Analysing Spontaneous Speech in Dysphasic Adults[1]

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ABSTRACT

In this paper we undertake a case study of two patients with moderate dysphasia. The patients are evaluated using a set of lexical richness measures which have been tested previously on a larger sample. The aim of this study is to demonstrate the usefulness of evaluating dysphasic patients on conversational speech and to detail the role of extensive linguistic analysis in prognosis and therapy of patients. The technique used in this paper quantifies word-frequency related measures and involves a detailed linguistic treatment of the data obtained through transcription. The evaluation brings out both qualitative and quantitative differences between the two patients considered and discusses the different nature of disorders in the two patients whilst comparing them to a set of normal controls. The paper discusses the usefulness of the proposed techniques for language therapists and highlights the advantage of evaluating impaired conversational speech for patient rehabilitation.

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INTRODUCTION

An important reason for carrying out a linguistic assessment of dysphasic patients is the need to classify language impairments in a way which can provide useful clues for the speech therapist in the preparation of appropriate treatment. A number of test procedures can be employed depending on the level and detail of the results required. In this article we shall evaluate the linguistic impairment of dysphasic patients by a quantitative analysis of their spontaneous output together with an assessment of the implications of the data for their communicative ability.

There are in existence a number of generalised tests which examine language in a decontextualized setting. The Boston Diagnostic Aphasia Examination, (Goodglass and Kaplan, 1983) is based on the proposition that the type and extent of disorder depend on the position and severity of lesions and attempts to classify patients in classical categories. Although the test in part examines spontaneous speech for prosody, fluency, articulatory agility and grammatical construction, the spontaneous speech cannot be described as conversational and the output depends on the patient's ability to concentrate and remember facts rather than a response to a random question. The Western Aphasia Battery (Kertesz, 1979), similarly, does not test performance in a conversational setting. Schuell's theory of aphasia as a unitary loss of language, (Schuell, Jenkins and Jimenez-Pabon 1964), is the basis for the Minnesota Test for Differential Diagnosis of Aphasia. Spontaneous speech in a conversational context is not tested although intellectual abilities such as numerical and arithmetic outputs are examined. Finally, the Porch Index of Communicative Ability gains its support from the cybernetic theory, (Porch, 1981), relating the language system to a closed circuit transmitting information. A reduced capacity of language production can therefore be

taken to be the result of impairments affecting storing, switching, processing or monitoring information. Once again, conversational speech is not tested.

In most of the generalized test batteries, free speech is often tested for its physical characteristics such as speech prosody and articulation, hence not dealing with its lexical and syntactic components which could in fact be very useful in planning patients' therapy. It has been shown by many researchers that there are genuine differences between picture description and free conversation tasks and that the results on one cannot be generalized to the other (Albert et al., 1981; Jones, 1986; Wagenaar, Snow & Prins, 1975). These differences support the need for a separate assessment of spontaneous speech, whose improvement is by far the most important to the patient.

The four major generalised tests we mentioned have different therapeutic implications. There is inconsistency in the way patients are scored in the different sections of the above mentioned tests. Hence the application of the results by clinicians will depend on their own subjective ideas of what they think is the correct theory for the explanation of aphasia. In fact, no single correct theory exists. Using more than one test might be confusing for the interpretation of results. A discussion of some of these tests and the cognitive neuropsychological approach to aphasia therapy can be found in Byng et al.(1990). Although a universal aphasia testing procedure has been proposed by Benton (1967), it has never been widely implemented. Such a battery of tests needs to be adjusted to different settings and once again the experience and personal preferences of therapists will play a major role in such a modification.

Therefore we have ultimately to ask ourselves two questions: why are we testing spontaneous free speech and how will the assessment help in therapy ? We feel that the restoration or improvement of conversational skills is one of the most

important goals of therapy because of the increased confidence it gives to patients in their social interactions. Their scores on decontextualized tests are not a reliable reflection of their conversational ability. Other test procedures which either use the Cookie-Theft picture or Cinderella Story (Goodglass and Kaplan, 1983), have a different input modality for information transmission and performance is related mainly to the memory of a particular story and the visual perception of the picture. Since these aspects are not normally part of the normal conversation (memory of course is involved in conversation but not in the sense of recall of stories), the results will not be particularly comparable to spontaneous conversation. Therefore, it becomes important to test patients using a set of linguistic measures which concentrate on conversation in a global way (so that fluency, grammaticality and lexical richness are quantified in the overall score). Such a process needs to be both simple and effective for understanding language deficits and making therapeutic decisions on the results obtained.

