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**RESEARCH PAPER**

# A controlled study of changes in conversation following aphasia therapy for anomia

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**Abstract**

This paper investigates the relationship between change in picture naming with anomia therapy and changes in word retrieval in conversations between adults with aphasia and a regular conversational partner. We present data from two therapy projects (Hickin et al. [1] and Best et al. [2]). In each study, therapy involved cueing with the aim of improving retrieval of a set of nouns. Naming of the experimental items was assessed twice prior to therapy and again immediately afterwards. There was a significant change in word finding, as measured by picture naming, for the group and for 11 of the 13 participants. At the same time points, we collected conversations between the person with aphasia and a regular conversational partner. We analysed these using Profile of Word Errors and Retrieval in Speech (Herbert et al. [3]) and investigated a set of conversational variables predicted to change with therapy. Unsurprisingly, the conversation data is not straightforward. There is no significant change on the conversation measures for the group but some changes for individuals. We predicted change in word retrieval after therapy would relate to change in everyday conversations and tested this by correlating the change (post-therapy minus mean pre-therapy) in picture naming with the change in conversation variables. There was a significant positive relationship between the change in picture naming and change in some conversation measures including the number of nouns produced in 5 min of conversation ($r = 0.50$, $p < 0.05$, one-tailed) and the number of nouns produced per substantive turn ($r = 0.55$, $p < 0.05$, one-tailed). The findings suggest changes in word finding following therapy for aphasia can be reflected in changes in conversation. The clinical implications of the complex results are explored.

**Keywords:** *Aphasia, therapy, conversation, anomia, cues, word finding*

## Introduction

One criticism directed at impairment-focused aphasia therapy can be that improvements found in naming assessments (usually picture naming) are not reflected in changes in the participants' real-life, day-to-day communication. This is a particular concern with therapy for anomia where changes are found to be limited, for most participants, to treated items [4]. Typically, research studies measure change on straightforward assessments of language processing and avoid the complexities of daily communication. The rationale for using picture naming as a measure of word retrieval ability is that it can produce very reliable, replicable results [5] and is, therefore, a sensitive measure for detecting change during treatment. Real life communication is, in contrast, necessarily variable, and measures of word retrieval in conversation are not straightforward. Nevertheless, Herbert et al. [3] established that there are some parameters of word retrieval in conversation, including the production of nouns, content words and turn

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types, particularly the proportion of substantive turns (i.e. those containing a content word or paraphasia where the target is clear) that show some consistency across both conversations and raters. Therefore, the novel question we address in this paper is whether changes in picture naming assessments with therapy are reflected in changes in participants' conversations. Furthermore, we combine data from two different studies to investigate the outcome for 13 participants with aphasia.

### *Studies of conversation*

There are relatively few intervention studies focussing on conversation reported in the literature. Most employ conversation analysis, a qualitative methodology to find patterns occurring in conversation reflecting the troubles and resources in a particular conversational relationship [6–8]. Studies have tended to focus on qualitative data collection to analyse a range of features in conversation including didactic behaviours [9,10]. However, in this study, we depart from traditional conversation analysis in that: (i) aspects of conversation are quantified and (ii) the conversation measure is used to evaluate changes in conversation after an impairment-based intervention. Nevertheless, the measure is grounded in conversational analysis, and it is naturalistic everyday conversations that are evaluated for change.

### *Anomia therapy and generalisation to conversation*

Anomia therapy is one of the areas of aphasia therapy where a strong evidence base exists for efficacy from single case and case series studies (for a review see [4]). Studies worldwide have shown improvements in word retrieval although there is limited evidence for either 'generalisation' to untreated items or for 'generalisation' across contexts, in this case carryover to connected speech [for an exception see 11]. It is the latter issue which is investigated in this paper. The very small number of studies that investigate generalisation of improved noun retrieval to connected speech is presumably due to the complexities presented by trying to measure such carryover. Those studies that do investigate this, use, for example, complex picture description, procedural discourse or narrative [12], but attempts to measure carryover in everyday conversation are conspicuous by their absence.

The issue of carryover of improved lexical retrieval to connected speech following lexical therapy also begs the question of what changes in the language processing system might underlie this. Evidence from the literature on therapy for verb retrieval difficulties is pertinent here. Conroy et al. [13] discuss why improvements in verb retrieval following lexical therapy have been shown to carryover to connected speech in some studies. They propose that 'perhaps the simplest explanation is that by reinforcing the link from meaning to word form, the target words are more likely to be available within the demanding time-window required for connected speech' (pp 1175). The same explanation could also relate to improved retrieval of nouns and is in line with the claim put forward by Hickin et al. [1] that the anomia therapy reported in this study worked best for those participants who had a deficit in mapping from semantics to phonology. However, it is important to note that what may crucially underpin the carryover of improved verb retrieval to connected speech is the central role that verbs play in determining sentence structure, a role which nouns do not, of course, assume.

### *Questions for this study*

1. Can a cueing intervention with adults with aphasia improve word finding as measured by picture naming?
2. Are there measurable changes in conversation that relate to changes in picture naming?

## Method

### *Background information*

The study reports combined data stemming from two intervention projects. The first, initiated in an academic setting, is called the 'Tavistock project', and, it could be argued, reflects conditions required for 'efficacy research' that establishes whether an approach can work under (something close to) 'ideal conditions'. The therapists were employed by Universities; participants were recruited via a variety of routes including stroke groups and University Clinics and were seen in university or home settings. The second study, the 'Amersham project', designed as a clinical replication and extension of the first, is closer to day-to-day clinical practice, with participants recruited via the health service, two research therapists employed in the health service and with sessions taking place on a hospital out-patient or domiciliary basis. This study therefore allowed for investigation of the 'effectiveness' of the therapy. Data are reported for 13 participants, 7 from the Tavistock project and 6 from the Amersham project. All participants had aphasia as a result of a stroke and were more than a year post-onset when they were

recruited to the study. All had English as their first language and had significant word finding difficulties. All had a regular conversational partner who was willing to be recorded for the research. A summary of background information for the participants is provided in Table I. As the studies are very similar in design, the findings from the two are combined. However, we briefly compare the findings from the two studies in order to explore any similarities/differences in outcome that arise and the implications of these for efficacy and effectiveness research.

*Study design*

The design of the study is illustrated in Figure 1. Participants were recruited in a rolling programme. At each assessment point, they were given a test of picture naming ($n = 200$ black and white-line drawings), and a conversation was recorded with a regular conversational partner. The findings from two pre-therapy and one post-therapy assessment are analysed in this paper[1]. In between the two pre-therapy assessments, participants had regular weekly sessions with the speech and language therapist involving background language testing. Thus, contact time and type of activity were matched during baseline and therapy phases of the study. This means that any effects post-therapy that were not evident at the second pre-therapy assessment could not be arising simply as a result of contact with the therapist contact or 'therapist charm' and are very likely to be due to the intervention. The findings are considered as a group and a case series making use of the variation in outcome for different participants.

