	100	Bus	100	tweezers	100	Postman	100
Biscuits	100	Dress	100	Chainsaw	100	Screwdriver	100
Knuckles	100	Horse	100	Golfer	100	zebra	100
Hurley	100	road	81	Flask	100	Microscope	100
Axe	81	teabag	100	Eyelashes	100	Pineapple	100
Donkey	100	Firetruck	100	Custard	100	tornado	86
Nun	100	sandcastle	100	toolbox	100	maze	81
Ink	95	Colander	81	windmill	100	Plaster	100
Peanuts	100	Dartboard	100	hanger	100	Apron	100
spoon	100	Seahorse	100	Hammock	100	Magnet	100
Candle	100	Highchair	81	Eyebrow	100	Dolphin	100
Fork	100	cobweb	81	Camels	100	Kettle	100
Cart	81	Pram	100	Jellyfish	100	Mushrooms	100
Pencil	100	unicycle	100	Binoculars	100	Cork	100
Passport	100	Abacus	100	socket	100	Cactus	100
Barrel	100	Dandelions	100	Banjo	100	Cabbage	100
Banana	100	Crisps	100	Crutches	100	sneeze	100
Elephant	100	Birdhouse	100	penguins	100	Lighthouse	100
Frog	100	Flowerpot	100	Saxophone	100	Mobile	100
Sailor	100	Hedgehog	100	Sprouts	81	toothpaste	100
Matches	100	Igloo	100	Crossword	100	mermaid	100
whip	100	Goalkeeper	100	Badger	100	wool	100
tap	100	seashell	100	Scarecrow	100	typewriter	100
Banks	100	Poppies	100	Snail	100	Hoover	81
socks	100	Icicles	100	Lollipop	100	Parachute	100
Rabbit	100	clothesline	100	Iceberg	100	ruler	100
Shadow	100	raspberries	100	Cello	86	Fingerprint	100
Chain	100	Lawnmower	100	Jigsaw	100	Bandages	100
Fox	100	Paintbrush	100	Snowman	100	volcano	100
Duck	100	Drainpipe	91	Octopus	100	Ivy	100
Piano	100	lamppost	86	Floss	95	Lettuce	100
robin	90	Cardigan	100	Nightgown	81	Stool	100
Cow	100	Hinge	100	Cucumber	100	Chalk	100
Bike	100	whisk	100	Tissues	100	referee	100
Bread	100	wheelbarrow	100	Badges	100	Bikini	100
Chocolate	100	Pitchfork	86	Lantern	100	Knot	100
Bath	100	pebbles	81	Scales	100	pub	100

tongue	100	Acorn	100	Runners	100	toaster	100
Gate	100	Motorbike	100	Peppers	100	Bulb	100
Football	100	Scones	86	Flute	100	Grapes	100
Pig	100	tongs	100	Panda	100	sunglasses	100
Coat	100	Pheasant	100	whiskers	100	Dinosaur	81
Milk	100	blackbird	86	Cushion	100	Pyramid	100
Nurse	100	Oar	81	stem	100	trumpet	100
Bird	81	Beehive	86	Knitting	100	Mop	100
Moon	100	Laces	100	Broccoli	100	postbox	81
Chimney	100	submarine	100	Pillow	100	tiger	100
Pasta	100	Pirate	100	Medal	100	Nail	100
olympics	95	Anchor	100	Picnic	100	Cowboy	100
triangle	100	shepherd	100	Garda	100	treasure	100
Comics	81	Chess	100	thumb	100	Boots	100
scars	95	Carriage	95	Rocket	100	Dragon	100
Classroom	81	umbrella	100	Needle	100	Pipe	100
Microphone	100	trophy	100	Log	100	salt	100
Grenade	100	zip	100	Lemon	100	wing	100
Peas	100	sausage	100	Beard	100	wolf	81
Balloons	100	Bracelet	100	Pump	100	Bat	100
violin	90	Batteries	100	Basket	100	wave	81
Lizard	100	Rainbow	100	waiter	100	Basketball	100
toothbrush	100	Ankle	100	Suitcase	100	Bowl	100
Altar	100	tray	100	Daisy	91	Circle	100
Blankets	81	Hose	100	Jam	100	Castle	100
Peacock	100	Jar	100	tooth	100	Cliff	100
skeleton	100	wig	100	Baker	100	Fruit	100
Handcuffs	100	Drum	100	Crown	100	Sandwich	100
Slippers	100	Butcher	100	Drill	100	Orange	100
thread	95	tin	100	Frame	100	pot	81
Globe	100	Cannon	100	Lightning	100	turkey	86
Cottage	81	Oven	100	brush	100	Rope	100
choir	100	Barbecue	100	Corn	100	Flower	81
Bin	100	Lighter	100	Beans	100	wallet	100
Squirrel	100	Popcorn	100	Angels	91	Library	100
Butterfly	100	Ladder	100	skull	100	Couch	81
Orchestra	100	Helmet	100	Shark	100	Newspaper	100
strawberry	100	towels	100	Blocks	81	stairs	100
Gorilla	81	Bench	100	Rice	100	tail	100
Owl	100	Necklace	100	whistle	100	Elevator	81
Pigeon	100	Clouds	81	Net	100	Poison	86
tomato	100	Bucket	100	Guitar	100	Pen	100
stamp	100	Envelope	81	singer	100	Doll	100
Comb	100	Branch	95	Helicopter	100	soup	100