There are several ways in which aphasia therapy can be supported through targeting conversation abilities of dysphasic adults. The three stages of aphasia management, i.e. assessment, prognosis and administering therapy, should prioritise the improvement of conversation abilities. Martin (1988:410) recognises the usefulness of evaluating conversational exchange: *" Free speech, defined here as the speech that occurs in conversational exchange, is the most important and yet the most difficult behaviour to elicit and to valuate*".

In general, there are several ways in which therapeutic procedures can be geared towards enhancing conversation abilities. The most important step, of course, is to make the patient conscious of his/her abnormal verbal output. Sarno (1974:430) has

illustrated the case of one of her patients, Prof. D., who improved significantly within a few weeks by monitoring his own output. She notes: *" This new willingness to practice in the evening was interpreted to indicate his increase awareness of his communication deficits*".

Weigl and Bierwisch (1970) have proposed the use of therapy material for re-establishing access to syntax. This could be accomplished by making use of a procedure called 'deblocking' which, when applied to syntax, takes the form of introducing the patient to all possible tense changes of a particular verb embedded in predetermined carrier sentences, e.g. 'mother irons the shirt', 'mother ironed the shirt', and 'mother will iron the shirt'. Therapeutic exercises could concentrate on vocabulary building, especially in the case of open class lexical items, by making use of naming and description tasks. Particular emphasis should be placed on description tasks, the eliciting of a wide range of behaviour using picture/video description and in conversation. At the same time, it would be appropriate to address other problems such as the availability of closed class lexical items and grammatical morphemes, word-order problems, paraphasias, and so on. Hatfield and Shewell (1988:69) state: "*In planning therapy for syntax, the semantics of words and sentence relations must be taken into account, as must pragmatic and functional aspects*".

Goda (1962:190) proposed a novel approach for preparing drill material using the spontaneous speech of dysphasic adults. According to him:

> *Because of the lack of specificity and relevancy in "canned" drill material, it is suggested that drill materials and vocabularies should be prepared for each individual case by the clinician. It is further suggested that the clinician use the spontaneous speech of the patient - or what remains of his spontaneous speech - as the primary source for constructing the exercise materials for use in articulation or language training.*

Goda obtained good results through using this approach on two of his patients. The patients' transcribed output was read aloud to them and they were asked questions on it. The sample was also used to generate specialised vocabularies and drill tasks.

A number of attempts have been made to quantify the pragmatic aspect of conversational speech (Lesser and Milroy, 1993; Lesser and Algar, 1995; Crockford and Lesser, 1994). These study have been important to characterise subject behaviour in terms of turn-taking and speech organisation. However, conversational analysis (CA) has often been criticised for validity of measurements and unavailability of what may be termed as 'normal data' for such studies. We must emphasise here that our own work is not directly related to such analyses and in fact complements pragmatic analysis of subject behaviour during test conditions. It comes closer to the work done by Saffran et al. (1989) who have developed extensive guidelines for the analysis of spontaneous speech of agrammatic patients. Considerable work has also been done in the production of software used for the evaluation of spontaneous speech such as SALT (Miller and Chapman, 1983), LARSP (Fletcher and Garman, 1988) and TAS (Gavin, 1988). The aim of our study is however different. We do not propose extensive guidelines for the analysis of dysphasic conversation. Rather, here we take the system initially developed and tested by Singh (1996) and investigate its usefulness in case-studies through a detailed linguistic analysis.

Holmes and Singh (1996 a, b) have subjected the data collected from seventy dysphasic patients and from a set of thirty unimpaired speakers to discriminant analysis, using a set of eight linguistic measurements, and have found that the two groups form separate clusters ($p = 0.000$, $\chi^2 = 81.40$, $\nu = 8$), lending support to the argument that it is possible to distinguish moderate dysphasic impairments from the

language of unimpaired speakers and to scale them. Prompted by the above results, and in order to investigate the use of the technique used by Holmes and Singh (1996 a, b) and Singh (1996) when applied to single patient case-studies, in this paper we will: first, provide an overview of the technique briefly in order to illustrate the linguistic measures used for quantifying conversational abilities, and second, describe a case-study of two patients investigating how the proposed technique can guide further assessments and therapy.