*Method and rationale for scoring the conversations*

Participants were encouraged to record an everyday conversation of around 10 mins. The middle 5 mins were used for analysis. The study did not investigate whether each individual produced the specific items that had been used in therapy in their conversations[2]. Instead, the conversation data were scored using Profile of Word Errors and Retrieval in Speech (POWERS, [3]). This measure was specifically designed to investigate the relationship between word retrieval in picture naming and in conversation and to look at change in word retrieval with therapy. POWERS quantifies four types of information: turns and types of turns (including minimal turns that hand back the conversational to the partner and substantive turns that in POWERS are defined as containing a content word); lexical retrieval; trouble-indicating behaviours; breakdown and collaborative repair. The measure includes 'word errors' that include semantic errors, phonological errors, neologisms, pauses of greater then 2 s and filled pauses (um, er, etc.). A set of variables were selected that

Table I. Participant's details at time of study.

| Participant | Study (1, Tavistock; 2, Amersham) | Gender | Years post-onset | Age (years) | Aphasia type (NF, non-fluent; F, fluent) | Occupation at time of CVA |
|---|---|---|---|---|---|---|
| MN | 2 | M | 1 | 55 | NF | Design consultant |
| SC | 1 | M | 5 | 65 | F mixed/Wernicke's | Retired |
| GB | 2 | M | 3 | 71 | NF | Retired florist |
| KR | 1 | F | 8 | 38 | NF Broca's | Homemaker |
| OL | 1 | F | 2 | 65 | F anomic | Retired |
| CM | 2 | M | 5 | 52 | NF | Plumber |
| IK | 1 | M | 3 | 68 | NF Broca's | Retired – ran own business |
| HM | 1 | M | 6 | 45 | NF Broca's | Cabinet maker |
| PH | 1 | F | 3 | 77 | F anomic | Homemaker |
| NK | 1 | M | 3 | 52 | F anomic | Accountant |
| TE | 2 | M | 1 | 69 | F anomic | Ran building business |
| FA | 2 | F | 2 | 64 | NF some apraxia | Personal assistant |
| CV | 2 | F | 2 | 56 | NF | Florist/gardener |

Gender: M, male; F, female. Fluency: F, fluent; NF, non-fluent as judged by participant's speech and language therapist.

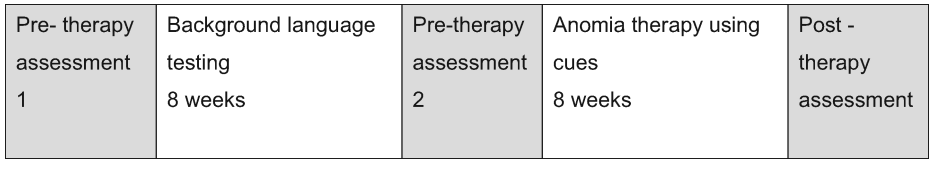


Figure 1. Design of study.

were predicted to change in a positive direction as a result of any improvement in word retrieval following therapy:

Predicted to decrease with increased word retrieval:

- Minimal turns/total turns
- Word errors/content word
- Word errors/turn

Predicted to increase with increased word retrieval:

- Number of content words/substantive turn
- Nouns/substantive turn
- Number of nouns produced (in 5 mins).

The rationale for these selections from the POWERS profile was as follows. Assuming a person is more able to access nouns after therapy, they may need to resort less to the use of minimal turns, which immediately allow the other speaker to take the floor. Better retrieval of nouns could also be predicted to lead to fewer word errors (including semantic and phonological errors) both as a proportion of content words and per turn. With greater facility in accessing nouns, we also predicted an increase in content words and, more specifically, nouns per substantive turn (i.e. in turns containing a content word) and in nouns produced overall. Each noun is counted regardless of whether it has already been produced in the conversation. The majority of variables in POWERS have a denominator, as interaction variables are held to link with opportunity rather than talking time. However, we also predicted change on the final variable (one without a denominator) as it relates in the most straightforward way to the intervention: if a person's ability to retrieve nouns for picture names improved, would the number of nouns retrieved in 5 mins of conversation change?

*Therapy*

In order to be clinically realistic in the UK, the intervention was carried out once a week for 8 weeks. In both studies, the therapy involved cueing a set of 100 experimental items (see Greenwood et al. [15] for details) and a set of personally chosen items (10 in the Tavistock project and 20 in the Amersham project). The findings from the personal sets are excluded here as they were not assessed twice prior to therapy, so there is no baseline, and the outcomes were varied. Participants were presented with a picture of each item: if they were unable to name the item, they were given progressive phonological and orthographic cues and finally the word form for repetition. The specific nature of the cues differed across the two projects and details are provided in Appendix 1.

## Results and discussion

The findings will be presented and discussed in three sections:

- Picture naming – findings for the group followed by the case series.
- Conversation – findings for the group followed by the case series.
- The relationship between change in naming and change in conversation.

*Picture naming*

As a group, the change in naming across the study was statistically significant, with scores increasing from 42% correct on average across the two pre-therapy baselines to 53% correct on average at post-therapy assessment i.e. on average, after therapy, participants named 11.7 extra items out of 100 treated items (repeated measures analysis of variance (ANOVA): main effect of test (three levels), $F(2,24) = 20.85$, $p < 0.001$). Post hoc $t$-tests show that pre-therapy naming scores (at tests A1 and A2, mean 40 and 43%, respectively) do not differ from each other ($t(12) = 1.82$, $p = 0.09$, two-tailed), but both pre-therapy assessments (A1 and A2) are significantly worse than post-therapy (A3, mean 53% correct; $t(12) = 5.23$, $p < 0.001$ and $t(12) = 4.84$, $p < 0.001$, respectively).

The results for naming the treated items over the course of the study are shown in Table II. Participants are ordered in the table according to the size of change in naming treated items from baseline to post-therapy assessment. It is clear from the table that participants varied considerably both in their initial ability to name pictures (ranging from 18 to 72% correct) and in the change in naming after therapy (using the post-therapy assessment score minus the mean pre-therapy score, the percentage change ranged from 1 to 28%). Most had fairly stable naming across the two baseline pre-therapy tests, although a few did not. For example, participant CV who improved the most after therapy also had better naming at the second than at the first-baseline assessment. Using Wilcoxon matched samples test comparing pre-therapy assessments combined with post-therapy, 11 of the 13 demonstrated significant change in picture naming (details provided in right hand column of Table II).

