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Research Report

Acquired dysarthria in conversation: Methods of resolving understandability problems

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Abstract

Background: People with acquired progressive dysarthria typically experience increased problems with intelligibility in everyday conversation as their disease progresses. Such problems are likely to impact on both the person with dysarthria and those with whom they interact. If this is the case then we may ask questions not just about the nature of these problems but how it is that such problems are dealt with by participants when they occur.
Aims: To investigate ways through which problems resulting from dysarthria in everyday conversation are resolved by participants. Further, to examine some of the features of repair resolution, particularly where understanding of self-repair attempts themselves prove difficult.
Methods & Procedures: Video data of natural conversation from two dyads were selected for this paper. One dyad features a 58 year-old man with multiple sclerosis and moderate intelligibility problems, the other a 79 year-old woman with motor neurone disease with mild to moderate intelligibility problems. Both elected to be recorded in conversation with their spouses. The dyads were video-recorded at home with no researcher present. Using the methods of Conversation Analysis (CA) a collection of sequences was identified and transcribed. The sequences were analysed with reference to how the participants resolve problems in the understanding of dysarthric speech.
Outcomes & Results: It is shown how some problems resulting from dysarthria in conversation can be resolved relatively quickly, particularly where a specific element of a prior turn is highlighted by the recipient as problematic. In other instances, the recipient's understanding problem may be more global. These result in longer repair sequences in which problematic elements are addressed individually. Such a resolution method is ultimately successful but may also be characterised by additional understanding problems. These findings draw attention to an important distinction between intelligibility and understandability.
Conclusions & Implications: It is concluded that problems resulting from dysarthria in conversation can require extensive repair work involving both parties. This has implications for the assessment of dysarthria in everyday conversation and also the promotion of intervention strategies that encompass the activities of both participants when dealing with dysarthria in interaction. These findings may be usefully employed in informing both direct clinical work and through training those who work with this client group and their significant others.

Keywords: conversation analysis, dysarthria, progressive neurological disorders, social interaction, repair, motor speech disorders.

What is already known
Existing work demonstrates that trouble sources identified by a recipient using an other-initiation of repair are a regular feature of conversations involving speakers with dysarthria. Much less is known about how participants resolve problems when they occur and what methods they employ when more complex understanding issues arise.

What this paper adds
Through the methods of Conversation Analysis this paper examines how understandability problems in everyday dysarthric talk get resolved on a turn-by-turn basis. In the dyadic conversations analysed here this resolution frequently involves particular repair methods of both participants. Understanding the detail of repair resolution in this client group may assist the evolution of dysarthria interaction assessment and promote more confidence in developing and employing structured approaches to interaction intervention.

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Introduction

The past decade has seen a growing interest in social aspects of acquired dysarthria, extending the traditional focus on perceptual features of speech to issues of intelligibility and comprehensibility (Hustad 2008), participation (Yorkston *et al.* 2008) and psychosocial issues (Walshe *et al.* 2009). Whilst much research in the field continues to explore acoustic/perceptual features of speech within experimental settings (Wang *et al.* 2009) both clinical management and psychosocial perspectives are receiving increasing attention, particularly in the progressive dysarthrias (Yorkston 2007).

For people with acquired dysarthria, and those with whom they interact, the psychosocial effects can be profound with reported changes in self-identity and emotional disruptions (Dickson *et al.* 2008) and feelings of stigmatization (Yorkston *et al.* 2001). Interpersonal problems during conversation are also reported (Robillard 1994). However, whilst the psychosocial impact of dysarthria on the individual may be profound, the effects of dysarthria on everyday social interactions are less clearly understood or documented. It is reported that changes in grammar may be one adaptive consequence of progressive dysarthria (Wilkinson *et al.* 1995), and that whilst speakers with dysarthria contribute the same number of turns in conversation as non-impaired speakers, there are fewer and shorter so called 'major turns' (Comrie *et al.* 2001). These findings indicate that dysarthria can affect the structure and balance of interaction but what remains unknown at present is how people with dysarthria accomplish normal everyday actions like telling stories, giving opinions, turn taking, changing topics etc. Two fundamental questions here are to what degree does reduced intelligibility as a result of dysarthria affect a person's ability to do whatever it is they are attempting to do, and if it does have an influence, how are these everyday actions affected?

Additionally, the role of the co-participant in interaction must be considered. Speech perception research commonly refers to the *listener*, reflecting the role assigned to a person required to judge the intelligibility or quality of an incoming speech signal (Bunton *et al.* 2007). However, in everyday conversation there is ongoing interaction demanding shared understanding *between* participants. From this perspective, the activities of both (or more) people in conversation need to be considered.

All of this leads to a very practical problem for participants dealing with dysarthria in conversation. It may be hypothesised that moderate to severe dysarthric speech is likely to lead to problems associated with intelligibility for all parties involved (Liss 2007). If this is the case then we may ask questions not just about the nature of these problems but how it is that such problems are dealt with by participants when they occur. What is it that the participants do and in particular what resources do they bring into play in order to accomplish a resolution to any troubles that may arise? Answering such questions may yield theoretical insights but just as importantly are likely to generate evidence that enables clinicians to develop new approaches to dysarthria intervention based on more naturalistic data. One method through which such questions can be investigated is Conversation Analysis (CA), directing attention to the methods participants themselves employ in dealing with dysarthria.

Conversation Analysis

CA is the systematic, data-driven study of naturally occurring talk-in-interaction (Schegloff and Sacks 1973). Primarily, CA takes conversation as an observable vehicle for human interaction and attempts to describe the interactional organisation of social activities on a turn-by-turn basis. It focuses on how each turn in a conversation is produced and how a recipient displays their analysis of that turn through their own ensuing talk. Of particular interest to the current study is the joint accomplishment of understanding and how participants manage a so-called dysarthric turn that has not been fully understood.