PERFORMANCE MEASURES

Singh (1996) has used a technique of analysing conversation which was first proposed by Singh (1994). The technique quantifies lexical and syntactical aspects of spontaneous speech by using a set of eight performance measures, all of which depend on word-frequencies (for a detailed discussion see Singh (1995) and Singh (1996)).

The set of linguistic measures which will form the basis of a comparative study of dysphasic speech (Singh, 1994) were determined by reference to what is known about the speech output of typical dysphasic patients. To a certain extent views on what characterises dysphasic speech are the result of observation rather than statistical analysis. For example, the views commonly held are that dysphasics use few verbs and articles and have syntactical problems in speech which results in the use of short, broken sentences, which is also supported by Berndt and Caramazza (1980:227): "*...Such speech is composed chiefly of nouns, adjectives, and main verbs with relatively few pronouns, articles, prepositions, auxiliary verbs and conjunctions - the so called function words*".

Since we shall be making use of the technique proposed by Singh (1994) for our case-study, the following is a brief summary of the linguistic measures used:

N-Rate: Noun Rate per 100 words

P-Rate: Pronoun Rate per 100 words

A-Rate: Adjective Rate per 100 words

V-Rate: Verb Rate per 100 words

TTR: Type Token Ratio = Total Vocabulary/ Total Text Length

C-Rate: Clause like Semantic Units per 100 words.

W: Brunet's Index, is given by $N^{V^{-.165}}$. N is the text-length, V is the total vocabulary and (-.165) is a constant proposed by Brunet. A lower value indicates a lexically richer speech

R: Honore's Indices, is given by $100*\log(N)/(1 - V_1/ V)$. N is the text-length, V_1 is the number of words spoken only once and V is the total vocabulary. A higher value indicates a lexically richer speech.

The first five measures are self-explanatory. C-rate is the number of CSUs per 100 words, where a CSU is a cohesive string of words as a unit of self-contained semantic information. In its simplest form, a CSU can be a single word and at best a complete sentence. Such a description distinguishes it from the strict grammatical definition of phrases and clauses which are rare in dysphasic speech. Therefore, in the utterance 'I went to the market | and I bought a new car | and I drove it', there are 3 CSUs of length 5, 6 and 4. A low CSU rate means on average longer CSUs in speech and is regarded better. Since CSU analysis has some differences with marking clauses

for normal language transcripts, a set of rules have been devised (see the appendix). This segmentation process is further supported by listening to the tape-recordings for intonation and related features. This is particularly important when segmentation is ambiguous on the basis of written rules only. We have found excellent inter-rater reliability for measuring C-rate. For the case studies presented in this paper, three judges marked the transcripts using the set of designed rules and working with the tape-recordings with more than 95% accuracy (a maximum of 5% deviation between C-rates). C-rate was also introduced to our other colleagues working on Alzheimer's disease for a similar analysis. It has been reported that after some initial practice and understanding of the rules, high levels of accuracy were achieved. Finally, W and R are lexical richness measures which do not correlate with text-length and further discussion on them can be found in Holmes (1994).

METHOD OF ANALYSIS

It is necessary to set certain guidelines for carrying out the recordings and further analysis. The recordings were made through one-to-one conversational sessions with a Sony tape-recorder and a clip microphone. The questions asked were very similar, open-ended with no one cueing for an answer. The questions related to subjects' hobbies, life-style, previous employment and current activities at the community centre. Subjects were only prompted when the interviewer felt that the subject was having frustration with his/her attempts. The speech was transcribed ignoring any exclamations. The word count was kept to approximately 1000 words for comparison between subjects. Only one person was in charge of transcription and analysis to maintain consistency (SS). Once the speech was transcribed on a computer, text

analysis was carried out using the Oxford Concordance Program (OCP) which lists word frequencies and gives other statistics (Hockey and Martin, 1988). The transcript was used to count nouns, pronouns, adjectives and verbs.

Data on Unimpaired Speech

This study needs to be comparative in another dimension; it needs to take into account the range of usage found in speakers without any language impairment. This is necessary to determine the quality of output of dysphasic speakers. However, much of the statistical work on lexical richness, the use of parts of speech and sentence structure has been carried out on written, especially literary texts and the few corpora of conversation which do exist are not accompanied by the statistical analyses which are relevant to this study. Therefore, in order to provide some evidence for unimpaired speakers we have analysed the speech of sixteen unimpaired subjects. In order to ensure some degree of consistency between the two groups, the data was gathered by the same researcher using the same methods as for the dysphasic speakers. The age group was similar (all were over 60 years of age), and subjects in both groups had formal schooling, and they were encouraged to talk about similar topics including their hobbies and life experiences.

