Naming Facilitation Therapy: Is it effective with large sets of words?

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# Naming Facilitation Therapy: Is it effective with large sets of words?

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Author’s Declaration

Supervisor: Professor Sue Franklin

I certify that this project report is entirely my own work and has not been submitted for any other academic award or part thereof, at this or any other educational institution. Where use has been made of the work of other people it has been fully acknowledged and fully referenced.

Signed:

X

Sinead Waldron

Date:
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Abstract

Background: Facilitation therapy has been shown to improve word-finding abilities of participants with aphasia (Nickels 2002). Kelly and Franklin (2012 unpublished) found that facilitation therapy was effective treating a large set of 500 words. The current study adopted a similar design to Kelly and Franklin (2012 unpublished) to investigate the effectiveness of treating large sets of words using repetition facilitation therapy. The current study also aims to examine the cognitive mechanisms that underlie facilitation therapy. This paper discusses results of two participants JMCC and MOB in detail.

Objectives: To investigate the effectiveness of facilitation therapy using a large treatment set (500 words) and to measure primacy and recency effects in data.

Methods: Five anomic participants were treated using repetition facilitation therapy. Six hundred nouns were selected and then divided into a large treatment set (n =500) and a control set (n=100). Participants received five weeks of repetition facilitation therapy (receiving two sessions per week). A different sub-set of treatment words (n=100) was targeted with each participant each week. This allowed measurement of possible primacy and recency effects.

Results: No significant improvements were found for participants as a group. However, significant improvements in naming accuracy for treated words were found for individual participants. Participants did not improve significantly on untreated words. No significant differences in outcomes were found depending on weeks treated i.e. no primacy or recency effects were evident.

Conclusions: Facilitation therapy can be effective treating large sets of words for individuals and treatment gains do not generalise to untreated words. No primacy and recency effects were evident suggesting that facilitation therapy works via a priming effect.

Keywords: Anomia; Facilitation Therapy; Large Sets; Priming.
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Introduction

Anomia and language models
Anomia (naming-difficulties) is extremely common in aphasia (Laine and Martin 2006). Furthermore, naming difficulties are the characteristic feature of a particular sub-type of aphasia known as anomic aphasia (Martin 2013).

Models of word production provide a helpful framework for understanding language impairments such as anomia (Wilshire 2008). The cognitive neuropsychological model is based on Morton and Shewell’s (1980) Logogen model, it is often used to describe language processing and deficits in aphasia (cited in Whitworth et al. 2005). This model allows for descriptions of the breakdown in language processing in aphasia (Herbert et al. 2003). Within this framework, anomia can be described as impaired access to words via the lexical semantic system and/or impaired ability to use semantic representations to access the phonological forms of words (Laine and Martin 2006). A breakdown at the lexical semantic level may result in anomia with semantic errors evident in spoken and written naming. Caramazza and Hillis (1990) have also argued that a selective impairment to the phonological output lexicon will result in similar semantic errors. Therefore, it seems that the lexical semantic representations and intact links between these representations and the phonological forms of words are crucial for accurate naming.

Treatment approaches for anoma
Treatments for anomia can be effective at improving naming ability and communicative skills (Nickels 2002a;, Wisenburn and Mahoney 2009). In a review of treatments for anomia Nickels (2002a) proposed that different treatments can be effective for individuals with similar impairments and that it was not always necessary to target impairments directly to achieve good outcomes in therapy.

Facilitation therapy
Facilitation therapy uses prior processing of a word to support subsequent retrieval or production of that word in therapy (Best et al. 2002). Facilitation therapy tasks involve matching word meaning to word form (Franklin and Morris 2012). Semantic
facilitation encourages semantic processing to aid word retrieval. Phonological facilitation involves using phonological tasks such as repetition, rhyme judgement and phonological cues to enhance the accessibility of phonological forms of words and support word production (Hickin et al. 2002). However, the distinctions between phonological and semantic facilitation might be redundant because facilitation tasks invariably evoke the semantic representations and the phonological forms of words (Howard et al. 2006, Heath et al. 2013, Monsell et al. 1992).

The mechanism underlying the facilitation therapy effect is not understood completely. Research has found facilitation therapy improves naming ability for people with aphasia by supporting mapping between the semantic and phonological levels of language processing (Best 2013; Howard et al. 2006; Lorenza and Ziegler 2009). It is proposed that facilitation therapy works through a priming effect that supports word production by reinforcing the links between the semantic and phonological forms of a word (Howard et al. 2006). Howard et al. (2006) found that word-to-picture matching activities improved aphasic participants naming abilities when there was an interval of up to twenty-five minutes between activities. Howard et al. (2006) argued that word-to-picture matching tasks primed word production by strengthened connections between the semantic and phonological forms of a word that facilitates production of the word. Howard et al. (2006) found that participants with less semantic impairment benefited more from this priming effect. This provides evidence that intact semantic processing is required for effective facilitation therapy. Recent evidence from fMRI research showed that strengthening the connections between semantic and phonological processing is associated with longer lasting facilitation effects, these effects were found to last over three days (Heath et al. 2013).

Alternative explanations for the effectiveness of facilitation therapy claim that the effect relies on episodic memory and associative learning. It has been proposed that facilitation therapy is effective because it allows aphasic clients to re-learn words and store words in their episodic memory (Wheeldon and Monsell 1992).