*Comparison across projects*

The naming scores of the participants from the first, academically-based project improved on average by 10%. Those from the second, clinical-based study, where participants were recruited via the health service, improved on average by 14% in their naming of treated items. In both projects, change in naming was gradual across therapy sessions[3]. Most participants improved and the degree of improvement was essentially equal across the two studies. The similar pattern of outcome across studies is important as it suggests the intervention is working in a similar way in the two settings. This suggests that other 'efficacy' studies, likely to be those based in academic settings and under more ideal conditions [17,18], have implications for the 'effectiveness' of approaches implemented in health service settings. Although further research on effectiveness of therapy remains necessary, the findings are very encouraging.

*Conversation: group data*

Several participants and conversational partners anecdotally reported a change in conversation after the therapy. However, the conversation data are very variable. This is in line with findings from previous studies of conversation in people with aphasia (Perkins et al. [19]). The mean scores for the group pre and post therapy are shown in Table III, which also provides standard deviations, a final column showing the size of the changes and the results of statistics on the group data.

As a group, the change in conversational variables across the study was not significant (repeated measures ANOVA: main effect of test (three levels), $F(2,22) = 1.86$, n.s. minimal turns/total turns, $F(2,22) = 1.35$, n.s. word errors per content word, and $F(2,22) < 1$, n.s. for word errors per turn, content words per substantive turn, nouns per substantive turn and for nouns per 5 mins of conversation). The lack of statistical significance is

Table II. Naming of total therapy set of 200 items; proportion correct on the two occasions of testing prior to therapy, post-therapy and proportional change.

| Participant | Pre-therapy A1 | Pre-therapy A2 | Mean A1/A2 | Post-therapy A3 | Proportional change | Wilcoxon matched samples, 1-tailed test | |
|---|---|---|---|---|---|---|---|
| | | | | | | *Z* | *p* |
| MN* | 0.22 | 0.32 | 0.27 | 0.28 | 0.01 | 0.34 | 0.365, n.s. |
| SC | 0.34 | 0.37 | 0.35 | 0.37 | 0.02 | 0.61 | 0.270, n.s. |
| GB† | 0.26 | 0.28 | 0.27 | 0.33 | 0.06 | 1.88 | 0.030, sig. |
| KR | 0.40 | 0.37 | 0.39 | 0.46 | 0.08 | 2.29 | 0.011, sig. |
| OL | 0.52 | 0.51 | 0.52 | 0.61 | 0.10 | 2.54 | 0.000, sig. |
| CM | 0.53 | 0.58 | 0.56 | 0.66 | 0.10 | 2.66 | 0.004, sig. |
| IK | 0.24 | 0.22 | 0.23 | 0.34 | 0.11 | 3.16 | 0.001, sig. |
| HM | 0.45 | 0.42 | 0.44 | 0.55 | 0.12 | 3.12 | 0.001, sig. |
| PH | 0.33 | 0.38 | 0.35 | 0.49 | 0.14 | 3.57 | 0.000, sig. |
| NK | 0.56 | 0.59 | 0.57 | 0.71 | 0.14 | 3.96 | 0.000, sig. |
| TE | 0.72 | 0.76 | 0.74 | 0.91 | 0.17 | 5.86 | 0.000, sig. |
| FA | 0.18 | 0.23 | 0.20 | 0.42 | 0.22 | 6.2 | 0.000, sig. |
| CV | 0.48 | 0.64 | 0.56 | 0.84 | 0.28 | 6.73 | 0.000, sig. |
| Mean (s.d.) | 0.40 (0.19) | 0.43 (0.17) | 0.42 (0.16) | 0.53 (0.20) | 0.12 (0.08) | | |

Participants ordered by proportional change in naming.
*Similarly MN was given 180 rather than 200 items in total. The Wilcoxon matched samples analysis compares naming at A1 and A2 combined, with naming at A3. Significance level taken at $p < 0.05$.
†Due to fatigue, GB's treatment set was reduced to 120 items rather than 200 items in total.

Table III. Group mean scores (and standard deviations) on conversation measures across the course of the study.

| Conversation variable | Pre-therapy 1 | Pre-therapy 2 | Post-therapy 3 |
|---|---|---|---|
| Predicted to decrease with increased word retrieval | | | |
| Minimal turns/total turns | 0.17 (0.14) | 0.24 (0.16) | 0.14 (0.10) |
| Word errors/content word | 0.70 (0.55) | 1.00 (0.90) | 1.03 (1.40) |
| Word errors/turn | 0.73 (0.46) | 0.68 (0.23) | 0.66 (0.32) |
| Predicted to increase with increased word retrieval | | | |
| Content words/substantive turn | 2.27 (1.36) | 2.39 (1.54) | 2.34 (1.17) |
| Nouns/substantive turn | 0.80 (0.43) | 0.78 (0.41) | 0.87 (0.38) |
| Nouns per 5 minutes of conversation | 22.6 (14.4) | 20.6 (14.9) | 24.9 (14.9) |

not surprising due to the variability evident from the large standard deviations. The six variables predicted to change with the intervention fall broadly into three patterns on average for the group. Two variables, word errors per turn and content words per substantive turn, remain fairly stable across the course of the study. Two show some change across the two baselines: minimal turns as a proportion of total turns rises numerically at the second assessment to return to a level just below that of the first assessment after therapy, and word errors per content words show a numerical increase from the first to the second baseline and remains at this level after the therapy. Finally, two variables have mean scores that are relatively stable before therapy and that increase numerically after therapy: nouns per substantive turn increases by around 10% of the initial score (from 0.79 on average pre-therapy to 0.87 after therapy), and nouns produced in 5 mins of conversation increases on average by around 2.4 (i.e. also by approximately 10%: an average increase of 2.4 nouns in 5 mins conversation could equate to an extra 28.8 nouns in an hour-long conversation). This is a description of the numerical data, and we caution again that the change for the group as a whole is not statistically significant.

*Conversation: case series*

Turning now from the group to the case series data, the full scores for all individuals, both baselines and post-therapy for all variables predicted to change, are provided in Appendix 2 along with the results of statistical analysis. A trend test was carried out for each individual on each variable. As this resulted in 78 tests (13 participants $\times$ 6 variables) a Bonferroni correction was made (by dividing by six to reflect the number of variables being tested for each individual), setting the significance level at 0.0083. While there are some patterns that might be linked with the therapy, there are others that alter in unpredicted ways. There is also considerable variability in the conversational findings, which raises the issue of whether these changes are real or are due to measurement error. Overall, very few of the changes reach statistical significance. Of the 16 findings that are significant, the majority (11) have either a missing baseline (as in the case of TE and FA) or considerable variation of more than 15% between the two baseline scores (calculated by taking the difference between baseline scores divided by the mean of the baseline scores).