The linguistic scores on our variables showed remarkable consistency within the unimpaired group, and the mean of each variable measurement set was used as a baseline for unimpaired speech with which dysphasic scores could be compared. However, the study of Clause like Semantic Units (CSU) profiles [which are plots of CSU frequencies against numbers of words in a CSU] showed that unimpaired speakers were very different from those of dysphasic speakers. Almost all of the

unimpaired speakers had CSU profiles which were very irregular, with multiple peaks and a degree of randomness. A number of studies have also tried to link the severity of aphasia with the phrase length of dysphasics. Miceli and Silveri (1989) have defined something very similar called the Mean Length of Utterances (MLU) which was used at both lexical and morphological level. Similarly Goodglass, Quadfasel and Timberlake (1964) have tried to develop the concept of *phrase-ratio* which can discriminate between different dysphasics. The conclusion that can be drawn is that the unimpaired speakers form their sentences in a very different way from dysphasic speakers, in spite of the fact that the quantity of nouns, verbs etc. may be statistically similar in both groups.

CASE STUDY

In order to illustrate the usefulness of the technique discussed above for initiating a detailed linguistic analysis, we will present a case study of two dysphasic speakers who reveal differing statistical data in most of the measures described below. In this study we have used two moderately dysphasic adults (NP5 and GB6), both aged sixty and above, with left hemisphere damage.

The first patient NP5(F), a retired hospital matron, is eighty three and her initial assessment was: "*Mild high level dysphasia and some slight verbal dyspraxia presumably as the result of a slight stroke, (left hemisphere). Her Functional Communication Score (FCP) of 94% is due to her ability to substitute words readily. She is able to express herself well despite having problems and is determined to overcome these. She is able to analyze her difficulties and is compensating well.*" NP5

had a few word-finding problems, but if she was using any compensatory mechanisms to sound normal, it was hard to detect on the basis of her tape-recordings alone.

The second patient, GB6(M), age 60, a former machine manager for a printing firm, suffered a 'large, low, attenuation lesion in the left parietal lobe'. The original assessment was: "*mild comprehension problems, slight short-term memory loss, very severe oral and verbal dyspraxia, and very severe expressive dysphasia. FCP score of 62.3% "*. GB6 was more severely dysphasic than NP5 and encountered considerable difficulties during conversation.

NP5 (nine years post-onset) has recovered considerably and has been misclassified in previous statistical analyses conducted by Singh (1996) as a normal subject. This sharply contrasts with GB6 (two years post onset) who still has considerable problems in carrying out a conversation. Both of the subjects, whose output has been studied in detail, were recorded for approximately 30 minutes on a one to one basis. Both these patients were interviewed in the same week and a linguistic analysis was carried out on their output. An application of the measures described before produced the results shown in Table 1.

Table 1.

The average normal score was the average of the scores of sixteen normal speakers on each individual variable. This table is presented here for a comparative view to appreciate the severity of aphasia in the two subjects, and must not be taken in the absolute sense.

It can be seen from Table 1 that the two speakers, NP5 and GB6, differ considerably from each other in their levels of impairment in most of the measures.

Particularly noticeable is the divergence seen in the case of nouns, pronouns, verbs and clause rates.

There is a correlation between their use of nouns and pronouns, in the sense that NP5 uses a low number of nouns, 12.8 per 100, (the lowest use by an unimpaired speaker is 11.12 per 100) but a high number of pronouns, 19.32 per hundred, (the highest by an unimpaired speakers being 19.11). On the other hand, GB6 uses a relatively high number of nouns: 17.32 per 100 and a relatively small number of pronouns: 13.19 per 100 (both just within the unimpaired range).

The significance of a comparative statistical measurement is that it directs the therapist's attention to those aspects of a patient's language which most deviate from the norm and which need further investigation. If we look more closely at the features already indicated we can draw some conclusions about both patients' use of these parts of speech. For example, it becomes clear that if we divide the number of different nouns by the total number of nouns used, the result is similar in both cases: NP5, 0.52 and GB6, 0.47. In fact, it can be seen that NP5 is slightly better in this respect than GB6. This suggests that NP5 is able to retrieve a range of nouns which compares well with unimpaired speakers (av. 0.38) but uses relatively few nouns in her structures. If we look at the distribution of nouns we find that of the 163 nouns she uses, the majority occur in prepositional phrases where she probably accesses the whole phrase rather than selecting the noun before creating the phrase. For example: 'go to bed', 'in the country', 'at Christmas'. Apart from the noun 'people' which is used as pronoun (c.f. Fr. 'on' and Ger. 'man'), only five nouns, including a verbal noun, occur in the subject position:

"Writing is still difficult"

"Her daughter won't ... put ... her ... into a hospital"

"Her memory is getting very bad"

"The matron said ..."

and finally a combined subject:

"She and her brother used to go round ..."