Repetition facilitation therapy requires patients to repeat a word in the presence of a picture that illustrates the word. Therefore, this therapy provides both
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the semantic representation and a model for the phonological form for the word. Repetition facilitation therapy has been found to significantly improve naming abilities of clients with aphasia (Müller Pedersen and Vinter 2001; Soni et al. 2012; Kelly and Franklin 2012). The current study aims to investigate the effectiveness of repetition facilitation therapy for clients with anomia using a large treatment set of five hundred words.

Facilitation Therapy and larger treatment sets

The majority of facilitation therapy studies have been done using relatively small treatment sets of thirty to forty nouns (Snell et al. 2010). This is a very small number considering that the average adult vocabulary contains thousands of words. Successful treatment of naming impairments targeting large sets of words could lead to greater functional improvements for anomic clients and greater enhancements of their communicative abilities. It is important to investigate the feasibility of effective treatment for anomia using large sets of words because SLT intervention should aim to significantly improve the client’s functional communication and quality of life (Kagan 2008 as cited in Martin 2013). Furthermore, research using large sets of target words might also provide theoretical understanding of facilitation therapy effects.

Evidence that facilitation therapy can be effective with large sets of target words might provide insights into the possible cognitive mechanisms underlying facilitation therapy. Effective facilitation therapy targeting large sets of words would indicate that facilitation therapy operates via a priming effect rather than storage of target words in episodic memory because it would be difficult to hold large sets of words in memory. Additionally, if episodic memory processes underlie facilitation therapy, typical patterns of memory decay would be expected in the results.

Primacy and recency effects are commonly observed in research concerning learning and memory processes. Primacy and recency effects result in items presented at the beginning and the end of experiments being remembered more accurately than items presented in the middle of experiments (Eysenck and Keane 2006). The implications of such primacy and recency effects in the current study would be that words targeted at the beginning and end of the intervention period would improve
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significantly more than other words targeted in the middle part of the intervention. The current study will measure primacy and recency effects in order to further investigate the mechanism underlying facilitation therapy.

Kelly and Franklin (2012 unpublished) investigated the effectiveness of repetition facilitation therapy using a large treatment set. They found that their participant’s naming ability improved significantly after an intervention using repetition facilitation therapy with a set of five hundred target words. Furthermore, Kelly and Franklin (2012 unpublished) found that there was no significant difference between treatment gains using a small set of fifty words and the large set of five hundred words. This suggested that treatment can be equally effective using larger facilitation therapy sets of words (Kelly and Franklin 2012). Kelly and Franklin (2012 unpublished) also found no significant primacy or recency effects were evident indicating that the facilitation effect was due to priming rather than episodic memory processes. The current study aims to build on these findings by using a similar research design to Kelly and Franklin (2012) to investigate the outcomes of treating participants with anomia using a set of five hundred words.

**Generalisation**

Studies have found that the treatment effects of facilitation therapy have tended to be item specific (Howard et al. 2006; Lorenza and Ziegler 2009; Soni et al. 2012). Recent research by Best et al. (2013) suggested that treatment gains could generalise to untreated words for participants with deficits at the level of phonological assembly only. This further supports the argument that intact semantic representations are important for facilitation therapy to be effective.

Kelly and Franklin (2012 unpublished) found that there was some generalisation of treatment effect to untreated control items. Kelly and Franklin (2012 unpublished) acknowledged that this apparent ‘generalisation’ might have actually been due to a practice effect rather than genuine generalisation. Nickels (2002b) demonstrated that even attempts at enhanced naming ability through a practice effect. The researchers in the current study minimise the potential for such a practice effect and monitor the results for evidence of any generalisation effects.
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**Dosage**

There is a scarcity of research regarding the optimum intensity and dosage for treatment (Basso 2010). Sage et al. (2011) proposed that less intensive intervention allowed for consolidation of words in memory and longer-term improvements. In the Sage et al. (2011) study participants in the ‘less intensive’ therapy group were given two sessions of therapy each week over a period of five weeks compared with those in the ‘intensive’ therapy group who received the same number of sessions over a period of two weeks. Participants in the current study received two thirty-minute therapy sessions with a student SLT each week over a period of five weeks which was similar to the ‘less intensive’ therapy group in the Sage et al. (2011) study, therefore, it would be interesting to conduct follow-up assessments with the participants in the current study to investigate if any treatment gains had been maintained over one month post-therapy as found by Sage et al. (2011).

It is also worth considering that the number of repetitions of words that the participants do per session may also be a relevant factor for determining therapy outcomes. In the current study repetitions of the target words were elicited twice during each session, therefore four times per week. This is a relatively small number of elicitations; facilitation therapy research often requires up to thirty elicitations per target (Snell et al. 2010).

**Research objectives**

There is a lack of research into naming facilitation therapy using large treatment sets of words. This has implications for SLT clinical practice and the theoretical understanding of mechanism underlying facilitation therapy. The current study will build on the work of Kelly and Franklin (2012 unpublished) to further investigate these issues. The current study aims to investigate the effectiveness of repetition facilitation therapy targeting a large treatment set of five hundred words. The current study will also measure any primacy and recency effect evident in the treatment results and examine whether any treatment effects generalise to untreated words.
Methods

Participants:
Participants were recruited through HSE SLT clinics. Five participants, (3 female and 2 males) participated in this research study.

Inclusion criteria:
Participants were required to be experiencing significant word-finding difficulties and have intact ability to repeat words. All participants were more than six months post CVA, to limit the possibility of spontaneous improvement unrelated to therapy, and have no significant cognitive impairments or outstanding health conditions which could compromise their ability to participate in the research. All participants were native English speakers who were not receiving any other speech and language intervention during the research intervention. Demographic information and pre-therapy assessment scores for all participants (n=5) are outlined in table 1 below. All participants met the inclusion criteria for this research. They had no significant comprehension or general cognitive impairments and they all had significant word-finding difficulties with intact ability to repeat words. A summary of demographic information and pre-therapy assessment outcomes for the group of participants (n=5) is outlined in table 1 below.
Table 1: Demographic and pre-therapy assessment data for group of participants (n=5).