Repair in conversation

Repair has been described extensively in the CA literature (Schegloff *et al.* 1977; Schegloff 2000). In summary, it refers to a range of practices used by participants to manage troubles in talk (Schegloff *et al.* 1977). These troubles are typically the types of problems encountered in everyday conversation through false starts, word repetitions, unclear speech sounds etc. The term *trouble source* is used in CA to describe what participants themselves identify as problematic during their own conversation, not what an observer might perceive this to be. Repair takes place in two stages: initiation (i.e. displaying something in the prior talk as a trouble source) and outcome (i.e. what may be called the repair itself). Participants involved in repair (in two party conversation) may be just the speaker of a trouble source (e.g. altering a word in progress), the recipient of the trouble source, or both.

Of particular interest in this paper is the practice of other-initiated self-repair (Schegloff *et al.* 1977). In this type of repair both participants are involved. One (participant B) treats something in another's (participant A's) turn as a trouble source by other-initiating repair on it. Regularly, though not always, the other-initiation of repair functions to highlight some difficulty participant B is having in understanding participant A's

turn (Schegloff 2007). There are a number of forms this repair initiation might take, including an 'open class' repair initiator such as 'pardon?' (Drew 1997), or a repair initiator which displays which specific part of the prior turn is the trouble source (e.g. 'you bought a what?'). Participant A then carries out a repair on his/her prior talk which has been highlighted as difficult to understand. The success of participant A's self-repair attempt will be seen in the fact that on its completion participant B produces no further other-initiations of repair but rather produces a turn in which s/he explicitly or implicitly displays an understanding of the previously problematic turn.

Schegloff (1979) notes that in normal (non-communication disordered) conversation, the practice of repair is designed for success and usually, although not invariably, a single repair effort resolves the trouble it addresses.

Repair in atypical talk

Previous work demonstrates that trouble sources identified by a recipient using an other-initiation of repair are a regular feature of conversations featuring speakers with dysarthria (Collins and Markova 1995; Bloch and Wilkinson 2004; Bloch 2006; Bloch and Wilkinson 2009). Through this work it has been established that dysarthric troubles in conversation are not simply analogous with unintelligible speech. Rather, the problems that recipients can be seen to experience in these conversations have been described more generally as problems with *understandability* (Bloch and Wilkinson, 2004), that is a difficulty for a recipient in understanding something about a prior turn as displayed by his/her launching of some type of other-initiated repair activity. While the intelligibility issues created by dysarthria are regularly a major factor in creating difficulties with the understandabilty of these turns, other features of these turns can also be seen to be important. For example, it has been noted that in conversation generally, an important issue in a listener understanding a turn is that s/he grasps the sequential relationship between that turn and the turns immediately preceding it (Drew 1997). This can be a problem for speakers with dysarthria and their recipients, even when the utterances are produced using AAC (augmentative and alternative communication) devices such as VOCAs (voice output communication aids). In these cases, recipients may have difficulty understanding a VOCA-produced utterance due to the fact that, even when each of the words is intelligible to them, the slowness in producing the utterance means they cannot understand the sequential relationship between that utterance and what has preceded it (Bloch & Wilkinson 2004). Further problems relating to the understandability of the speaker with dysarthria's turn can arise if the recipient misinterprets or fails to grasp what it is about the speaker with dysarthria's turn which is making it difficult to understand (Bloch & Wilkinson 2009). This can lead to additional problems in completing the repair, with these problems intensified if in turn the speaker with dysarthria does not perceive that the recipient is having difficulty in understanding what the exact nature of the trouble is (Bloch & Wilkinson 2009).

To date, the small body of work relating to dysarthria in conversation has largely focused on the nature of trouble sources and how repair is initiated on them by recipients. Far less is known about how participants manage these troubles once they have been identified. More specifically we have little understanding of the relationship between other-initiation of repair and a subsequent self-repair attempt, nor of how a repair sequence unfolds if a first self-repair attempt is unsuccessful. This latter point is particularly pertinent to severe dysarthric speech in conversation given the probability of multiple turn repair sequences.

In this paper we explore how understandability problems in dysarthric talk get resolved. As will be seen, in the dyadic conversations analysed here this resolution frequently involves particular repair methods of both participants. The implications of these findings for our understanding of the nature of dysarthric talk and how it may be clinically treated will be discussed in the final section of the paper.

Methods

The data presented are obtained from longitudinal work examining the conversations of 15 dyads. Each dyad featured one participant with a progressive neurological disorder and associated moderate to severe progressive dysarthria. In the present paper, data and subsequent analysis are based on four extracts obtained from two dyads. The data, and the dyads from which they were extracted, were selected for their clarity and range of features within the phenomenon under consideration. Extracts featuring augmentative and alternative communication system use were excluded but will appear in subsequent publications. Participant characteristics and data analysis from the two dyads are presented below.

Data collection and method of analysis

Following NHS research ethics committee and research governance approval (2000 and 2009) the couples described below volunteered and consented to participate in a study examining the effects of acquired dysarthria and AAC use on everyday conversation. They

were recruited through their local NHS speech and language therapy services.

The couples were loaned standard video camera equipment. They were then asked to record themselves, with no researcher present for approximately 30 minutes within an agreed one-week sampling period. It was requested that the recording take place during a regular opportunity for everyday conversation (e.g. at a meal or coffee time). This process was repeated at three monthly intervals (+/-one week) over a maximum 18-month period. To reduce the possible effects of video presence on interaction (Goodwin 1981), the middle ten minute segment of each recording was selected for analysis.

In addition to the video data collection, a Frenchay Dysarthria Assessment (Enderby and Palmer 2007) was administered to the participants with dysarthria within one week of each recording. The Amyotrophic Lateral Sclerosis Severity Scale (Hillel *et al.* 1989) was also used to provide an overall rating of communication severity based on the perceptions of the participants themselves. It is acknowledged that this scale was developed just for people with ALS but its application as a purely descriptive tool addressing the effects of unintelligibility on a wider clinical population was seen as useful for the current study. These assessments were used to provide more specific measures of perceptual change with the potential for correlation analysis between speech and conversation features in future publications.