We will outline the remaining five changes in individual's conversations that are statistically significant and where there is some stability in the variable across the two pre-therapy assessments. Two of these are from IK's data. He has severe aphasia and non-fluent speech. IK shows a dramatic reduction in minimal turns as a proportion of turns after therapy (0.21, 0.19 pre-therapy to 0.00 post-therapy) that is a change in the predicted direction, but also an increase in word errors per turn (0.73, 0.75 pre-therapy to 1.24 post-therapy), contrary to the change predicted. It is also worth noting IK produced few nouns, and this did not change with therapy. The quantitative findings suggest fewer turns in total in the post therapy conversation but within these, significantly fewer where the floor is simply handed back to the partner. The increase in word errors appears to stem from a small increase in the number of phonological errors and filled pauses (um, er, etc.) per turn after therapy. Like IK, GB also showed a reduction in the number of minimal turns after therapy (0.42, 0.37 pre-therapy to 0.12 post-therapy). BG also has severe aphasia, and the fact that he produced the second highest proportion of minimal turns in the group shows that a large part of his interaction involved handing the floor back to his conversation partner. This change was in the predicted direction. KR with less severe non-fluent aphasia showed a significant reduction in the number of word errors she produced per turn (0.88, 0.97 pre-therapy to 0.46 post-therapy). This change stemmed from a small reduction in word errors combined with an increase in her number of turns. Examination of the nature of her errors reveals a reduction in neologisms and in pauses (both filled and within turn pauses lasting $>2$ s). Finally, PH produced fewer content words per substantive turn after therapy (3.25, 3.35 pre-therapy to 2.08 after therapy). This is a change in the reverse direction to that predicted. PH, with less severe fluent anomic aphasia, tended to produce more turns and particularly substantive turns after therapy (46.5, 43 pre-therapy to 60 post-therapy). The significant change reflects her content word production not keeping pace with this increase in substantive turns.

This summary above of the picture for those individuals where there was significant quantitative change on the individual conversation measures provides a surface analysis of the changes. Importantly, anecdotal report suggests changes may also be occurring in the partners' conversation in relation to that of the person with aphasia. This warrants further qualitative examination of the patterns in conversation in future studies.

We now consider the relationships between naming (which clearly improves with therapy for most participants) and the conversational variables for the group as a whole. Are the results for the case series in line with our predictions?

*Evaluating our predictions – relating change in naming to change in conversations*

In order to test our predictions about conversational change after the therapy, we can make use of the variability in outcome as measured by picture naming. This entails taking change in picture naming as reflecting an improvement in word retrieval and asking whether the size of change relates to the size of (non-significant) change in conversation. A relationship between picture naming and word retrieval in conversation has already been demonstrated for people with aphasia prior to therapy [3]; this study takes the investigation a stage further, comparing word retrieval pre- and post-therapy. Correlations between change in picture naming and in conversation were calculated for all the variables predicted to change with therapy. The results are provided in Table IV.

The correlations show that two of the variables predicted to change in relation to picture naming in a negative direction after therapy did not do so (word errors/content word, word errors/turn). The lack of change in the proportions of word errors may obscure changes not currently captured by the POWERS measure; for example, there may have been a change in error type. Further research could investigate whether errors are closer to target words in conversation after therapy. The predicted correlation between change in content words per substantive turn in conversation and change in naming also did not occur. However, there was a significant relationship between change in naming and change in minimal turns/total turns ($r = 0.57$, $p < 0.05$, one-tailed), although as discussed above and shown in Table III, there is on average a big increase in score (of around half a standard deviation) between the two pre-therapy measures with a return to just below the first baseline after therapy. The main change occurred over the baseline and was not therefore likely to be linked directly to therapy.

There was a significant relationship between change in picture naming after therapy and change in the two conversational measures incorporating nouns (number of nouns/5 mins of conversation, $r = 0.50$, $p < 0.05$, one-tailed and nouns/substantive turn, $r = 0.56$, $p < 0.05$, one-tailed). This is a striking finding, particularly given the variability in conversations across occasions, likely noise and measurement error involved in trying to quantify aspects of everyday communication. The intervention focused on noun retrieval and two measures of change in noun production in conversation related significantly to change in picture naming. This close link between the focus of therapy and the two variables, which changed in tandem with naming, increases the likelihood that the findings reflect a 'real' relationship and not simply a random variation. The other three variables, which we had predicted would change with therapy, did not. Therefore, our findings also have implications for outcome measurement in conversation; it is likely that the closer the relationship between the therapy target and the conversational variable, the more likely change in the two is linked.

Figure 2 provides scatter plots showing the raw data for change in naming and change in noun retrieval in conversation (/substantive turn and/5 mins). There are two points to note. First, the change in conversation is in a negative direction for several individuals (7 for nouns/5 mins and 6 for nouns/substantive turn). Positive changes would be a much more favourable outcome for these participants. Nevertheless, on average, for the group, there was improvement in both measures of noun retrieval in conversation, and this paralleled the improvement in picture naming over the course of the study. This is illustrated in Figure 3. There were also some additional reports of change not captured in our conversation measure used in this study[4].

The relationship between the different variables on the *y*-axis in this figure is not important as they measure different aspects of noun retrieval; one variable relates to the task of naming pictures and the other to noun retrieval in conversation. The *y*-axis could be changed in scale to make the lines closer or further apart. The important thing to note is the pattern, repeated across the measures, of stability over baseline (A1A2) and an increase at post-therapy assessment (A3). Thus, despite the great variability across individual participants and across occasions of testing, in noun retrieval measured by both picture naming and conversation, for the group on average, there is stability pre-therapy, followed by change after therapy.

Table IV. Pearson's correlations (with one-tailed significance levels) for change in picture naming with change in conversational measures for the group (post-therapy minus mean of pre-therapy assessments).

| | |
|---|---|
| Not significant | |
| Content words per substantive turn: 0.05, n.s | |
| Word errors/content word: −0.06, n.s. | |
| Word errors/turn: −0.12, n.s. | |
| Significant | |
| Minimal turns/total turns: 0.57, $p < 0.05$. | |
| Nouns/substantive turn: 0.56, $p < 0.05$ | |
| Number of nouns produced (in 5 min): 0.50, $p < 0.05$ | |

*Summary of findings*

The picture obtained from investigating the influence of anomia therapy on everyday conversations is