<table>
<thead>
<tr>
<th></th>
<th>POD</th>
<th>JMMC</th>
<th>MOB</th>
<th>GM</th>
<th>AB</th>
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<tr>
<td>Age (years)</td>
<td>76</td>
<td>90</td>
<td>78</td>
<td>70</td>
<td>75</td>
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<tr>
<td>Gender</td>
<td>Male</td>
<td>Male</td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
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<tr>
<td>Time post-CVA (months)</td>
<td>120</td>
<td>120</td>
<td>36</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Raven's Matrices Part A (/12)</td>
<td>8</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Clock Test Score</td>
<td>2</td>
<td>2*</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CAT: Comprehension of Spoken Words (/30)</td>
<td>21</td>
<td>20</td>
<td>27</td>
<td>28</td>
<td>26</td>
</tr>
<tr>
<td>CAT: Real Word Repetition (/32)</td>
<td>26</td>
<td>31</td>
<td>29</td>
<td>27</td>
<td>30</td>
</tr>
<tr>
<td>BNT (/60)</td>
<td>15</td>
<td>12</td>
<td>20</td>
<td>26</td>
<td>15</td>
</tr>
<tr>
<td>PALPA (/60)</td>
<td>34</td>
<td>22</td>
<td>39</td>
<td>41</td>
<td>38</td>
</tr>
<tr>
<td>Treated Items (/500)</td>
<td>109</td>
<td>73</td>
<td>227</td>
<td>299</td>
<td>152</td>
</tr>
<tr>
<td>Control Items (/100)</td>
<td>22</td>
<td>20</td>
<td>50</td>
<td>68</td>
<td>35</td>
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*Required several demonstrations by student SLT before completing task successfully.

This paper will discuss results of the group of participants and will also discuss two particular participants, JMCC and MOB in more detail. (Detailed discussion of other participants can be found in papers written by other researchers involved in this project). Due to the small numbers of participants and the heterogeneity of participants within groups used in aphasia research individual case studies and analysis can be very effective for investigating treatment effects that may not be apparent through analysis of group data alone (Franklin 1997).
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JMCC’s profile:

Case History:
JMCC was a ninety-year-old gentleman who developed aphasia as a result of a peri/post surgical CVA ten years ago. JMCC was in good general health and independently mobile. JMCC lived alone as his wife had died six months prior to the start of this research project. JMCC had a large family that were very supportive and involved in his care. JMCC had been a successful businessman prior to his retirement. He was a sociable and outgoing man who had many interests. He was keen to communicate and clearly frustrated by his word-finding difficulties. He reported that these difficulties prevented him from engaging in many social activities that he previously enjoyed. He was extremely motivated to participate in the therapy.

Cognitive and Language Profile:
JMCC had lowest scores of all the participants on the word-to-picture-matching subtest of the CAT (score of 20) suggesting that he did have some difficulties with semantics and comprehension. He also had difficulty with the Clock Drawing Test and required several demonstrations by Student SLT to complete the task successfully. Notwithstanding evidence of some semantic impairment, JMCC’s was deemed to have adequate levels of cognitive ability to participate in this research study. JMCC’s ability to repeat words remained intact suggesting that the phonological output buffer level remained intact. There was no frequency effect evident in his pre-therapy naming abilities i.e. he found high and low frequency words equally difficult to name. JMCC had fluent speech characterised by severe anomia. He used circumlocutions a great deal in his conversational speech to express himself and he occasionally used natural gesture to support his communication. His errors on naming tests were characterised by semantic errors and circumlocutions e.g. [helicopter] -> [Ship] and [bed] -> [where you go to sleep]. The student SLT found that phonemic cues aided his word naming accuracy. This profile suggests that JMCC’s deficit may lie in impaired lexical semantics or a difficulty accessing the phonological output lexicon via the semantic system (his
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comprehension difficulties suggest that his impairment may be more associated with semantic processing.

**MOB Profile:**

**Case History:**
MOB is a 78-year-old lady who had developed aphasia as result of a CVA three years previously. She was in good general health and independently mobile. She reported that she had contracted Ramsay-Hunt Syndrome 12 months prior to her CVA. Ramsay-Hunt Syndrome occurs when the Herpes Zoster (Chicken pox) virus attacks the facial nerve. MOB reported that she had recovered from this but had residual hearing and vision loss in her right ear due to the Ramsay-Hunt syndrome. MOB was taking Warfarin, medications to treat hypertension and high cholesterol, Beta-blockers and medications to control gastric reflux hypothyroidism during the research. These underlying medical conditions appeared to be managed well by her GP and did not affect MOB’s ability to participate in this research study. She was a sociable lady and keen to communicate but she reported being frustrated by her word-finding difficulties. She also reported that her communication difficulties had reduced her self-confidence and prevented her from engaging in some social activities that she had previously enjoyed and from doing more to help on her family’s farm. She was motivated to participate in the therapy. She lived near her family who were supportive and engaged in her care.