The video recordings were digitized to facilitiate repeated-viewing using Apple QuickTime software. Each video recording was then examined for potentially interesting, possibly orderly, interactional phenomena in the data. As a result it was noted throughout the data that problems with understandability were resulting in extended repair sequences. A series of extracts was then identified and the talk transcribed using CA conventions (Jefferson 1984). A closer analysis of other-initiated self-repair sequences followed with ongoing refinement of the transcripts. Each sequence was then subjected to an in-depth analysis, which focused on explicating the sequential context in which the phenomenon was occurring, the interactional work that was being achieved, and the orientation of the participants towards the phenomenon. Finally, four extracts were selected as representative examples of the phenomenon under consideration. This overall analytical procedure follows established CA methods reported previously in this journal (Beeke *et al.* 2007; Bloch and Wilkinson 2009).

Participants

The participant couples are identified in the text by the following pseudonyms: Rose and Tom, and Simon and Ruth.

Simon, 58, diagnosed with multiple sclerosis 20 years prior to this study was recorded in conversation with his wife, Ruth, 55. At the time of recording for video 1 Simon presented with a mixed ataxic-spastic dysarthria characterised by articulatory and prosodic incoordination. From video 1 Simon's speech ability was rated at level 5 on the ALS Severity Scale – 'Frequent repeating required'. His Frenchay assessment conversation intelligibility subsection was rated at grade c: 'speech severely distorted; can be understood half the time. Very often has to repeat'. Simon displayed mild memory retention problems but no evidence of cognitive difficulties that may have affected his ability to participate in conversation. Ruth had no reported or observed communication problems.

Rose, 79, diagnosed with motor neurone disease 18 months prior to this study was recorded in conversation with her husband, Tom, 82. At the time of recording for video 1 Rose presented with a mixed spastic-flaccid dysarthria characterised by a harsh voice quality and mild hypernasality. The emergence of mild articulatory weakness was also noted with mildly reduced tongue movement. From video 1 Rose's speech ability was rated at level 6 on the ALS Severity Scale – 'Repeats message on occasion'. Her Frenchay assessment conversation intelligibility subsection was rated at grade b: 'speech abnormal but intelligible: patient occasionally has to repeat'. At the time of video 2, her ALS Severity Scale rating was 5 – 'Frequent repeating required'. Rose did not display nor report any language and/or cognitive problems which may have affected her ability to participate in conversation. Tom himself had no reported or observed communication problems.

Data selection

The extracts analysed in this paper come from a larger collection of sequences where the participants treat a turn by the speaker with dysarthria as problematic to understand. Each extract for this paper was selected to show the methods used by participants to resolve troubles and also to examine lengthier repair sequences in which resolution of the trouble source turn necessitated more than one round of repair attempts.

Analysis

Four examples will be presented where the participants treat a turn by the speaker with dysarthria as problematic to understand, and where the speaker with dysarthria is then able, sometimes after multiple tries, to re-do the problematic turn in such a way that the recipient subsequently displays an understanding of it. As will be seen, in this situation eventual understanding is a mutual and collaborative achievement. The role

played in this process by the speaker with dysarthria is perhaps the most obvious in that it is s/he who re-does the problematic turn (or parts of it), sometimes several times. However, the conversation partner also has an important role to play. For example, as Bloch and Wilkinson (2009) described, the form of repair initiation produced by the partner can be important for signaling to the speaker with dysarthria which parts of his/her prior turn have and have not been understood. Similarly, if the speaker with dysarthria's first attempt to re-do the problematic utterance is not successful, the manner in which the conversation partner displays what s/he has understood and not understood about that re-doing will have implications for any further attempt by the speaker with dysarthria.

Extract 1

One way in which the speaker with dysarthria and the conversation partner may collaborate to quickly and successfully resolve a problematic understanding of the speaker with dysarthria's talk can be seen in Extract 1.

The extract begins in line 01 with Simon, the person with dysarthria, concluding the report of a previous event that he and a carer found humorous. The latter part of this turn is notably indistinct, as marked by this part of the turn being enclosed in round brackets in the transcript (see Appendix 1 for a full list of transcription symbols used in this paper).

A silence in the talk follows (0.5 seconds). In normal (non-communication disordered) talk a silence following a completed turn can be the first sign that this turn is in some way problematic for the recipient and may be followed by an other-initiation of repair (Schegloff *et al.* 1977). This pattern has been found to also occur following talk by speakers with dysarthria before the recipient initiates repair (Bloch & Wilkinson 2009) and this is what happens here. In line 04, Ruth's 'the:' is a partial repeat of Simon's prior turn and functions here as an other-initiation of repair. It can be seen here to be a useful form of repair initiation in facilitating Simon to attempt a self-repair; it locates for Simon which part of his turn Ruth has understood (the 'the') and which parts she has not (the part which follows the 'the'). In response, Simon can now focus his impaired motor speech abilities on producing just that part which has been problematic for Ruth. Here he is able to do that by producing just one word ('laminate' in line 05). This focus on just one word (rather than, for example, the ten words used in the original attempt in line 01) perhaps allows Simon to use his remaining motor speech abilities to attempt to make that word as intelligible as possible. In this instance the central mid-vowel [ə] is replaced with a more open front vowel sound [æ] in the repair attempt turn. This re-doing of the trouble source item, involving a phonetic upgrading (Curl 2004) can be seen from Ruth's behaviour in line 06 to be successful.

The 'oh' in Ruth's turn functions to signal that she has undergone a 'change of state' (Heritage 1984) and now understands what was previously problematic for her. 'Oh' is commonly used by recipients to receipt the self-repair of trouble source turns upon which they have earlier produced an other-initiation of repair (Heritage 1984). Here, Ruth's turn is characterised by an 'Oh+' construction in which a turn initial 'oh' is followed by a repeat of the repaired item (laminate') and a subsequent acceptance token ('yeah'). Such a formulation appears to be a characteristic of dysarthria intelligibility trouble source repairs, having been noted in the repair talk of other dyads (Bloch and Wilkinson 2004; 2009). Here, Ruth's post-repair receipt turn shows Simon that she has found his repair attempt intelligible and understandable.