A sample of NP5's speech is presented below:

"I got I got in ah oh at first of all I could I could get away by saying 'good morning' etc. 'yes', 'no', 'thank you' if people didn't know me but of course people who would know me realised that it it it was different and first of all I couldn't I couldn't know some various very very simple things but I live alone I had nobody to worry me and nobody to say 'don't worry' 'don't worry' so I used to wake up at five o'clock in the morning and couldn't go to sleep again I I had something in my head ..."

In common with GB6, she seems to have difficulty in selecting a noun as a subject, especially an inanimate noun, and less difficulty with a direct object, which is perhaps partially selected by the verb. The implication for the therapist is to direct therapy not just at improving noun retrieval but also at encouraging her to structure more of her sentences with nouns as subjects and direct objects of verbs. In other words to encourage her use of noun phrases as well as prepositional phrases. The comparison with unimpaired speakers shows that, although these speakers use more pronouns than nouns as subjects of verbs the ratio is very different from that shown by NP5. (8:1 average for unimpaired speakers, 29:1 for NP5).

A detailed study reveals that there are similarities between NP5 and GB6, even though the global figures imply a statistical difference. The conclusion to be drawn, and which will be strengthened in the next section, is that the analysis of GB6's data reveals a greater severity of impairment which is also more complex than NP5's.

With regard to verbs, the global figures indicate that NP5 uses verbs at a higher frequency than any of the unimpaired speakers (24.03 per hundred). The highest rate for the latter was 27.36. GB6, on the other hand, has a rate which is below any unimpaired speaker. Yet if we just pay attention to the different verbs that occur and express them as a ratio of the total number used we find that GB6 uses 31 different verbs out of out of a total of 136 (23%) which compares with NP5 who uses 72 different verbs out of a total of 306 verbs (23.5%). Both of these ratios come within the range of normal speakers recorded, although the average for the latter was 30%.

It is evident as well that NP5, although she uses a large number of verbs, relies heavily on just a few, in fact as already mentioned, 44% of verbs used comprise just five verbs (*have, go, get, can, be*). On the other hand, she uses a number of verbs which are not in the highest frequency range, e.g., *assess, overlook, transpose, discover, converse, rope in, wind up (irritate), fight, irritate* and *evacuate.*

GB6 does not display such a range, the least infrequent verbs used by him are: *sow, cut, follow, swim, dance* and *play.* 50% of his verbs comprise 3 verbs namely *go, be* and *have.* Again, although they are very different in the frequency with which they use verbs, they are about equal in the number of different verbs they use. This implies that GB6 should be encouraged to use more different verbs since the quality of his communication is badly affected by this deficit while NP5's frequent use of verbs, together with her frequent use of ‘I’ and ‘and’, indicates that the organisation of her speech needs some attention.

In both cases there is evidence to suggest that some help to improve the range of verbs which can be accessed would be beneficial, but their comparison with the

unimpaired speakers in this respect does not reveal a major problem. Rather, the problem seems to be in the area of syntax.

A higher value on the C-Rate scale for GB6 implies that he used more CSUs per 100 words, which in turn means that they were relatively short. This is supported by the statistical evidence discussed above. In the case of NP5, her peak value is 5 words per clause in contrast with GB6's peak at 2 words (see Figure 1). NP5's peak value is similar to normal usage although most of the unimpaired speakers recorded have quite a different tail structure with more peaks in their profile. Translated into impact on the listener, it means that NP5's conversation sounds, superficially at least, relatively normal. But, for the reasons given above, the listener will instinctively feel an oddity about the organisation of her discourse. GB6, on the other hand, presents a different picture in spite of the underlying similarity of vocabulary range. The fragmented nature of his speech alluded to earlier can be confirmed by the length of these units.

NP5's conversation reveals a greater than normal frequency of the use of ‘and’ (5.73 per 100 words). This shows a preference for concatenating clauses into longer sentences. This must be considered a positive tendency which facilitates the expression of more complex ideas and adds to the flow of speech. The measure of clause length helps to explain the differences in the speech of the two patients. This is shown in Figure 1.