**Cognitive and Language Profile:**
MOB scores on the cognitive tests met the inclusion criteria for this research study. She had little difficulty with the cognitive test and demonstrated intact cognitive and semantic processing. MOB’s ability to repeat words remained intact suggesting that the phonological output buffer remained intact. There was no frequency effect evident in her pre-therapy naming abilities i.e. she found high and low frequency words equally difficult to name. MOB’s speech was fluent but characterised by moderate-severe anomia. MOB’s errors on naming tests were characterised by semantic errors and circumlocutions e.g. [helicopter] -> [airplane] and [hammock] ->
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[sleeping place]. The student SLT noticed that phonemic cues did not appear to aid her naming accuracy. This profile suggested that her deficit might lie at the level of the phonological output lexicon (or access to it via the semantic system).

**Ethical approval:**
Ethical approval for this research study was obtained from the University of Limerick Hospital Ethics Committee. Informed consent to participate was obtained from each participant using aphasia friendly materials before the research began and participants were aware that they could withdraw from the study at any time without prejudice (see Appendix A for information sheet and consent form).

**Materials:**
All participants received an information sheet about the research in an aphasia-friendly format (see Appendix A).

Set A of Raven’s coloured progressive matrices (Raven 1998) were administered to assess participant’s non-verbal cognitive skills and rule out any significant visio-spatial deficits or visual neglects. The Clock Drawing Test (Shulman et al. 2004) was also used to assess participants non-verbal cognitive functioning.

The comprehension of spoken words and repetition of words subtests from the *Comprehensive Aphasia Test* (CAT) (Swinburn et al. 2004) were administered to assess participants auditory comprehension and word repetition abilities.

The Standard Form of the *Boston Naming Test* (BNT) (Kaplan et al. 2000) and the Picture Naming by Frequency subtest of the *Psycholinguistic Assessments of Language Processing in Aphasia (PALPA)* (Kay et al. 1992) were administered to assess the participants’ word naming abilities.
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Untreated words from the BNT and PALPA assessments also served to probe for generalisation of treatment effect to untreated words. Franklin (1997) proposed that the use of control tasks within aphasia studies might support the validity of findings and can be used to measure generalisation of treatment effects to untreated items.

_Treatment and control words sets_

600 pictures representing nouns were selected for use in this study, these words and pictures had previously used by Kelly and Franklin (2012 unpublished). Colour pictures sourced from the internet were used to depict the target words. Target from other sources were also included to meet specific frequency and syllabic requirements. In the event of certain targets proving problematic to depict, arrows were added to the pictures to clarify the word being elicited. Colour images from the Internet were randomly arranged in a slide show format that was presented to participants.

Kelly (2012) found that these 600 pictures had at least 80% naming naming agreement in a pilot study with 22 participants. Frequency ratings were obtained from the CELEX database (Baayen et al., 1995 as cited in Kelly 2012). Kelly (2012) calculated that the mean log frequency for these 600 words was 2.63 (S.D .70, range .48 – 4.17) and the mean syllable length was 1.72 (S.D .74, range 1 – 4).

The 600 items were then divided into a large set (n =500, subdivided into 5 sets n=100), and a control set (n=100). (See Appendix B for list of words used and which sets they were assigned to).

Kelly and Franklin (2012 unpublished) conducted a balanced assignment of items to each set. It is important that each of these sets was balanced to support the validity of this type this type of research (Franklin 1997) by matching the individualised therapy and control sets for log frequency, syllable length and baseline naming ability.
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**Procedures:**
Four SLT students conducted the research. They visited individual participants in teams of two and conducted the assessments and therapy in the participant’s home or nursing home room.

**Pre-therapy assessments:**
Two 30-minute sessions were carried out with each participant every week for eight weeks. Part A of Raven’s Progressive Matrices, Clock Drawing Test and subtests of the CAT were administered during the first two weeks. These were administered to screen for cognitive and Visio-spatial deficits, Baseline naming accuracy scores on the BNT, PALPA and set of 600 words were also obtained during the first two weeks.

The treatment phase took place over the following five weeks, with two 30-minute sessions occurring each week. Each participant was presented with a different set of 100 target words from the treatment set of 500 words each week. Each client was assigned a different set of 100 words for each week of the 5 weeks of treatment; this prevented any one set of 100 words to be treated with more than one client each week.

**Therapy Method**
During the therapy sessions, the student SLT presented each of the 100 pictures consecutively to the participant. A simultaneous spoken model of the target word accompanied each picture. The participant was requested to repeat the target word before the next one was presented. This method aimed to facilitate errorless learning of the target word for the participant. Phonetic distortions were accepted as adequate repetitions. Treatment of each set of 100 words was carried out twice during each session and then repeated again in the second session each week. Therefore, this amounted to a total of four repetitions of each word per week. A different set of 100 treatment words was targeted with each participant every week. This allowed measurement of possible primacy and recency effects in data.
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Post-therapy assessments:
The eighth and final week of the intervention involved post-treatment assessments. An assessor who had never met that participant before conducted the post-treatment assessments. This was in order to reduce an expectancy bias from a familiar assessor, which could impact the reliability of the results. However, it should be noted that the assessor was aware of which items were in the treatment group and which were in the control group therefore they were not a truly blind assessor as their knowledge of which words belonged to the treatment as opposed to the control set may have biased their expectations of the participants’ performances to some extent.

Post-treatment naming accuracy scores were obtained on the BNT; the treated set of 500 treated words and untreated set 100 words. Post-treatment naming accuracy scores were also obtained on additional untreated words from the PALPA (20 words). These words were used to probe for generalisation of any treatment effect to untreated words.