In summary, this first extract provides an example of a recipient's difficulty in understanding a dysarthric utterance where the repair was successfully accomplished through one attempt by the speaker with dysarthria. Following the recipient's other-initiation of repair highlighting which particular element of the speaker with dysarthria's turn was proving problematic to understand, the speaker was able to re-do just that problematic element. In addition, he was able to produce the problematic word in a manner that was closer to the target and thus more intelligible to the recipient.

Extract 1

01	Simon	yeah we did have a ⌈↓ laugh ⌉ (.) (about the l[ə]minate thing).
02	Ruth	⌊((*nods*)) ⌋
03		(0.5)
04	Ruth	⌈the: ⌉
		⌊ ((*leans forward to Simon*)) ⌋
05	Simon	l[æ]minate
06	Ruth	=oh the laminate yeah
07	Simon	ye⌈ah ⌉
08	Ruth	⌊yeah ⌋ (0.4) yeah

Extract 2

01		Rose	oh, ⌈Jean was surprised to °'av 'erd° from Kay⌉
02			⌊((*looks to Tom*))⌋
03			(0.3)
04		Rose	weren't sh⌈e ⌉
05	→	Tom	⌊((*begins to shift gaze to Rose*))⌋ who?
06			(0.2)
07	→	Rose	Jean was surprised to 'av 'erd from Ka:y.
08			(1.0)
09	→	Tom	⌈OH: Jean Jean ⌉yeah
10		Rose	⌊Kay: (phoned) yeah ⌋
11		Rose	⌈mm ⌉
12		Tom	⌊Jean ⌋knew that er:
13		Rose	°yeah°
14			(0.4)
15		Tom	°sh°(.) °k° she was pleased that er (0.3) Kay had rung us=
16		Rose	=yeah ⌈mm ⌉
17		Tom	⌊yeah⌋

Extract 2

The second extract is taken from a conversation between Rose, the speaker with dysarthria, and her husband Tom. As in Extract 1, the repair takes the form of an other-initiated self-repair where the recipient displays a difficulty in understanding the talk of the speaker with dysarthria. As with the earlier extract, the trouble is repaired relatively quickly, and again the successful redoing by the speaker with dysarthria involves a form of phonetic modification (Rutter 2009) in relation to the first, problematic, attempt. Unlike in Extract 1, however, the recipient's other-initiation of repair does not unequivocally locate one part of the speaker with dysarthria's turn as the source of the difficulty. In this case, therefore, the speaker with dysarthria has to do more work to be understood in that she cannot simply focus on the word highlighted as problematic.

Following a lapse in the conversation, Rose initiates a new sequence with talk about two people, Jean and Kay (line 01), with the turn beginning 'oh' marking this talk as being disjunctive with what has gone before and 'touched off', for example by a sudden remembering (Jefferson 1978). There is no immediate verbal or non-verbal uptake of turn by Tom in the next turn (line 03), perhaps implicitly marking a difficulty for Tom in producing the next turn due to problems in understanding what Rose has just said. Following this 0.3 second silence, Rose adds a 'tag question', thus now explicitly implicating an answer from Tom.

Tom then explicitly displays trouble with the prior talk (line 05), perhaps linked to the fact that Rose's talk constitutes a new episode in the conversation and, as such, Tom has little or no prior context to draw on to help him understand it. By saying 'who?' Tom locates a person reference in Rose's prior talk as problematic. This reveals some level of hearing and understanding on the part of Tom in that he is showing that he has heard enough of Rose's talk to know that she has made reference to a person or people, but he does not know, at this point, the actual name(s).

However, there are two people named in Rose's turn, Jean and Kay, and it is not clear from Tom's repair initiation which name is causing the trouble, or even whether it is both. Rose's repair attempt deals with this issue by repeating most of the turn, including both names. At the same time, she 'dispenses' (Schegloff 2004) with the initial 'oh' and the follow-up tag question. In the repair attempt she modifies her earlier production of both names; she adds stress to the name 'Jean' and adds a prolongation to the name 'Kay' (line 07). In both cases, the effect is to give the name emphasis in a manner that was not present in the original attempt in line 01.

As was the case in Extract 1, the self-repair attempt incorporating phonetic modifications compared to the original attempt (here increased loudness and duration on the names) is successful. Following a silence at line 08, Tom produces his hearing of Rose's attempted self-repair completion. This hearing takes a similar form to that used by Ruth in Extract 1 i.e. an 'oh, followed by a repeat of the trouble source item and a 'yeah'. In his receipting turn, Tom thus displays 'Jean' as the name which was problematic for him, but which he now understands.

In both prior extracts the recipients have encountered a trouble which makes problematic their understanding of the speaker with dysarthria's talk. A repair has been other-initiated by the recipient of the trouble source turn. In each case, the speaker with

dysarthria's self-repair attempt was able to successfully modify the original attempt through varying the phonetic parameters (Rutter 2009), with that success displayed in the receipt by the recipient in the following turn. In both cases, therefore, the trouble source was able to be successfully repaired through the use of one self-repair attempt. As will be shown in the remaining extracts, however, successful self-repair of dysarthric talk is not always so quick and straightforward, and as such, more interactional work may be needed from both participants.

Here we will discuss two such examples. In both cases the person with dysarthria uses the method of breaking up the utterance into two parts in an attempt to try to get the recipient to understand each part separately. An advantage of this method is that it allows the speaker with dysarthria to focus their physical effort on redoing the sub-set of the turn which they believe to be the main source of the understanding problem, as was also seen in Extracts 1 and 2. A potential problem with this method, however, is that if the recipient has not understood much of the original attempt at the whole utterance, he or she may have very little contextual knowledge to bring to bear on understanding the speaker with dysarthria's subsequent attempt at making part of that utterance understandable.