Figure 1

Type-token ratio, as has been indicated earlier, is a measure of lexical richness. In the overall scores (all the once occurring words divided by the total number of words), the average for unimpaired speakers was 0.322, which is better than either of the patients being studied. GB6 scored 0.2638 and NP5, 0.3008. The lowest score among the unimpaired speakers is 0.291. A low value for W and a high value for R for NP5 compared to GB6 shows that she performed better on both the measures compared with the latter. Both these measures (i.e., W and R) have been extensively used in stylometric studies of written text, (Holmes, 1994), and NP5's better scores on both these scales denote a lexically richer speech.

NP5 relies very heavily on introducing her sentences with the pronoun ‘I’. The type of conversational narrative elicited in the interview, it must be admitted, prompts the use of this subject pronoun but her use of it far exceeds any of the other speakers, impaired or unimpaired. In all she uses it 104 times in her conversation comprising 1273 words. It is as though she is using this pronoun as a crutch for structuring her sentences. This of course has a knock-on effect in the organisation of her information and the type of predicate she can produce and restricts her choice of verb. The five most commonly used verbs (have, be, get, can, go) comprise almost half of the total number of verbs used. This observation excludes the auxiliary use of 'have' and 'be'. While not suggesting that she avoids the use of ‘I’, we feel that active encouragement to use nouns (animate and inanimate) as subjects of verbs would give her the opportunity to develop her ideas more fully and would lead to a decrease in the number of sentences of the type described.

The extensive use of ‘I’ tends to limit her conversation to a series of statements with herself as a topic. In normal conversation, the new information in the rest of the

sentence can be taken up in the next sentence by making it, directly or indirectly, the topic about which more is going to be said. Because she tends to start the next sentence with 'I', the narrative does not develop as in a normal conversation.

Again, the implication for the therapist is that a reduction in the use of 'I' and an increase in noun subjects will allow NP5 to organise her conversation more effectively. Evidence for the above conclusion can be found in the number of verbs used. Her use of a simple sentence structure often including clauses concatenated with 'and' ties in with her use of the subject pronoun 'I' to list a sequence of actions.

In the case of GB6, it was indicated above that although he uses more nouns per 100 words than NP5,(17.3 as opposed to 12.8), the extent of his noun vocabulary is slightly more limited. This suggests that he may have more problems than NP5 in retrieval. He uses even fewer nouns in subject position than NP5 (3 out of 174 in a conversation length of 993 words). On two other occasions he uses a noun as topic, then follows it up with a subject pronoun. It seems difficult for him to form a normal subject-predicate construction with a noun:

(i) Jean, she has a brother living down in Swansea..

(ii) boy he lives...

He can form a compound subject:

(iii) me and my wife go...

So his ability to use nouns has limitations. Again, his main use of nouns is in prepositional phrases (especially time expressions) or unattached nouns, as in the answers to questions. His rare use of nouns as direct objects is limited to the verbs 'have (got)', 'see', 'watch tv', 'play' and 'like'. A small sample of GB6's conversation is presented below:

" ...will go up in the summer swimming and in October for a we go for a we go dancing I get up in morning I have breakfast I listen to the about nine o'clock on the radio eh local always its good like that I go out to walk eh with Jean walk yeah ... lawns need cutting . . . in evening watch television good film film and the games like football and and snooker and the rugby afternoon on Sunday afternoon we go we go once in a friends have a cup of tea and talk"

The above extract illustrates at a lexical level the limited number of independent nouns compared with the far greater use of nouns in prepositional phrases. The first type of nouns are typically objects of high frequency verbs: 'have a cup of tea', 'have breakfast'. At one point he does list a set of co-hyponyms for the subordinate 'games': football, snooker and rugby, which shows the effective working of a retrieval process. The only example of a noun subject is in the phrase: 'lawns need cutting', where the noun is not an agent but the patient.

A syntactic examination reveals a series of simple structures involving a list of actions, usually without elaboration. The nature of his syntactic arrangements are predictable from the statistical results of the count of CSUs.