Data analysis:
SPSS version 21 software was used to analyse the results of pre and post-therapy assessments. Exploration of group data revealed that it was not normally distributed (Skewness > -1 and kurtosis <0). Therefore parametric statistical tests such as ANOVAs could not be carried out on this data to assess changes in variance and any possible statistical interactions within the data.

Repeated-measures t-tests were used to analyse data for the group of participants and assess if there were statistically significant changes in assessment scores for the group of participants comparing pre-therapy scores with post-therapy scores. Related-sample. McNemar tests were also performed on the each individual participants assessments results comparing assessment scores pre-therapy with their post-therapy assessment results to ascertain if there was a significant treatment effect evident post-therapy. McNemar tests were deemed to be the most appropriate form of statistical test for this kind of single-subject research as the data required non-parametric analysis.
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Chi-square tests were used to compare post-treatment scores across treatment weeks for the items for each individual participant. This was done in order to measure any primacy and recency effects, which would predict better performance on the first and last sets of items respectively. The chi-square tests are non-parametric tests that were also chosen because they were the most appropriate statistical test for analysis of data concerning individual participants.
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Results

Group Analysis:

Analysis of results on 600 words

Analysis of the descriptive statistics for the group of participants (n=5) showed that there was improvement in naming accuracy for the treated words after therapy. Mean percent correct pre-therapy was 34.4%, SD = 18.25, compared with mean percent correct was 44.0%, SD= 18.47 for the same set of words post-therapy. The control set of words improved by an almost negligible amount. The percentage of correct responses for the control set was 39.0%, SD= 20.17, pre-therapy compared with 39.4%, SD=21.52 post-therapy. These results are showed in Table 2 and Figure 1. Mean percentages were used to report results to compare results accurately do to the difference in set sizes.

Table 2: Summary of correct responses for group of participants n=5 across time and sets.

<table>
<thead>
<tr>
<th></th>
<th>Pre- Therapy</th>
<th>Post-Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated Set (500 words)</td>
<td>34.4%, SD = 18.25</td>
<td>44.0%, SD= 18.47</td>
</tr>
<tr>
<td>Mean Correct responses %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Set (100 words)</td>
<td>39.0%, SD= 20.17</td>
<td>39.4%, SD= 21.52</td>
</tr>
<tr>
<td>Mean Correct Responses %</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A paired sample t-test was conducted to compare the percentage of correct responses pre and post -therapy for the treated sets of words. Paired sample t-tests were deemed to be the most appropriate statistical tests for this analysis as the data were not normally distributed (Skewness > -1 and kurtosis <0). There was no significant difference found between the percent of correct responses in the treatment set pre-therapy (M= 34.40, SD= 18.25) and post-therapy (M=44.04, SD =18.47); t(4)= -2.15, p>0.05, two-tailed.

**Analysis of results on BNT and PALPA:**
Similar analysis was also carried out on group data (n=5) to investigate whether there was a change in naming accuracy on the PALPA and the BNT. Twenty words on the PALPA were used as a second control set and the BNT contained both treated and untreated words that were analysed separately. Although there was some change in naming accuracy on non-treated words pre and post-therapy this change was not statistically significant. These results are summarised in table 3 below.
Table 3: Summary statistics of BNT and PALPA pre and post-therapy, n=5

<table>
<thead>
<tr>
<th></th>
<th>Mean Percentage Correct Pre-Therapy</th>
<th>Mean Percentage Correct Post-Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated words from BNT (25 words)</td>
<td>40.8%, SD = 7.31</td>
<td>50.4%, SD = 16.34</td>
</tr>
<tr>
<td>Untreated words from BNT (35 words)</td>
<td>19.4%, SD= 6.5</td>
<td>18.9%, SD=7.5.</td>
</tr>
<tr>
<td>Untreated PALPA (20 words)</td>
<td>52%, SD= 18.9</td>
<td>60%, SD= 12.2.</td>
</tr>
</tbody>
</table>

A paired sample t-test was carried out to compare percentage accuracy on the untreated words of the BNT pre and post-therapy. There was no significant difference between percentage accuracy of the untreated words on the Boston Naming Test pre-therapy (M=19.4, SD=6.5) and post-therapy (M= 18.9, SD=7.5); t(4)=0.152, p>0.05, two-tailed.

A paired sample t-test was also carried out to compare the percentage naming accuracy of the treated words on the BNT pre and post-therapy. There was no significant difference between the percentage accuracy on the treated words on the BNT pre-therapy (M=40.8, SD=16.3) and post-therapy (M=40.4, 15.9); t(4)=-1.76, p>0.05, two tailed.

Another paired sample t-test was also carried out to compare the untreated words on the PALPA pre and post-therapy. No significant difference was found between percentage naming accuracy on the PALPA pre-therapy (M=52, SD=18.9) and post-therapy (M=60, SD= 12.2); t(4)= 9.34, p>0.05, two tailed.

**Analysis of primacy and recency effects**

As outlined in the methods section, a different sub-set of 100 treatment words were targeted with each participant each week. Analysis of change in naming accuracy across treatment weeks revealed no significant difference in outcomes between treatment weeks for the group of participants (n=5). This is illustrated in figure 2 below.
Chi-squares tests were performed on post-therapy scores for each participant to examine whether there was a significant difference between outcomes for the 5 sets of 100 words. These Chi-squares revealed that there was no statistically significant difference between post-therapy scores on the various treatment sets that were treated on different weeks during the intervention period, \( p>0.05 \).

**Individual Analysis:**
As discussed in the methods section, separate analysis was conducted on each individual participant to investigate individual treatment effects that were not apparent from the group analysis. This paper will report and discuss participants JMCC and MOB’s results in detail.