Extract 3

Prior to the talk in Extract 3, Rose and Tom have made reference to the advantages of a disability car permit, enabling Rose to park closer to local amenities than would otherwise be normally allowed. Despite these benefits Rose proceeds to identify one area where parking is still problematic.

Rose's first turn (lines 01–02) is produced in a number of parts. The first names a location – 'that space at Safeways', and the second appears to present some form of complaint about it -'always full up innit, the road'. With the use of 'innit', Rose here appears to be explicitly inviting a response from Tom in next turn. The last part of the turn 'the road' represents a within-turn self-repair on 'that space' mentioned at the start of the utterance.

Following a silence, Tom in line 05 produces an other-initiation of repair on Rose's prior talk. The form of this ('the what love?') would appear to locate Rose's mention of the 'space/road' as a problem for Tom, although this repair initiation might also be being used in a more general way. In response, Rose attempts a self-repair. She starts with that part of the turn which Tom's repair initiation appeared to highlight as a problem ('road outside Safeways' in line 06). This re-doing emphasizes the words 'road' and 'outside' (similar methods to those seen in Extracts 1 and 2). The mention of 'road', however, is produced partly in overlap with Tom's talk, which might obscure it to some extent. When there is no subsequent response or uptake from Tom (line 08), Rose treats this silence as a sign that Tom is having some difficulty in understanding her at this point (see also Bloch & Wilkinson 2004). In response to the silence she does not re-do the part of her utterance that concerned the space/road but rather adds the other main part of the turn ('all full up with cars'). It is notable that the self-repair attempt which has now been produced in lines 06–09 is not simply a repeat of the original attempt in lines 01 and 02. For one thing, like the self-repair attempts in Extracts 1 and 2 it is shorter (here through dispensing with elements such as the introductory 'uhm' and the tag question 'innit'). It also involves lexical changes; 'that space' becomes 'road', 'at' becomes 'outside', and 'always' becomes 'all'.

This example can be seen to differ from those shown in Extracts 1 and 2 in that here one repair attempt is not enough to resolve the understanding problem. Following Rose's talk in line 09, there is again a lack of uptake or response from Tom, and Rose treats this silence (line 10) as indicating that Tom is still having difficulty in understanding her despite her repair attempt. She focuses again on the first part of her trouble source turn, once more stressing the word 'road' as well as changing the lexical formulation ('road along by Safeways' in line 11). Tom now responds with a candidate hearing of what he believes Rose might have said. This hearing ('OH Rose?' in line 14) indicates to Rose not only that Tom has misheard her reference to 'road', but also that he appears still not to have a secure understanding of the rest of her trouble source utterance originally produced in lines 01 and 02 (since the inclusion of 'Rose' in this utterance would appear to make no sense). Rose now moves on to another repair attempt, shortening the attempt again to now focus on just one part of the problematic utterance, the misheard word 'road', and producing this with stress. She does this first in line 18 but it is there produced in overlap with Tom's talk, so she then produces it again in line 20, and this time the word is understood by Tom (line 21).

Despite much work by the participants up to this point, and in particular by Rose, the original utterance from lines 1 and 2 can still be seen to not have been understood. While Tom now understands that Rose is talking about a road (and perhaps a road outside Safeways) his utterance 'OH I can park there' (line 21) shows that while he appears to believe he has grasped what Rose was saying about the road in her original utterance, he has not. Rose now addresses the understanding of that second part of her utterance by re-producing it with 'that's all full up' (line 22). As with the first part of the repair attempt, this part too is

Extract 3

01	Rose	uhm (0.5) that space at er (.) Safeways
02		⌈always er ⌉ (0.4) ⌈full up ⌉ innit, the road.
03		⌊((*shakes head*)) ⌋ ⌊((*hand across*)) ⌋
04		(0.6)
05	Tom	the what lo⌈ve? ⌉
06	Rose	⌊roa ⌊d out⌈side ⌉ Safeways
07		⌊((*hand across*))⌋
08		(0.4)
09	Rose	all full up with cars.
10		(0.6)
11	Rose	⌈road along ⌉ by Safeways
12		⌊((*hand out, moves hand across*))⌋
13		(0.3)
14	Tom	OH⌈ Rose? ⌉
15	Rose	⌊((*nods head*)) ⌋
16		(0.2)
17	Tom	⌈oh yeah⌉
18	Rose	⌊ road ⌋
19		(0.4)
20	Rose	road=
21	Tom	=the road (.) OH I can park there.=
22	Rose	=((*nods*)) m: yeah⌈ that's all full up ⌉
23	Tom	⌊I've never tried it ⌋ but (.) there are disabled bays there.
24		(0.4)
25	Rose	⌈they're all⌉ full up
26		⌊((*nods*)) ⌋
27		(0.7)
28	Tom	oh its full up I know
29		(0.5)
30	Tom	but (0.3) er the other (0.3) places where it's gonna come in handy for us
31		is er (0.2) at the back of Boots!
32		(0.2)
33	Rose	⌈m: m ⌉ (0.3) °mm°
		⌊((nods)) ⌋
34		(0.4)
35	Tom	I mean anything you want in Boots an or to cut through to the (.) wassname.
36		(0.2)
37	Tom	tis gonna come in very handy.

unsuccessful in the first instance. In this case it is overlapped by Tom's talk which starts in line 23.

This overlap may be a sign of the type of difficulty which can ensue when this type of 're-doing the problematic utterance in parts' repair method is used. It appears that since Tom believes he has grasped what Rose has been talking about (as seen in his utterance in line 21), he thinks he can now leave behind the repair attempt focusing on understanding Rose's problematic utterance and instead move the topic on with new material, which he does in line 23. His belief that he has grasped what Rose has been trying to say may also be influenced by the fact that Rose first appears to agree with his displayed understanding at the start of her turn in line 22.

As a result of Tom's problematic understanding, Rose re-does the second part of her original utterance once more in line 25. An understanding of this utterance is now displayed by Tom (line 28). As with Extracts 1 and 2 this understanding is prefaced with 'oh' and includes a repeat of part of the not-understood turn, in this case along with the epistemic marker 'I know' in response to what he now understands that Rose is telling him.