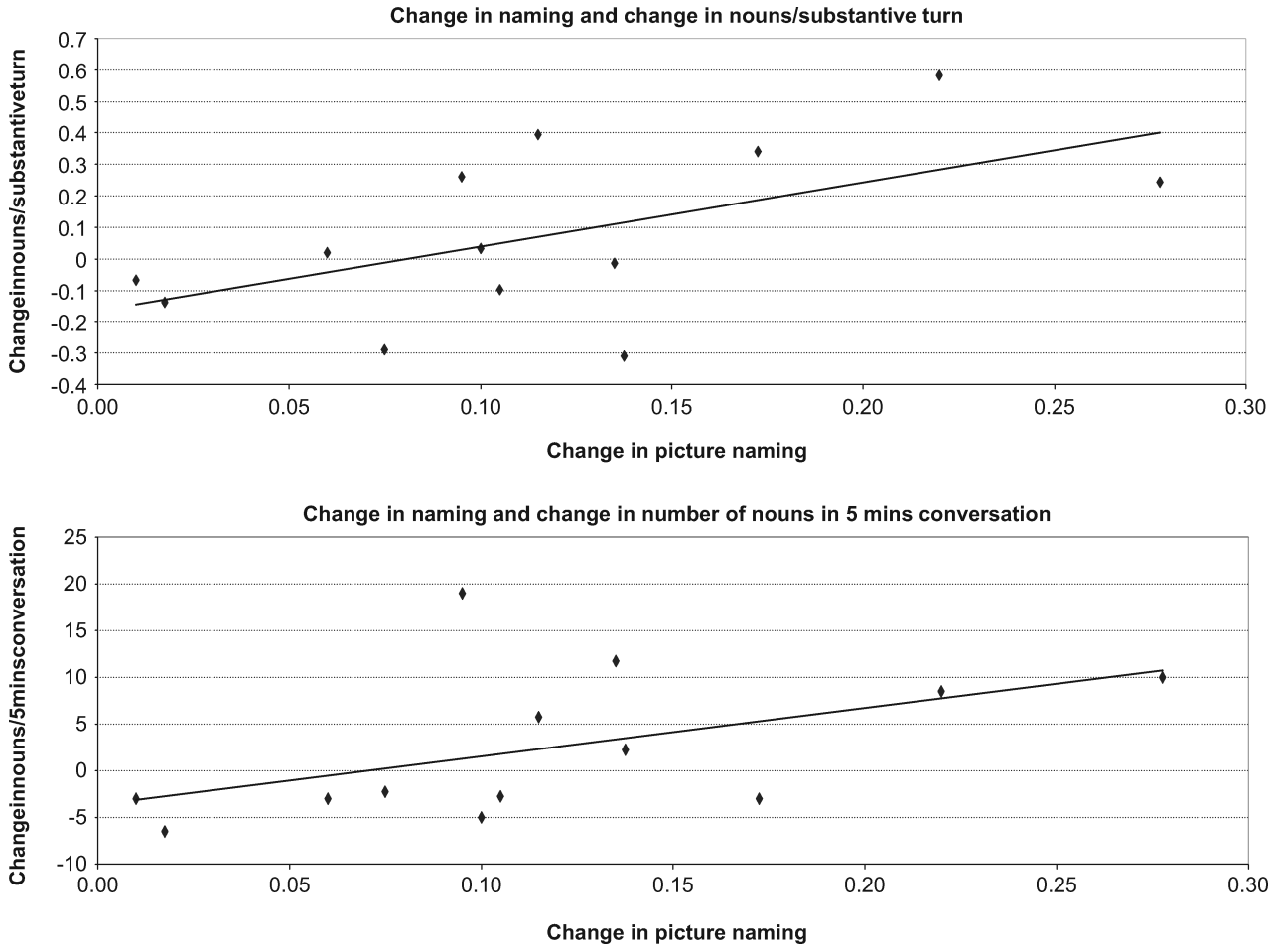


Figure 2. Scatter plots of the relationships between change in picture naming and change noun retrieval in conversations. The change is calculated as the post-therapy score minus the mean pre-therapy score.

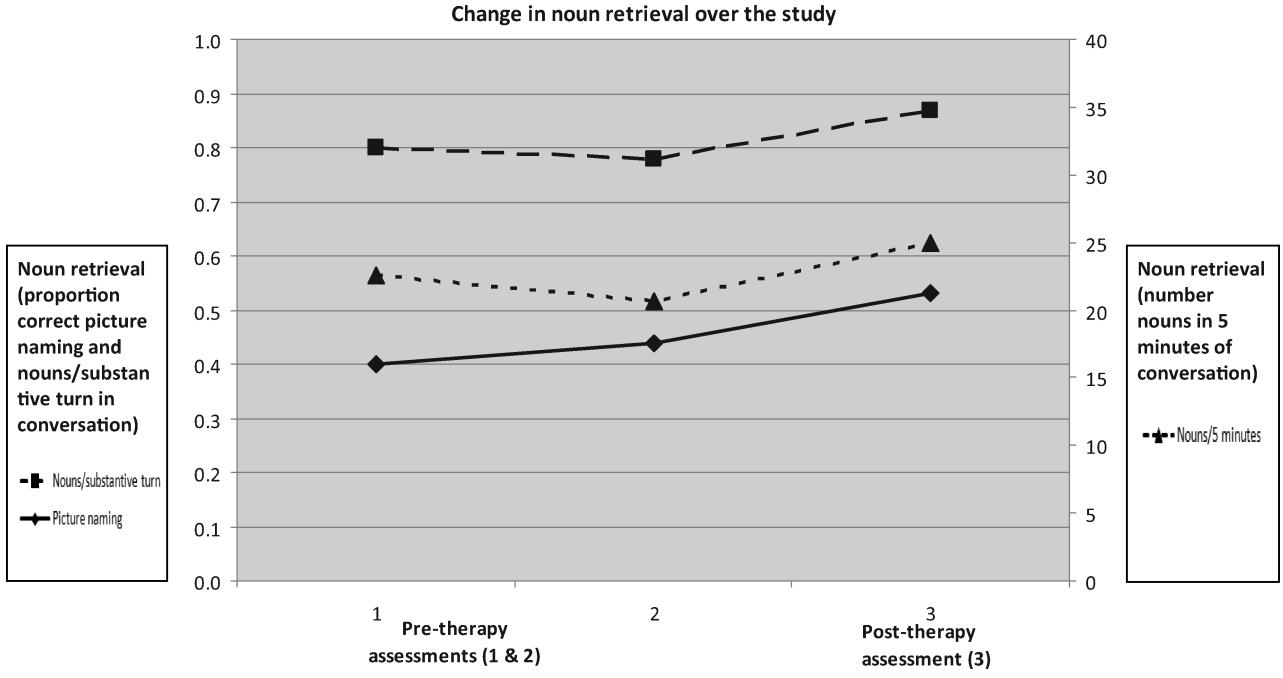


Figure 3. Graph of change in noun retrieval over the course of the study illustrating parallel change in picture naming and conversation.

not straightforward. There was significant change for the group on picture naming, and this improvement was significant for 11 of the 13 individuals in the study. However, there was no significant change for the group on the conversation variables that we predicted would change and few significant changes for individuals. The data from the conversations are very variable, which is likely to reflect the fact that they were unconstrained, everyday conversations and not limited, for example, by topic. Despite the general lack of significant change in conversation, we did find a statistically significant relationship between change in naming and change in conversation for the two variables reflecting the intervention focus most closely (nouns per substantive turn and nouns/5 mins of conversation). This change is suggestive of 'carryover' from cueing therapy to conversation.