**JMCC: Individual Analysis:**

*Analysis of results on 600 words*
JMCC’s naming accuracy on treated words increased from 73 correct names pre-therapy to 95 correct names post-therapy. His scores on the control set decreased
Naming Facilitation Therapy: Is it effective with large sets of words?

from 20 correct responses pre-therapy to 14 correct responses post-therapy. These results are illustrated in figure 3 below.

![Graph showing JMCC: Naming Scores on Control & Treatment Sets](image)

**Figure 3: JMCC results across time on treated set (500 words) and control set (100 words).**

A related sample McNemar’s test revealed that the increase in JMCC’s naming accuracy on treated words was statistically significant $p<0.05$.

A related sample McNemar’s test revealed that the decrease in JMCC’s naming accuracy on control words was not statistically significant $p>0.05$.

**Measurement of primacy and recency effects:**
Further analysis was also conducted to assess changes in JMCC’s naming accuracy on the treatment set across treatment weeks. Results of this analysis are illustrated in figure 4 below.
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As reported above within the group analysis, a Chi-square test was performed on JMCC’s results to assess if there was any difference between outcomes for the treatment weeks. This Chi-square test showed that there was no significant difference between outcomes in relation to treatment week $p>0.05$.

Observation of the raw data of outcomes in terms of weeks treated revealed that JMCC obtained his lowest pre and post-therapy scores on set 1 which was targeted with JMCC in week 1 of therapy; he obtained a score of 4 on this set pre-therapy and 8 post therapy on set 1.

**Analysis of results on BNT and PALPA:**
Further analysis was conducted on JMCC’s results on the BNT and PALPA. Results are summarised in table 4 below.
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Table 4: Summary of JMCC’s results on BNT and PALPA pre and post-therapy.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Therapy</th>
<th>Post-Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated BNT (/25 words)</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Untreated BNT (/35 words)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>PALPA (/20 words)</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>

A related samples McNemar’s test revealed that there was no significant change in JMCC’s results on the BNT and PALPA across time.

**MOB: Individual analysis:**

**Analysis of results on 600 words**

MOB’s naming accuracy on treated words increased from 227 correct responses pre-therapy to 270 correct responses post-therapy. Her naming accuracy on control words decreased from 50 correct responses pre-treatment to 47 correct responses on the same set of control words post-therapy. These results are illustrated in figure 5 below.

Figure 5: MOB naming accuracy pre and post-therapy for treated set (500 words) and control set (100 words).

A related sample McNemar’s test revealed that the improvement in MOB’s naming accuracy on treatment set was statistically significant p<0.05. Similarly to results reported for JMCC,
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another related sample McNemar’s test revealed that the change in MOB’s scores on the control items was not statistically significant.

Measurement of primacy and recency effects:
Further analysis was also conducted to assess changes in MOB’s naming accuracy on the treatment set across treatment weeks. Results of this analysis are illustrated in figure 6 below.

![Figure 6: MOB's naming accuracy on treatment words pre and post-therapy across weeks.](image)

As reported above within the group analysis, a Chi-square test was performed on MOB’s results to assess if there was any difference between outcomes for the treatment weeks. Similarly to results reported for JMCC, this Chi-square test showed that there was no significant difference between outcomes in relation to treatment week $p>0.05$.

Similarly, to observations reported concerning JMCC's results, MOB obtained her lowest pre and post-therapy scores on set 1 of the treatment set which was targeted with MOB in week 5 of therapy. She obtained a score of 36 correct responses on this set pre-therapy and 46 post-therapy.

Analysis of results on BNT and PALPA:
Further analysis was also conducted on MOB’s results on the BNT and PALPA. A summary of these results is outlined below
Table 5: Summary of MOB’s results on BNT and PALPA

<table>
<thead>
<tr>
<th></th>
<th>Pre Therapy</th>
<th>Post-Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treated BNT</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Untreated BNT</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>PALPA</td>
<td>14</td>
<td>13</td>
</tr>
</tbody>
</table>

Similarly to results reported for JMCC, Related samples McNemar’s tests revealed that there was no significant change in MOB’s results on the BNT and PALPA across time.
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Discussion:

Effectiveness of treating 500 words:
The results of this research study found that there were no significant treatment effects for five participants as a group. However, this result should be interpreted with caution because a significant treatment effect for the group may have been negated by the small group of participants in this study (n=5) and the significant variability between individual participants’ abilities.

Individual analysis of participants’ results revealed significant improvements for individual participants on treated words post-therapy. This suggests that repetition facilitation therapy can be effective using a large set of 500 words for individuals. This supports the findings of Kelly and Franklin (2012 unpublished). These findings also demonstrate the importance of individual analysis and single case study style research for aphasia in order to investigate possible treatment effects thoroughly (Franklin 1997).

This finding also has theoretical implications; the effective treatment of large sets of words suggests that a priming effect underlies facilitation therapy effects rather than re-learning of words and storage of words in episodic memory because it would be difficult to hold such a large set of target words in episodic memory. This finding support the theory that facilitation therapy works via priming effect that strengthens the links between the semantic and phonological forms of words (Howard et al. 2006). The findings of the current study provide evidence that indicates that word repetition is an effective means of facilitation reinforces the lexical routes for word production by activating both the semantic and phonological forms of words (Nazbanou et al. 2010).