Extract 3, therefore, displays an example where one self-repair attempt by the speaker with dysarthria is not sufficient to convey to the recipient what is being said. By the time the recipient is brought to an understanding of what has been said, the repair has taken multiple attempts totalling around twenty seconds, a significant amount of time in conversation for a repair attempt.

One method used by the speaker with dysarthria to repair the original utterance and make it understood was to break it down into smaller parts and try to get these understood individually by the recipient. Our final example, Extract 4, provides another, shorter, example of this method being used.

Extract 4

Immediately prior to this episode, Rose and Tom have been talking about a table-top (jumble/thrift) sale in which Rose has purchased a set of plates for a notably low price. In attempting to recall the name of the plate collection Tom moves to retrieve one of the plates from a bag. He mentions (lines 04–06) that these eight brand new plates cost only one pound. As the talk continues, it emerges that Rose disagrees with two elements of Tom's assertion here.

Firstly, Rose corrects the amount she paid for the plates to five pounds (lines 07 and 09). Tom quickly accepts this, stating he knows she paid five but the man selling them to her had only asked for a pound (see Tom's talk between lines 08 and 20). Following this, in line 19, Rose starts to produce another utterance. It is this utterance, and what follows after it, which will emerge as difficult for Tom to understand.

Rose's first attempt to produce the utterance is overlapped by Tom's talk in line 20 and she temporarily

Extract 4

01		Tom	((*reaches into bag to lift out plate*)) yeah ((*turns plate over and looks at reverse*))
02			yeah (1.6) oh Mountain Wood Collection.
03		Rose	yeah
04		Tom	brand new! eight of them
05		Rose	((*nods*))
06		Tom	fer (0.4) one pound
07		Rose	=((*shakes head*)) ar: ⌈((*holds up five fingers*))⌉=
08		Tom	⌊although ((*smiles*)) ⌋
09		Rose	=⌈five ⌉ ⌈((*holds up five fingers*))⌉ five=
10		Tom	=⌊((*nods*)) ⌋I know you⌊gave five. ⌋
11		Tom	=coz it (0.3) it wasn't fair, he had no idea the=
12		Rose	=no:
13			(0.6)
14		Rose	⌈((*coughs*)) ⌉
15		Tom	⌊what they ⌋were worth the chap who s-er ⌈(0.6) Julie's husband that
16		Rose	⌊((*copens mouth to speak holds finger up*))
17		Tom	sold em to ya, he had no idea!
18			(0.4)
19		Rose	the ⌈(news)⌉ ((*moves hand to plate*))
20		Tom	⌊he ⌋just said pound for the eight.=
21	→	Rose	=((*nods*)) °yeah° (0.5) (newspaper they were wrapped in.)
22			(0.5)
23		Rose	newspaper.
24			(0.2)
25		Tom	newspaper
26			(0.2)
27		Rose	nineteen ninety four.
28			(0.9)
29		Tom	nineteen?
30			(0.2)
31		Rose	ninety four ((*holds up four fingers*))
32			(0.3)
33		Tom	nineteen ninety four.=
34		Rose	=((*nods*)) yeah,=
35		Tom	=ar:=
36		Rose	=(2 syllables)
37			(0.3)
38		Tom	oh they were wrapped in⌈ (.) that ⌉ newspaper,=
39		Rose	⌊yeah ⌋
40		Tom	=yeah: they look brand new.

gives up until Tom has finished talking, at which point she re-does the utterance (line 21). While Rose's talk here is markedly unclear (as indicated in the transcript by single brackets), it sounds like she says something like 'newspaper they were wrapped in.' Following Rose's turn, Tom looks at her but does not say anything (line 22). This lack of uptake is treated by Rose as an indication that Tom is having difficulty understanding her (see Extract 3 above and Bloch & Wilkinson 2004). She now attempts a self-repair by using a similar method to that seen in Extract 3 – she produces one part of her problematic utterance, here the single word 'newspaper'[1]. In this case, this method works in that Tom is able to repeat it back to her, showing he has found the word intelligible. As yet, however, there is no sign he has understood Rose's larger original utterance from line 21 of which the word 'newspaper' was only part. He does not, for example, produce a display of understanding prefaced by 'oh' in the way in which understanding is normally displayed following other-initiated self-repair (Heritage 1984), and which he has used elsewhere in the couple's conversations (see Extracts 2 and 3). Rose now pursues understanding by adding another utterance, 'nineteen ninety four' (line 27). Tom other-initiates repair on this utterance by repeating back the first word with a questioning intonation. Rose then attempts a self-repair by repeating 'ninety four', and holding up four fingers. At line 33 Tom now repeats the full date, showing he has found this intelligible, and Rose then confirms he has indeed heard this correctly (line 34).

At this point in the sequence, therefore, it is clear that Tom now finds intelligible the two 'sub-elements' of Rose's turn that she has presented to him ('newspaper' and 'nineteen ninety four'). As was also seen in Extract 3, however, a possible complication of this repair method is that even when a recipient understands one or more parts of the original utterance, he or she may not yet know how to make sense of those parts in order to achieve the main goal here i.e. understanding that original difficult-to-understand utterance (here, line 21). Again at this point (line 35), Tom does not produce a display of understanding (for example one prefaced by 'oh'), and it is only after Rose says something else at line 36 (which is unintelligible on the tape) and more time has passed that Tom is finally able (in line 38) to display he has understood what Rose has been attempting to convey. Once more, this display of understanding takes the form of the change-of-state token 'oh' (Heritage 1984) and a repeat back to Rose of what Tom now understands she was saying to him in line 21. He then goes on (line 40) to pull out the inference of what Rose has said to him i.e. that the plates are not brand new, as he had said they were in line 04.