DISCUSSION

In this paper we have attempted to provide a comprehensive way of quantifying the lexical aspect and to a certain extent the syntactical aspect of speech and language. The importance of the present approach lies in its role in assessment and devising therapy for patients based on their spontaneous speech. Linguistic aspects of dysphasia can be clinically examined at three main levels: phonological (including both the phonetic and phonemic aspects), lexical and syntactic dimensions. Albert et al.(1981) note that: "*The important point to be made here is that conversation and narrative speech must*

be used as an indispensable part of the dysphasia examination. Highly structured stimulus-response tasks are necessary but not sufficient for evaluating the status of the lexical component of language". We have studied the linguistic features and applied a set of optimal parameters which can discriminate between the performance of various patients and can be judged against the normal control population. Some of these measures have been used in other studies, i.e., nouns, verbs, adjectives, pronouns and some have been specifically derived. Although we know that dysphasic speech is characterized by laborious articulation, great reduction in the flow of speech and the loss of grammatical structures, most of the recent literature is largely concerned with redefinitions of the agrammatism in aphasia, and exploring the availability of certain grammatical structures still available to dysphasics. Availability does not necessarily mean usage and without a spontaneous speech analysis, there is no possibility of addressing this problem.

The general conclusion with regard to the implications of this type of analysis for therapy is that a more language-specific remedial approach can be developed which, based on statistical evidence, can complement clinical observation with objective data. Many of the techniques for improving language skills and communicative competence of language learners, especially those used in EFL courses, could be adapted to item specific tasks as indicated in the paper. Rather than adopting a blanket approach to improve the retrieval of, say inanimate nouns, it should be possible to target the therapy at improving performance in the use of inanimate nouns as subjects of verbs, which is where a patient may have particular difficulties revealed by this type of analysis.

Statistical analyses not only help in the discrimination of dysphasics and the determination of a final index which may quantify their overall performance, it also

helps in determining which measurements are of higher importance in such an analysis and should be targeted for improvement by the therapist. Holmes and Singh (1996b) have noted that C-rate, A-rate, TTR and W play a more significant role than others in discriminating between patients and normals, and contrary to what has been upheld in aphasia literature, verb-rate and noun-rate are least important. In their study on a total of seventy dysphasic adults and thirty normal subjects, these variables were found to be statistically significantly different for dysphasic patients from normal speakers: all variables including C-Rate different between the two groups at the 5% significance level using the Mann-Whitney test. Statistical analyses of the spontaneous speech of dysphasic patients is also of crucial importance to the postulation of fluent-non fluent distinction, (Wagenaar, Snow and Prins, 1975). Kerchensteiner, Poeck and Brunner (1972:233) note that: "*The introduction of the fluency-non fluency dimension has given the classification of aphasic speech an empirical basis, more convincing than older anatomo-clinical sub-groupings, based on a preconceived and schematic thinking*". This unidimensional scale differentiation of fluency in aphasia can be achieved using our spontaneous speech analyses.

We have tried to avoid the pitfalls of other statistical studies which have been listed by Wagenaar, Snow and Prins (1975). The statistical scoring of variables has been done in an objective way and it is easily possible to replicate the sampling and analyses with proper guidelines. Since the speech characteristics have not been scored by judges on predefined scales, the subjective element has been minimised. The analyses do attempt a characterisation of the grammatical structure at a higher level and there is not significant variance between the way the samples were collected or transcribed.

The scope of the present study extends to affective disorders. Newman and Mather (1938) and Andreason and Pfohl (1976) have tried to classify manics and depressives on the basis of spontaneous speech samples and used some of the measures we have used above. It would be interesting to observe the performance of our measures for this problem. Initial results of a pilot study performed on Alzheimer's patients has shown interesting results with the same variables as used in this study: 87.5% correct discrimination between eight AD subjects and normal controls (Bucks ety al., 1996).

In conclusion, it is important to realise that it is very difficult to predict language behaviour on the basis of mere clinical observation and quite often the clinical judgements may not be supported by objective statistical analysis. We believe that there is a need for more sophisticated tools for the characterisation of spontaneous speech which should supplement the existing test batteries. This study has effectively shown that statistical conversational analysis can indicate abnormal linguistic patterns in dysphasic patients which can be then subjected to a fine grained analysis. We expect that this approach will be desirable both from the clinical point of view because it refines the area of research and provides an objective test of communicational ability for testing patients using language rather than relying on individual opinions within the academic and clinical community.