Elbow	100	spider	100	Clown	100	tank	100
Earrings	100	worm	100	teddy	100	Plate	100
Horns	100	Brick	100	powder	100	Knees	100
wheelchair	100	Burger	100	Fence	91	swing	100
Curtains	100	Magazines	100	Poker	100	Egg	100
roots	100	Jeep	81	Pin	100	sword	100
Jeans	86	Plug	100	Bishop	100	Priest	100
Feather	100	Dice	100	Grass	100	shoulder	100
vegetables	100	Collar	100	Sink	100	Garden	100
scissors	100	statue	100	Salad	100	wood	81
Sponge	100	Lamb	100	turtle	81	wire	86
razor	100	pumpkin	100	Circus	100	Plant	81
Crab	100	Nest	81	Flag	81	witch	100
Fountain	90	Dentist	100	tent	100	Desert	100
Shelf	100	potato	100	cigarettes	100	Pie	100
Lips	100	Books	100	Hen	81	Berries	100
Spring	100	tape	81	Deer	81	Doorbell	100
silver	100	Church	100	toes	81	Hammer	100
square	100	Sun	100	Belt	100	Apple	100
Map	100	wall	100	Finger	100	Glasses	100
Ear	100	Beer	100	Cat	100	Arm	100
Telephone	100	Brain	100	Ladybird	100	Schoolbag	100
Monkey	86	Radio	100	yoyo	100	shamrock	100
television	100	Gold	100	Cauliflower	100	Arrow	100
Mountain	100	Ice	100	Stethoscope	100	Hairbrush	100
Ghost	100	Fish	100	Spaceman	81	Ladle	86
Paint	100	Fly	100	Pear	100	Brooch	86
Letters	100	record	100	Eskimo	100	Lifeguard	100
screw	81	window	100	Gums	100	waterfall	100
sugar	100	Key	100	Beetle	100	radiator	100
Hook	100	Box	100	spade	81	Kangaroo	100
Airport	81	Ring	100	Handbag	100	Harp	100
soldier	100	train	100	Rake	100	telescope	100
Cheese	100	Plane	100	Parrot	100	Ashtray	100
Bell	100	Boat	100	Carrots	100	tractor	100
meat	100	ship	100	Onion	100	Doughnut	100
tie	100	Earth	86	Kitten	100	Scarf	100
Cake	100	Building	81	Leaf	100	trousers	86
ticket	81	Mouth	91	Dam	81	flood	81
Bridge	100	table	100	Coal	100	wardrobe	100
Shirt	100	Handle	100	Ants	81	Jelly	95
Knife	100	King	100	tricycle	100	Saddle	100
Cards	100	Food	86	Buttons	100	Balloon	100
rain	81	City	86	skirt	100	Menu	100

Chair	100	Children	100	Bee	100	wrist	100
van	100	Gun	100	Eagle	100	Puppy	100
Rose	100	Eyes	100	Drawer	100	Lamp	100
Band	100	water	91	Cave	100	Sail	95
Nuts	81	week	86	lion	100	soap	100
Bomb	100	town	81	Gloves	100	Chips	100
queen	100	Paperclip	100	Bible	81	Iron	100
Cross	81	Parsnips	100	Butter	100	Sand	100
river	100	Fishbowl	91	Ambulance	100	snake	100
Legs	100	Daffodil	100	Bride	100	mirror	100
Lock	100	Mousetrap	100	Chick	100	Bone	100
Smile	86	Bed	100	shoe	100	Farm	81
Clock	100	Fire	100	Pocket	100	Roof	86
Computer	100	Doctor	100	Shower	100	Island	95
wind	81	Hand	100	Cup	100	Bottle	100
Neck	100	Door	100	Bear	100	Camera	100
sea	81	Chin	100	Breakfast	100	smoke	100
wine	100	Limes	100	star	100	Judge	100
Glass	100	Cherries	100	Birthday	100	stick	81
Bathroom	100	Sheep	100	Captain	100	Dog	100
tree	100	Goat	100	Hair	100	teapot	100

(Kelly and Franklin 2012)

Appendix 3

Schedule of Assessments & Therapy

Weeks 1-2	<u>Assessments:</u> BNT Clock Drawing Test Raven's matrices A PALPA Frequency Naming Test CAT spoken word to picture matching CAT word repetition 600 pictures
Weeks 3-7	<u>Treatment:</u> 100 words per week. 2 sessions per week with 2 repetitions per word per session.
Week 8	<u>Assessment:</u> 600 pictures BNT PALPA Frequency Naming Test