Like Extract 3, therefore, this extract provides an example what might be thought of as the 'break the problematic utterance down into smaller parts' repair method used by a speaker with dysarthria in an attempt to resolve an understandability problem. While this method can be successful, it may contain an inherent difficulty for the recipient; even when the individual parts are intelligible to the recipient, it may be difficult for him or her to see how these parts can assist in understanding the original problematic utterance. In the case of Extract 4, part of the difficulty may be that the action which Rose was attempting to achieve with the original problematic utterance – i.e. correction of something Tom had said – is one which, by its nature, Tom would not have been expecting. This type of difficulty is a general one that people with a wide range of communication disorders may face. Wilkinson (1999), for instance, noted that a person with aphasia also had particular difficulty in conveying to a recipient that he was attempting to correct something she had just said.

Discussion

In this paper we have used the principles of Conversation Analysis to examine the methods used by the participants in conversation to resolve problems in the understanding of dysarthric speech. One method which can be used, and which we have analysed elsewhere (Bloch & Wilkinson 2004) is the use of an AAC device, such as a voice output communication aid (VOCA). Here, we have focused on the use of speech to resolve problems of intelligibility and understandability.

As seen in Extract 1, some problems can be dealt with relatively quickly. If the recipient is finding one particular word or element of the speaker with dysarthria's turn to be unintelligible, he/she can highlight which part this is through the design of the other initiation of repair (e.g. Ruth's 'the:' in Extract 1, and other examples in Bloch & Wilkinson 2009). In the next turn, the speaker with dysarthria can then focus his/her self-repair efforts on this one problematic part. For speakers such as these with limited motor speech abilities, this focusing of motor effort on making one or two words more intelligible may well be easier than producing a whole sentence, as may have been done in the original attempt. This was seen in Extract 1 when comparing Simon's original, and unsuccessful, production of an utterance in line 01, and in line 05 his subsequent, successful, re-doing of

[1] In the other three extracts, the problematic understandability of the speaker with dysarthria's turn has been signalled explicitly by means of the recipient producing an other-initiation of repair that is then responded to by the speaker with dysarthria by means of a self-repair attempt. In this extract, it is the recipient's silence and lack of uptake which is treated by the speaker with dysarthria as marking her just-produced utterance as problematic to understand, leading to her launching a self-repair attempt.

the one word which had been highlighted by Ruth as problematic for her ('laminate'). Through being able to focus his efforts on the production of this one word, the speaker with dysarthria was able to make it more intelligible than when it was first produced as part of a sentence. This was achieved by re-doing the problematic word with a more open front vowel sound.

A somewhat similar phenomenon was seen in Extract 2 where the recipient's other-initiation of repair in the form of 'who?' highlighted two possible words as problematic (i.e. the two names 'Jean' and 'Kay'). In response to this in her self-repair attempt the speaker with dysarthria produced not one word but a whole sentence. However, through dispensing with some elements of the original turn (as is done routinely in repair attempts: Schegloff 2004), the speaker with dysarthria's redone sentence was shorter than the original attempt. As in Extract 1, the speaker with dysarthria was able to focus her motoric efforts on making phonetic modifications to the words highlighted by the recipient as problematic for him. These changes took the form of increased emphasis on each of the two possibly problematic words through means such as longer duration and increased loudness. In both Extracts 1 and 2, a single self-repair effort by the speaker with dysarthria is sufficient to make the problematic items intelligible and understandable to the recipient. This compares favourably with findings from non speech-disordered conversations in which a trouble is usually, but not always, resolved with a single repair effort (Schegloff 1979).

Extracts 3 and 4, on the other hand, are quite different. In both cases it appears that there is not one discrete element of the speaker with dysarthria's turn that is proving problematic for the recipient to understand. Rather, the recipient's understanding problem may be more global, involving several elements and/or the overall action of the speaker with dysarthria's turn. One method which was used by the speaker with dysarthria in these two examples was to break the original turn down into one or more smaller parts and to try to make these smaller parts intelligible and understandable to the recipient.

One way this process worked, as seen in Extract 4 (line 23) was for the speaker with dysarthria to present part of the trouble source turn and then stop. This provided the recipient with an opportunity to show that he had found it intelligible by repeating it back (line 24). Such a routine is observed elsewhere in repair sequences (Collins and Markova 1995) as well as outside of trouble talk (Bloch 2005; Bloch and Beeke 2008) but it is not always successful (Bloch 2006) and relies on the recipient knowing what the speaker with dysarthria is attempting to do (i.e. provide something for the recipient to show it has been found intelligible by, for example, repeating it back).

In both Extracts 3 and 4 this method of breaking the problematic utterance down into parts proved to be relatively successful, although not without its drawbacks. Some of these drawbacks related to the effect on understandability when the original, whole, utterance was broken down into parts. The recipient, for example, might incorrectly think that when he had understood one of the re-done parts of the utterance he now understood the whole utterance. This was seen, for instance, in line 21 of Extract 3. Here Tom's utterance 'the road (.) OH I can park there' showed that when he came to understand that Rose was talking about a road, he incorrectly believed he also understood what she was attempting to convey in relation to the road. Conversely, it is also the case that when a recipient has little understanding of what the original utterance is, this may make it harder to understand the part which is being re-done. This was seen in line 14 of Extract 3 where Tom's utterance 'OH Rose?' makes it evident that his guess is off the mark because he has insufficient knowledge of the original utterance from which Rose has extracted this part for him to understand. Another drawback is that this method would often appear to be relatively time-consuming, in part for the reasons just mentioned.

Extracts 3 and 4 also displayed another method used by the speaker with dysarthria; to use different lexical items in the self-repair attempt(s) compared to those used in earlier tries. These different methods (phonetic modification, lexical replacement, breaking the utterance down into parts) are, of course, not mutually exclusive and could be used together in various combinations.

It is important to note that whatever the nature of the troubles in these extracts and however long it takes the participants to establish what is being said, the problems do on the whole get resolved through the co-ordinated work of both participants. From a review of the whole data set generated by this research it is extremely rare for repairs to be abandoned once initiated. Abandonment is by no means impossible but does not appear to be a common feature in dysarthric speech conversations.