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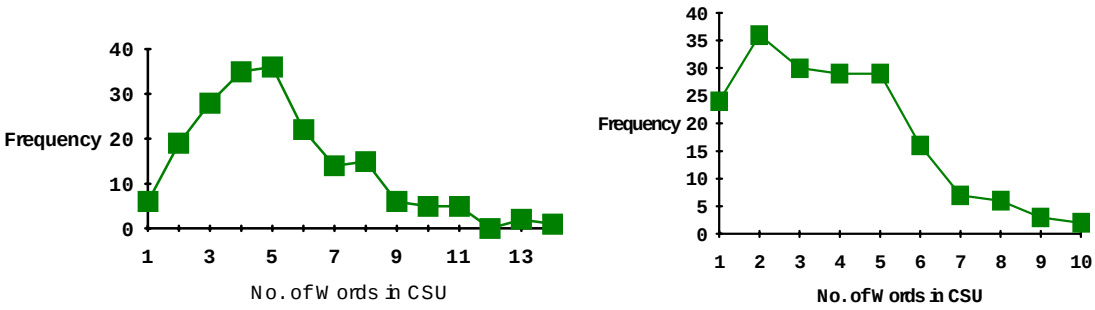
Table 1. Linguistic measures for NP5, GB6 and normal elderly control subjects, descriptive statistics

Measure Subjects	Mean	Std. dev.	Min.	Max.
N - rate				
NP5	12.80			
GB6	17.32			
Normal	*15.91*	*2.09*	*11.12*	*19.11*
P - rate				
NP5	19.32			
GB6	13.19			
Normal	*15.81*	*1.82*	*13.19*	*19.03*
A - rate				
NP5	4.55			
GB6	5.84			
Normal	*7.23*	*1.37*	*5.14*	*11.28*
V - rate				
NP5	24.03			
GB6	13.19			
Normal	*21.00*	*2.46*	*16.63*	*27.36*
TTR				
NP5	0.30			
GB6	0.26			
Normal	*0.32*	*0.02*	*0.29*	*0.35*
CSU - rate				
NP5	14.76			
GB6	18.32			
Normal	*15.19*	*2.17*	*10.97*	*17.94*
W				
NP5	14.57			
GB6	15.69			
Normal	*14.35*	*0.31*	*13.75*	*14.79*
R				
NP5	1629.83			
GB6	1300.71			
Normal	*16.13.81*	*136.56*	*1401.62*	*1863.65*

Figure 1

CSU profiles of NP5 and GB6



NP5 **GB6**

Appendix: CSU computation rules summary

Rule 1. Most of the CSUs will have boundaries at conjunction words such as *but, and, since, so, because,* etc. Prosodic and intonation cues should be used in conjunction.

example: " I went to the market where I met my friend / but I didn't recognize him at first / I was hungry / and we had the money / so we went to a restaurant / ".

Rule 2. As long as the segment is cohesive, do not divide it. Prosodic and intonation cues should be used in conjunction.

example: " I went to this place when I knew that I was not getting a job / but then there was no option /and I had to go for it /no matter what would happen / ".

Rule 3. Include incomplete segments as long as they are syntactically well-formed.

example: " I was new in there / but I worked for / I liked it / and there was ___ / "

Rule 4. When a number of objects or names are uttered separated by *and,* do not segment.

example: " It was Tom and David / and they had a spade and a shovel / ".

Rule 5. When in above (rule 4) the words are not separated by *and*, segment them individually.

example: " It was hot / humid / rainy / ".

Rule 6. Do not include words such as *Well*, *Yes*, *No*, *Blimey*, etc. in the count.

example: " [Well Yes] actually I did like it / [Oh God] / I loved it / ".

Rule 7. Do not count the same word if it appears in succession.

example: " We [we we] did go there / but [but] we didn't like it / ".

Rule 8. If the subject rephrases during a sentence, take out the words which are not in logical sequence.

example: " [I was] She was [much sick no] much tired after [the holiday no no] the work / ".

Rule 9. As in rule 8, especially for numbers and dates, accept only the last one.

example: " I have [one two three four Oh God] three children / ".

Rule 10. Ignore automatisms.

example: " I have [one one] [Oh dear dear dear dear] one child / [you know]"

Rule 11. Automatisms which are actually a part of the sentence, where the sentence becomes meaningless without them, should not be taken off.

note: "Any examples of this category are rare and none have been found in our previous experience. This rule, however, covers all eventualities."

Rule 12. Include greetings and single word responses.

example: " Thank you / Good / Very Good / ".

Rule 13. Treat many words which are part of a single name as one entity.

example: " I like Coronation-Street / Emmerdale-Farm / Home-and-Away / ".