The result of individual analysis for the two participants reported in this paper suggests that facilitation therapy can be effective for clients with anoma of various degrees of severity. Comparison of JMCC and MOB’s profiles showed that although they might have had similar types of deficit their communicative abilities were affected differently. JMCC clearly had a more severe naming-impairment compared to MOB according to the pre-therapy naming assessments and yet both participants had significant improvements on treated words. JMCC benefited less from the therapy; it could be argued that this might have been due to his greater semantic impairment. Howard et al. (2006) found that participants with greater levels of semantic impairment benefited less from facilitation therapy. It might be the case that clients
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have greater semantic impairments have poorer semantic representations for target words and so do not benefit as much from the strengthening of the links between the semantic and phonological forms of words that facilitation therapy seems to provide.

Interestingly, analysis of raw data indicated that all 5 participants obtained their lowest pre and post therapy scores on treatment set 1 (i.e. the first 100 target words) treatment regardless of when this set was treated suggesting that set 1 contained more difficult target words even though all sets had been previously balanced in terms of word frequency and length.

Implications of finding for future SLT research:
Successful treatment of large sets of words using facilitation therapy has the potential to improve clinical outcomes for clients who have anomia, expanding their vocabularies significantly and improving their functional communication abilities considerably. Future research should further investigate these treatment effects using larger groups of participants.

The improvements in naming accuracy demonstrated in the current study were relatively small but they were found to be statistically significant improvements for individual participants. This indicates that facilitation therapy can be effective using large sets of treatment words. Improvements could be harnessed to improve the functional communication abilities of participants by using words that were functionally useful and personally relevant to individual clients.

Furthermore, the limited gains demonstrated by the current study might have been further developed if participants had been allowed to practice production of target words between sessions. In order to limit the possibility of practice effects confounding the results of this research, participants were not given resources to practice production of words independently however it has been demonstrated that attempts at naming can facilitate improvements in naming accuracy (Nickels 2002b; Kelly and Franklin 2012). Future research could investigate how improvements in naming might be supported by independent practice by participants between sessions. Repetition facilitation is a relatively simple technique; clients and their families could be taught how to implement practice using repetition facilitation easily at home. Basso (2010) proposed that therapy should be supported by practice outside of the clinic to support therapy gains.
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Future research could also investigate maintenance of therapy effects over time. Follow-up assessments could be conducted with the participants in the current study within the next few months in order to assess the maintenance of these effects.

The individual analysis reported in this paper shows promising indications that this type of therapy can be effective for clients with naming-impairments of various severity but further research should investigate the relationship between severity of anomia and treatment outcomes. This is relevant because the severity of aphasia varies extensively between individuals.

**Investigation of primacy and recency effects**

Analysis of the results revealed that there was no significant difference in treatment outcomes depending on when words were targeted in therapy. Therefore, there were no primacy or recency effects evident. The absence of such effects is further evidence that a priming effect underlies facilitation therapy rather than episodic memory processes.

**Implications of finding for future SLT research:**

This finding provides some insight into the mechanism of facilitation therapy. This finding has theoretical implications because it suggests that a priming effect is at the root of facilitation therapy and thus facilitation therapy does potentially strengthen the links between the semantic and phonological forms of a word as argued by Howard et al. (2006). A priming effect such as this that works by reinforcing cognitive links within word production processes has the potential to be more powerful and genuinely rehabilitative than a treatment effect that is merely the result of an ability to store words in episodic memory.

**Generalisation of treatment effects to untreated items**

This research consistently found that treatment effects did not generalise to untreated items; either the control set of 100 words or untreated words on the BNT and PALPA. This supports previous research that has also found that facilitation treatment effects tended to be item specific (Soni et al. 2012).

Interestingly, the treated words on from the BNT did not improve significantly along with the other treated words as might have been expected. This might have been because the treated words from the BNT were unusual low frequency words that may have represented more difficult and obscure targets for the participants in this study e.g. words such as [pyramid], [unicorn] and [abacus]. High frequency words are often easier to retrieve than low
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frequency words (Alario et al. 2010). It should be noted that neither of the participants discussed in this paper demonstrated a frequency effect in terms of their abilities to name words on the PALPA pre-therapy; it may have been the case that word frequency did influence the effectiveness of the priming effect associated with repetition facilitation therapy. Wheeldon and Monsell (1992) proposed that priming effects were more successful for higher frequency words than lower frequency words. Further research is needed to investigate the influences that lexical factors such as word frequency and imageability might have on facilitation therapy effects.

Implications for future SLT practice and research

The item-specific nature of treatment effects of facilitation therapy means that target words for therapy should be chosen carefully with clients to ensure that they are functionally relevant and appropriate for them. Furthermore, participants might be more motivated to engage with therapy if the target words were selected with them and were more relevant for their daily communication needs.

Further research could also investigate whether improvements in naming accuracy for words carried-over to other pictures and stimuli representing the target words. It would be expected that the treatment effects observed in this study would improve general production of target words in a variety of contexts. However, if it were found that participants’ naming accuracy improved only when they were presented with the specific images used in this study that would suggest that the improvements shown were not functionally beneficial and might actually be the result of specific associations being formed between the images presented and the target words that participants committed to memory rather than as the result of a priming effect.

Future research could also examine how treatment gains might carry-over to participants’ conversational speech rather than just focusing on improvements at a single word level. Franklin (1997) argued that it was important to measure the extent that any treatment effect transferred to ‘real-life’ situations. Furthermore, future research might also investigate whether facilitation therapy effects might be effective treating other classes of words such as verbs since previous research has tended to target nouns exclusively. Successful treatment targeting functional verbs might prove to be beneficial for client’s overall communicative ability because verbs carry a large amount of meaning in sentences. However,
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depictions of words such as verbs and adjectives might be significantly more difficult compared to depictions of nouns for the purposes of therapy.