In considering the significance of the findings, it is also important to bear in mind that statistical and clinical significance are not the same thing. A small increase in the number of words a person with aphasia is able to retrieve in conversations may have a substantial effect on their communication and their views of their aphasia. Hillis [20] gives the example of a woman, who chose 'Bacardi and Coke' as a therapy target so that she could order for herself in a bar. While the small change in word retrieval would not reach 'statistical' significance, the impact for her was important. The effects in this study are also small, in terms of change in word retrieval, but they can result from once-a-week therapy, for 8 weeks, for someone over a year post-stroke.

### *An effect of therapy?*

What evidence do we have that changes in word retrieval result from the intervention? It might be the case that participants' anomia decreased as they recovered from their aphasia or simply as a result of involvement in the study and carrying out language tasks. There are several lines of evidence in support of the changes resulting directly from the therapy involving cues:

- Participants were all more than a year post-onset at the start of study.
- Word finding was relatively stable and did not change significantly for the group over the pre-therapy phase (between A1 and A2), despite regular contact and language-related activities during this time (although this was not the case for all individuals, see data from CV in Table II).
- Changes were limited to treated items for most participants. Obviously, generalised changes would be preferable, but the change focused on treated items clearly suggests the improvement arose directly from the therapy.
- Replication in a clinical setting produced comparable findings; the Amersham study resulted in very similar patterns of outcome for participants. Had the changes from the first academically based study not arisen as a result of therapy, it is unlikely that similar changes would have been found in the replication study.
- Finally, the significant relationship between changes in conversation and changes in picture naming occurred for conversation variables that measured noun retrieval directly. The measures less directly linked with therapy: 'word errors' and 'content words' did not show a significant relationship. This suggests that the impairment-based noun retrieval therapy can have specific effects on conversation for some people.

This study does not address whether therapy for adults with aphasia should focus on impairment, with the aim of improvement generalising to everyday conversation, or should focus directly on conversation or indeed other aspects of functional communication. It may be that the answer is different for different people and at different points in their journey. Further research is necessary to address this important question and related issues concerning the level of language processing targeted by impairment therapy and the mechanisms by which therapy works. In addition, the process by which carry-over to improved word retrieval in conversation occurs needs further investigation [13].

### *Possible mechanism for change*

Evidence that this type of cueing intervention is most effective at improving word finding in those with a deficit in accessing word forms from meaning [1] suggests that it is this process that is facilitated by the intervention. We hypothesise that there may be a subtle shift in ease of lexical access which, while not reaching the threshold required for correct production of the untreated items in confrontation naming, may nevertheless allow more nouns to be produced in conversation. Further investigation combining quantitative and qualitative analyses of conversation, including changes in error types, and studies of priming in production are necessary to investigate this hypothesis further.

*Critique*

Tate et al. [21] list criteria for good single case experimental design. The criticisms that can be levelled at this study from their framework are (i) there were two rather than three or more pre-therapy baseline measures, (ii) there is no measure of inter-rater reliability for observations and (iii) the assessor was not independent from the therapist. On all counts, we agree that the study would be better with these in place. However, on (i) repeated testing on picture naming, despite the regular contact between therapist during the baseline prior to therapy revealed considerable stability (for the group, mean score first baseline assessment: 0.40, second baseline assessment: 0.42). Points (ii) and (iii) can be addressed in further research. In future studies, there will continue to be a tension between the feasibility of clinical research, particularly that addressing effectiveness (such as the clinically based Amersham study) and the rigour of experimental design. All the other criteria suggested by Tate et al. were met in our study: (i) outcome measures were relevant, precise and repeatable, (ii) the design involved a control (no treatment) condition and (iii) replication, across participants and across projects, (iv) the results were subject to statistical analysis (not purely visual inspection) and finally, core to this paper, (v) we investigated transfer to conversation i.e. impact beyond the treated behaviour. A novel aspect of the study was replication in a clinical environment. Further research could also involve an 'overlap' analysis investigating the extent to which treated words were used before and after therapy in everyday conversations.

*Clinical implications*

This study has shown that participants with aphasia who are clinically stable can show improvements in word retrieval in conversation following impairment therapy which focuses on picture naming. Such changes can be achieved in a clinical setting with weekly therapy over an 8-week period as is a common pattern of therapy delivery in the UK. Although the changes in conversation measures were numerically small, the impact on wider communication can be greater (see Best et al. [2] for some participant's views on changes following this therapy). Variability in patterns of change within the group make it difficult to predict individual outcomes for conversation; however, where positive changes were found in conversation measures, there were always significant changes in picture naming. It is clinically important to demonstrate that impairment-based therapy, which has a growing evidence base, can have positive effects on the conversation of people with aphasia. Our evidence for positive changes combined with positive views from participants [2] leads us to different conclusions from those who suggest impairment-based approaches, particularly those involving correction, will have a negative effect on interaction [10]. This concern may be relevant for some interventions but is not necessarily the case for intervention targeting word retrieval using cues.

## Summary and conclusion

In this study, 13 participants with aphasia were involved in an intervention targeting word retrieval. Data from two projects are combined and is remarkably similar:

(i) Participants' word retrieval, as measured by picture naming, improved following an intervention using cues.
(ii) The intervention took place once a week for 8 weeks and was feasible within current UK clinical speech and language therapy provision.
(iii) There was considerable variability in participants' word retrieval in conversation over the study
(iv) Several aspects of conversation predicted to change with intervention did not show significant correlations with change in picture naming (content words per substantive turn, word errors/content word, word errors/turn)
(v) There was a significant correlation between change in naming and the proportion of minimal turns in conversation – a variable that was not stable over baseline testing, and, importantly, change in the two measures of noun retrieval in conversation (nouns/substantive turn and number of nouns produced in 5 mins).

These findings suggest that improvement in naming pictures with therapy may be reflected in changes in noun retrieval in everyday conversation.

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## Notes

1. Both projects entailed a second phase of therapy, following the cueing therapy, aimed at increasing use of treated items in connected speech. The findings from this phase of the Tavistock Study are reported in Herbert et al. 2003 [14]. In the Amersham project we also investigated participants' views using the Communication Disability Profile [2]. Finally, it is beyond the scope of this paper to report on generalisation to untreated items. This data is discussed for a single case in Greenwood et al. 2010 [15] and across the two projects in Best et al. 2006 [16]).
2. While this approach may also be informative, it would have entailed different items for different participants, as each individual also had their own chosen set included in therapy. Furthermore the number of items in this personalised set differed across the two studies. Finally, we considered the most likely outcome of such an analysis of 'overlap' would be that some participants used some of their treated words some of the time. We doubt how informative this extremely time intensive analysis would be in this case but suggest it could be employed in future research where all participants have the same number of treated items.
3. see Hickin et al. 2002 [1]; Greenwood et al. 2010 [15] for details of change during therapy.
4. For example, CV, who showed a significant improvement in picture naming, was reported to hesitate much less after the therapy. This was substantiated by a further analysis which demonstrated a reduction in the number of pauses lasting greater than three seconds per substantive turn from 0.7 pre-therapy to 0.4 post-therapy. Further exploration of the complexity of her 'hesitation's requires detailed individual qualitative analysis which is beyond the scope of this paper.