A further feature of interest is the ways in which understanding is eventually displayed by recipients (for example through 'oh' and a repeat of the problematic talk) and how the participants move out of repair related talk. The achievement of understanding in these extracts is seen to be the outcome of a process of repair work involving both participants. Such an observation resonates with the idea of speech intelligibility being an emergent property of the listener's knowledge (Liss 2007) but extends this notion by including the speaker with dysarthria as a vital component of the understanding process. In coming to appreciate the

methods used to achieve understanding of dysarthric talk within conversation, we have aimed to show that these methods have to be investigated in relation to the activity of all the participants in the interaction, and that their use and success are closely linked to the temporal and sequential unfolding of the talk of which they are part.

Whilst the extracts presented in this paper and the dyads from which they have been drawn are necessarily selective, the authors consider them representative of the whole data set. The incidence of troubles and repair will vary across each conversation and each dyad but the evidence here shows that participants are organised in their identification and resolution of troubles even when these problems lead to lengthy repair sequences. Initial observations suggest that such lengthy resolution sequences can and do occur at relatively early as well as later stages of dysarthria.

Clinical implications

It has been suggested elsewhere that a CA influenced approach to dysarthria assessment could complement existing perceptual/intelligibility assessments (Bloch and Wilkinson 2009; 2011). Here we similarly argue that baseline and outcome measures may be enhanced through a refined analysis of repair of trouble sources. Thus, the ways in which a dyad deals with dysarthric-related troubles (including associated AAC difficulties) could provide an important interaction measure. Such an approach need not entail a full conversation analytical methodology but could, for clinical purposes, consider the impact of troubles on a dyad's interaction and the resources they employ to both minimise and resolve difficulties when these arise.

In addition, understanding how people with dysarthria and their conversational partners resolve difficulties in real life settings is one way in which clinicians might approach clinical intervention, complementing speech intelligibility and functional improvement as a key intervention goal in speech and language therapy (Dykstra *et al.* 2007). This is particularly the case for people with progressive moderate to severe dysarthria. In such cases a clinician may well want to utilise a continuum of interventions (Hustad and Weismer 2007) including compensatory strategies and partner training. Sequences of practical steps to resolve communication breakdowns at different stages of speech disturbance, including ideas for both the listener and speaker are well presented in the literature (Yorkston and Beukelman 2000; Yorkston *et al.* 2004). The work presented in this paper endorses the view that such techniques, particularly dyad-focused, should be given greater clinical prominence. As with assessment a CA influenced approach to intervention for dysarthria might usefully employ discussions regarding dyad specific video recordings with consideration of what facilitates interaction as well as what leads to problems. The full potential of such an approach for families affected by dysarthria and the wide range of health and social care professionals with whom they interact awaits future investigation and clinical trials.

This paper has focussed attention on repair resolution and offered some insights into the practices of lengthier repair sequence management. Ongoing data analysis is likely to reveal further important features of dysarthric trouble source occurrence and resolution, particularly in terms of the role of repetition or re-doing by the co-participant, something that appears particularly prevalent in these conversations. Of additional interest is in how different co-participants might vary in their contribution to the repair process, particularly with respect to their relative level of familiarity with the person with dysarthric speech. Analysis of differences between family members and heath/social care professionals might provide a profitable source of knowledge for the development of therapy and training resources.

In conclusion, the extracts and analysis presented here represent one feature of many associated with dysarthria-in-interaction. Of importance is the fact that repair sequences are the activity through which many of the effects of dysarthria are played out by participants. By examining such sequences in depth we can begin to understand not only these effects but how participants themselves are resolving difficulties when they arise. It is through this type of analysis that new methods of clinical intervention for this client group may be developed.

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Appendix 1: Key to transcription symbols

⌈ ⌊	a large left-hand bracket links an ongoing utterance with an overlapping utterance or non-verbal action point where the overlap/simultaneous non-verbal action begins.
⌉ ⌋	a large right-hand bracket marks where overlapping utterances/simultaneous non-verbal action stops overlapping.
=	an equals sign marks where there is no interval between adjacent utterances.
(.)	a full stop in single brackets indicates an interval of less than one tenth of a second in the stream of talk.
(0.6)	a number in single brackets indicates the length, in tenths of a second, of a pause in the talk.
oh:	a colon indicates an extension of the sound or syllable it follows (more colons prolong the stretch).
.	a full stop indicates a stopping fall in tone, *not necessarily the end of a sentence*.
,	a comma indicates a continuing intonation.
?	a question mark indicates a rising inflection, *not necessarily a question.*
!	an exclamation mark indicates an animated tone, *not necessarily an exclamation*.
but-	a single dash indicates a halting, abrupt cut-off to a word or part of a word.
↑↓	marked rising and falling shifts in intonation are indicated by upward and downward pointing arrows immediately *prior* to the rise or fall.
<u>stress</u>	underlining indicates emphasis.
(*sadly*)	italicised text between braces represents a description of the prosodic quality of the talk.
°no°	degree signs indicate a passage of talk which is *quieter* than surrounding talk.
TALK	capital letters indicate talk delivered at a *louder volume* than surrounding talk.
heh	indicates discernible aspiration or laughter (the more hs the longer the aspiration/laughter).
fu(h)n	an h in single brackets marks discernible aspiration or laughter *within* a word in an utterance.
°h	discernible inhalation (the more hs the longer the inhalation).
>talk<	lesser than/greater than signs indicate sections of an utterance delivered at a *greater speed* than the surrounding talk.
⌈yes ⌊((*nods*))	italicised text in double brackets represents a gloss or description of some non-verbal aspect of the talk, and is linked to simultaneous talk with large brackets (see above).
(dog)	single brackets containing either a word, phrase, or syllable count (if utterance is very unclear) mark where target item(s) is/are in doubt.
#	indicates an AAC key selection
she	italicised bold text represents AAC voice output
[læminaɪt]	square brackets contain talk transcribed using IPA symbols