Limitations of this study

The small group with heterogeneous participants was a limitation of this study. The control tasks in this study were related naming tasks, which assessed generalisation of treatment effects to, untreated items but no unrelated control task was used to assess other types of cognitive change that might have been occurring during the therapy. A control task such as digit span ability or repetition of non-words could have been used to assess change that may have been unrelated to changes in participants’ naming accuracy scores. This study conducted one set of assessments pre and post-therapy. Multiple baselines assessments could have been administered to obtain more reliable and accurate measures of participants’ pre-therapy ability levels.

Another limitation of this study was that researchers did not have access to participants’ complete medical records. It would have been beneficial to have more information regarding any underlying medical conditions and in particular it would have advantageous to have more detailed medical information regarding the nature and extent of their CVAs and to have access to relevant MRI or CT Scan brain images. Furthermore, researchers did not have access to any previous Speech and Language Therapy notes regarding participants. Participants were referred to the research group from SLTs working in the HSE and assessed for suitability as described in methods section but researchers did not have complete information regarding their language deficits or the nature of any previous SLT intervention. Researchers should have performed a full battery of language assessments with participants before the research began in order to build a comprehensive understanding of their language profiles and gain a better understand their deficits but this was not deemed to be practicable given the time and resource constraints of this study. Future research should aim to obtain full medical records and language profiles for each participant. Although efforts were made in this study to ensure that sets of treatment words were balanced for word frequency and length it appears that all participants found one set more difficult than the others indicating that the sets were not balanced correctly. More extensive measures should be taken to ensure that sets of words were balanced in future research.
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The therapy procedure in this research project attempted to use errorless learning to support word production by presenting participants with a picture of the target word along with a simultaneous spoken model of the word. However, it could be argued that this might not have always guaranteed errorless learning as when the participants saw the picture an incorrect word might have come to mind first that was then corrected by the spoken model provided to them by the researcher. This possible confound could be controlled for by providing the participant with the spoken model of the target word before they see the picture.

Conclusions
Repetition facilitation therapy is a simple form of facilitation therapy that has been shown to be effective in treating large sets of words in this research study. Facilitation therapy targeting large sets of words has the potential to significantly improve clinical outcomes and functional communication for many people with aphasia. The treatment gains reported in this paper appear to be item-specific and so therapy targets should be chosen with care to ensure that targets are functionally relevant and useful for clients with anomia. The evidence presented in this paper indicated that a priming effect underlies facilitation therapy effects and that this priming effect has the potential to improve naming accuracy for individual participants. More research is needed to investigate these treatment effects in more detail.
Naming Facilitation Therapy: Is it effective with large sets of words?

References


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Nickels, L. (2002a) 'Therapy for naming disorders: Revisiting, revising, and reviewing,' *Aphasiology*, 16(10-11), 935-979.

Nickels, L. (2002b) 'Improving word finding: Practice makes (closer to) perfect?', *Aphasiology*, 16(10/11), 1047-1060.


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Naming Facilitation Therapy: Is it effective with large sets of words?

Appendix A

Aphasia-friendly Information sheet and Consent sheet provided to participants

Therapy for treating naming of 500 words for people with aphasia following stroke

INFORMATION SHEET

Research carried out by Speech and Language Therapy Students from the University of Limerick:
Naming Facilitation Therapy: Is it effective with large sets of words?

What is this Study about?

Does naming therapy work with large numbers of words?

What will I have to do?

Speech Therapy: 14 x 1 hour sessions (2 per week)

Over 7 weeks

We will audio record your picture naming
Naming Facilitation Therapy: Is it effective with large sets of words?
**Naming Facilitation Therapy: Is it effective with large sets of words?**

**Is the research Confidential? YES**

**Your name will not be used.**

**Your information will be kept private.**

**Information will be destroyed after 5 years.**

**Do I have to do this research?**

**It will not affect access to future speech and language therapy.**
Naming Facilitation Therapy: Is it effective with large sets of words?

Can I Change My Mind? YES – At ANY TIME
Naming Facilitation Therapy: Is it effective with large sets of words?

More Questions?

E-mail Us

sue.franklin@ul.ie

Phone Us

061 234 274

This research has received ethical approval from the University of Limerick Research Ethics Committee. If you have concerns regarding this study, please contact: Chairman, Education and Health Sciences, Research Ethics Committee, EHS Faculty Office, University of Limerick, Tel (061) 234101 Email sue.franklin@ul.ie.
### Consent Form

<table>
<thead>
<tr>
<th>Statement</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>I read the information leaflet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I had an opportunity to ask questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I was satisfied with the answers to my questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I understand what is involved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I understand that information is kept safe and private</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I know I can stop at any time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I agree to being audio-recorded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I consent to the researchers seeing my medical records</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

I agree to participate in this study.

Name: __________________________       Name Researcher: __________________________
Naming Facilitation Therapy: Is it effective with large sets of words?

Signature: ___________________________  Signature  Researcher: ___________________________

Date: _____________________________
Naming Facilitation Therapy: Is it effective with large sets of words?

Contacts

E-mail Us

sue.franklin@ul.ie

Phone Us 061 234 274

This research has received ethical approval from the University of Limerick Research Ethics Committee. If you have concerns regarding this study, please contact: Chairman, Education and Health Sciences, Research Ethics Committee, EHS Faculty Office, University of Limerick, Tel (061) 234101 Email ehsresearchethics@ul