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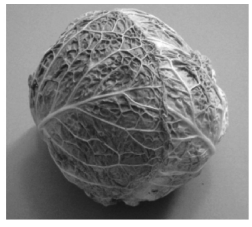
## Appendix 1

### Cueing therapy: item allocation and nature of cues across projects

In both projects, if unable to name the pictures after 5 seconds, participants were given cues. The first cue was a single phoneme plus schwa or single grapheme. The second cue was the first syllable of the word, or CV if the target was monosyllabic. If the progressive cues did not aid naming, participants were given the word to repeat, still in the presence of the picture. The projects differed in the item allocation and nature of the cues as follows:

In the Tavistock project, the 200 items were divided as follows:

100 treated items: 50 with phonological cues and 50 with orthographic cues
100 control items matched with 100 treated items
All items were presented with a choice of cues [1].



| | | |
|---|---|---|
| W | G | C |
| WED | GOD | CAB |
| WEDDING | GODDESS | CABBAGE |

Figure A1. Example of therapy item with choice of cues.

In the Amersham project the 200 items were divided as follows:

100 treated items: 50 with a single cue and 50 with a choice of cues.
All cues were both phonological and orthographic, administered simultaneously as would be most likely in clinical practice. The number of distractors was increased gradually over the sessions, to three; the cues and distractors were presented in random order [2, 16].

**Appendix 2 Conversation measures predicted to change, raw data for individual participants and the results of statistical analyses**.

| | Min turns/total turn | | | | | Trend test for rankable counts | | |
|---|---|---|---|---|---|---|---|---|
| Partic. | A1 | A2 | Mean A1/A2 | A3 | ppn change | z | *p* | Significance at level $<0.0083$* |
| MN | 0.45 | 0.30 | 0.37 | 0.17 | −0.20 | 1.49 | 0.068 | n.s. |
| SC | 0.08 | 0.19 | 0.13 | 0.07 | −0.06 | 1.04 | 0.149 | n.s. |
| GB | 0.42 | 0.37 | 0.39 | 0.12 | −0.27 | 2.83 | 0.002 | sig. |
| KR | 0.18 | 0.33 | 0.26 | 0.26 | 0.00 | −0.17 | 0.434 | n.s. |
| OL | 0.11 | 0.58 | 0.35 | 0.15 | −0.20 | 2.42 | 0.008 | n.s. |
| CM | 0.00 | 0.10 | 0.05 | 0.15 | 0.10 | −1.34 | 0.090 | n.s. |
| IK | 0.21 | 0.19 | 0.20 | 0.00 | −0.20 | 2.61 | 0.005 | sig. |
| HM | 0.15 | 0.28 | 0.21 | 0.22 | 0.01 | −0.18 | 0.428 | n.s. |
| PH | 0.17 | 0.16 | 0.17 | 0.13 | −0.04 | 0.75 | 0.225 | n.s. |
| NK | 0.00 | 0.13 | 0.07 | 0.04 | −0.02 | 0.8 | 0.212 | n.s. |
| TE | 0.17 | | 0.17 | 0.28 | 0.11 | −1.28 | 0.100 | n.s. |
| FA | 0.26 | 0.00 | 0.13 | 0.28 | 0.15 | −2.57 | 0.005 | sig. |
| CV | 0.00 | | 0.00 | 0.00 | 0.00 | 0 | 0.500 | n.s. |
| mean | 0.17 | 0.24 | 0.19 | 0.14 | −0.05 | | | |
| s.d. | 0.14 | 0.16 | 0.12 | 0.10 | 0.13 | | | |

| | Word errors/content word | | | | | Trend test for rates** | | |
|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | Mean A1/A2 | A3 | ppn change | t (df) | *p* | |
| MN | 1.73 | 2.30 | 2.01 | 2.00 | −0.01 | 0(27) | 0.499 | n.s. |
| SC | 0.52 | 0.31 | 0.42 | 0.24 | −0.17 | 2.59(358) | 0.005 | sig. |
| GB | 0.83 | 1.23 | 1.03 | 1.32 | 0.29 | 1.18(78) | 0.121 | n.s. |
| KR | 0.80 | 0.56 | 0.68 | 0.50 | −0.17 | 1.64(257.5) | 0.051 | n.s. |
| OL | 0.27 | 0.46 | 0.37 | 0.18 | −0.19 | 2.36(250) | 0.009 | n.s. |
| CM | 0.29 | 0.18 | 0.24 | 0.31 | 0.07 | 1(185) | 0.159 | n.s. |
| IK | 1.75 | 2.91 | 2.33 | 5.21 | 2.88 | 6(34) | 0.000 | sig. |
| HM | 1.32 | 1.12 | 1.22 | 1.68 | 0.46 | 1.99(101.5) | 0.025 | n.s. |
| PH | 0.28 | 0.31 | 0.29 | 0.34 | 0.05 | 0.76(418) | 0.223 | n.s. |
| NK | 0.35 | 0.26 | 0.31 | 0.27 | −0.04 | 0.61(400) | 0.272 | n.s. |
| TE | 0.385 | | 0.385 | 0.167 | −0.22 | 3.25(226) | 0.001 | sig. |
| FA | 0.200 | 1.333 | 0.767 | 0.923 | 0.16 | 0.27(22) | 0.396 | n.s. |
| CV | 0.393 | | 0.393 | 0.224 | −0.17 | 1.81(135) | 0.037 | n.s. |
| mean | 0.70 | 1.00 | 0.80 | 1.03 | 0.23 | | | |
| s.d. | 0.55 | 0.90 | 0.68 | 1.40 | 0.82 | | | |

| | Words errors/turn | | | | | Trend test for rates | | |
|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | Mean A1/A2 | A3 | ppn change | t (df) | *p* | |
| MN | 0.29 | 0.58 | 0.43 | 0.35 | −0.09 | 0.46 (149) | 0.324 | n.s. |
| SC | 0.77 | 0.76 | 0.77 | 0.74 | −0.02 | 0.17(160.5) | 0.434 | n.s. |
| GB | 0.77 | 0.78 | 0.78 | 0.97 | 0.19 | 1.02(104) | 0.156 | n.s. |
| KR | 0.88 | 0.97 | 0.93 | 0.46 | −0.47 | 4.13 (218) | 0.000 | sig. |
| OL | 0.67 | 0.55 | 0.61 | 0.42 | −0.19 | 1.43(120) | 0.077 | n.s. |
| CM | 0.71 | 0.45 | 0.58 | 0.80 | 0.22 | 1.14(73) | 0.129 | n.s. |
| IK | 0.73 | 0.75 | 0.74 | 1.24 | 0.49 | 2.56(113) | 0.006 | sig. |
| HM | 0.65 | 0.84 | 0.74 | 1.24 | 0.50 | 3.18(156.5) | 0.001 | sig. |
| PH | 0.60 | 0.62 | 0.61 | 0.52 | −0.09 | 0.85(220.5) | 0.198 | n.s. |
| NK | 2.06 | 0.93 | 1.50 | 0.71 | −0.79 | 3.41(107) | 0.000 | sig. |
| TE | 0.70 | | 0.70 | 0.51 | −0.19 | 1.18(94) | 0.121 | n.s. |
| FA | 0.05 | 0.20 | 0.13 | 0.31 | 0.18 | 1.66(96) | 0.050 | n.s. |
| CV | 0.62 | | 0.62 | 0.35 | −0.27 | 1.85(86) | 0.034 | n.s. |
| mean | 0.73 | 0.68 | 0.70 | 0.66 | −0.04 | | | |
| s.d. | 0.46 | 0.23 | 0.31 | 0.32 | 0.36 | | | |

(*continued*)

Appendix 2 (*Continued*).

| | Content words/substantive turn | | | | | Trend test for rates | | |
|---|---|---|---|---|---|---|---|---|
| Partic. | A1 | A2 | Mean A1/A2 | A3 | ppn change | t (df) | *p* | Significance at level $<0.0083$* |
| MN | 1.00 | 0.63 | 0.81 | 0.80 | −0.01 | 0.23(35) | 0.410 | n.s. |
| SC | 2.09 | 3.59 | 2.84 | 3.49 | 0.65 | 2.32(119) | 0.011 | n.s. |
| GB | 1.61 | 1.00 | 1.31 | 1.79 | 0.48 | 1.50(56) | 0.069 | n.s. |
| KR | 1.76 | 3.00 | 2.38 | 1.75 | −0.63 | 2.05(123.5) | 0.021 | n.s. |
| OL | 3.02 | 2.65 | 2.83 | 3.39 | 0.56 | 1.26(79) | 0.106 | n.s. |
| CM | 2.95 | 4.47 | 3.71 | 3.47 | −0.24 | 0.30(50) | 0.382 | n.s. |
| IK | 1.09 | 0.76 | 0.92 | 0.64 | −0.29 | 0.90(40) | 0.188 | n.s. |
| HM | 1.50 | 1.65 | 1.58 | 1.95 | 0.37 | 1.01(59) | 0.158 | n.s. |
| PH | 3.25 | 3.35 | 3.30 | 2.08 | −1.21 | 4.63(147.5) | 0.000 | sig. |
| NK | 5.94 | 4.63 | 5.28 | 3.32 | −1.97 | 4.67(89) | 0.000 | sig. |
| TE | 2.18 | | 2.18 | 4.26 | 2.08 | 6.20(73) | 0.000 | sig. |
| FA | 0.71 | 0.60 | 0.66 | 0.93 | 0.27 | 0.88(29) | 0.193 | n.s. |
| CV | 2.44 | | 2.44 | 2.62 | 0.18 | 0.41(52) | 0.343 | n.s. |
| mean | 2.27 | 2.39 | 2.33 | 2.34 | 0.02 | | | |
| s.d. | 1.36 | 1.54 | 1.32 | 1.17 | 0.97 | | | |

| | Nouns per substantive turn | | | | | Trend test for rates | | |
|---|---|---|---|---|---|---|---|---|
| | A1 | A2 | mean | A3 | ppn change | t (df) | *p* | |
| MN | 0.73 | 0.63 | 0.68 | 0.60 | −0.08 | 0.23(35) | 0.410 | n.s. |
| SC | 0.66 | 1.16 | 0.91 | 0.73 | −0.18 | 0.80(119) | 0.213 | n.s. |
| GB | 0.44 | 0.38 | 0.41 | 0.43 | 0.01 | 0.13(56) | 0.450 | n.s. |
| KR | 0.94 | 0.97 | 0.96 | 0.66 | −0.29 | 1.77(123.5) | 0.040 | n.s. |
| OL | 0.73 | 0.68 | 0.70 | 0.97 | 0.27 | 1.26(79) | 0.105 | n.s. |
| CM | 1.70 | 1.41 | 1.56 | 1.60 | 0.04 | 0.08(50) | 0.466 | n.s. |
| IK | 0.36 | 0.38 | 0.37 | 0.27 | −0.10 | 0.47(40) | 0.319 | n.s. |
| HM | 0.87 | 0.87 | 0.87 | 1.26 | 0.39 | 1.42(59) | 0.081 | n.s. |
| PH | 0.60 | 1.08 | 0.84 | 0.82 | −0.03 | 0.07(147.5) | 0.472 | n.s. |
| NK | 1.49 | 1.00 | 1.24 | 0.91 | −0.34 | 1.38(89) | 0.085 | n.s. |
| TE | 1.05 | | 1.05 | 1.39 | 0.34 | 1.33(73) | 0.094 | n.s. |
| FA | 0.14 | 0.00 | 0.07 | 0.64 | 0.57 | 3.21(29) | 0.002 | sig. |
| CV | 0.72 | | 0.72 | 0.97 | 0.25 | 0.98(52) | 0.165 | n.s. |
| mean | 0.80 | 0.78 | 0.80 | 0.87 | 0.07 | | | |
| s.d. | 0.43 | 0.41 | 0.38 | 0.38 | 0.28 | | | |

Sig.significant change in predicted direction. Sig.: significant change in the opposite direction to that predicted. *P* values given for 1-tailed tests as prediction as to the direction of change was made. *Due to the large number of tests, a Bonferroni correction was employed by dividing 0.05 by the number of conversation variables (6), findings are statistically significant when $p < 0.0083$ as indicated in the right hand column of the tables. Weightings: In all the statistics the pre-therapy baselines are weighted −1 and −1 and the post therapy score as +2, enabling us to answer the question 'is the post-test score different from pre-therapy scores?' For TE and CV both without a usable second pre-therapy baseline, the scores were weighted −1 and +1 to compare pre and post therapy. **This was selected as the appropriate test: while number of word errors may exceed the number of content words, the latter acts as an approximation for opportunities. ***Note, however, for a Poisson trend test, where the number of observations in any condition is less than 5, the *z* score approximation may not be very accurate. Missing data for TE and CV, also A1 and A2 are averaged across raters for some participants, hence the scores ending in 0. 5.