**On making a sandwich: Procedural discourse in adults with right-hemisphere damage**

**Louise Cummings**

**Abstract:**

In a clinical language evaluation, procedural discourse is often afforded less emphasis than either narrative or expository discourse. Yet, the generation of procedural discourse is a highly complex task that demands the integration of a range of cognitive-linguistic skills. The aim of this paper will be to investigate those skills with a view to demonstrating the potential diagnostic significance of procedural discourse in a clinical language evaluation. The context for these remarks will be the study of seven adults with right-hemisphere damage who were studied at two clinical facilities in the United States. These adults were recorded as they attempted to explain to an examiner how they would make a peanut butter and jelly (jam) sandwich. An analysis of the discourse produced by these adults reveals a complex and highly variable profile of skills and deficits. It will be argued that this profile is a consequence of cognitive and linguistic heterogeneity in the RHD population, with language impairment manifesting itself in different ways across a range of clients.

**Key words:** clinical language evaluation; egocentrism; information management; pragmatics; procedural discourse; right-hemisphere damage; stroke; tangential language; verbosity

*Appears in:* Cummings, L. (2019) ‘On making a sandwich: Procedural discourse in adults with right-hemisphere damage’, in A. Capone, M. Carapezza and F. Lo Piparo (eds), *Further Advances in Pragmatics and Philosophy: Part 2 Theories and Applications*, Series: Perspectives in Pragmatics, Philosophy & Psychology, Vol. 20, Cham, Switzerland: Springer International Publishing AG, 331-355.

**1. Introduction**

It has been recognised for some time that focal damage to the right hemisphere of the brain can result in a language disturbance which is quite unlike the classical aphasia syndromes (e.g. Wernicke’s aphasia). Investigators over the years have struggled to capture this disturbance. Terms such as egocentric, verbose, and tangential are just a few of the labels that have been used to characterize the language disturbance in right-hemisphere damage (RHD). Notwithstanding a lack of terminological agreement, there is at least a general consensus that the disturbance arises as a result of focal damage to the right hemisphere. This is most often caused by a stroke or cerebrovascular accident. Less common causes include brain tumours, cerebral abscesses, and traumatic brain injuries. A further point of consensus is that the language disturbance in RHD cannot be assessed adequately through the use of language tests and batteries of the type that are routinely used by speech-language pathologists to assess clients with aphasia. Rather, the somewhat elusive language impairments of these clients are best assessed through discourse production tasks. Typically, these tasks include story telling (narrative discourse), picture description (expository discourse), and giving directions and instructions (procedural discourse). One of these forms of discourse has been used less consistently than the others in a clinical setting. That form is procedural discourse. In this article, it will be argued that procedural discourse has potential diagnostic significance in a clinical language evaluation which its relative neglect by clinicians overlooks.

The argument of this paper will unfold as follows. In section 2, one particular procedural discourse task will be examined in detail. This task requires examinees to explain to an examiner how they would make a peanut butter and jelly (jam) sandwich. In order to be executed successfully, this procedural discourse task requires the skilful deployment of a range of cognitive-linguistic skills. Each of these skills is examined and illustrated using data from adults with no neurological impairment. Then in section 3, the different labels that have been used to characterize the discourse impairments of adults with RHD are examined. It will emerge from this examination that there is a lack of agreement among clinicians about the central features of the language disturbance in RHD. There are two possible conclusions that can be drawn from this state of affairs. First, clinicians lack sufficiently sensitive diagnostic tests with which to obtain a definitive and reliable clinical description of the language disturbance in RHD. Second, wide variability is inherent in right-hemisphere language disorder, with individual clients exhibiting one or more impairments from a wider constellation of cognitive-linguistic impairments. In section 4, support for the second of these conclusions is based on an examination of the procedural discourse of seven clients with RHD. Data from these clients is available through RHD Bank, part of the TalkBank System (MacWhinney *et al.*, 2011). Finally, in section 5, a new and more prominent role for procedural discourse tasks in a clinical language evaluation of adults with RHD is considered.

**2. Examining procedural discourse**

Procedural discourse pervades everyday communication. When speakers explain the rules of a game to a listener, give directions to a motorist, and describe the steps to be followed in a recipe, they are producing procedural discourse. All of these communicative activities involve a hearer who wants to be guided through stages or steps in a procedure, and a speaker whose role it is to ensure that these stages are made manifestly clear so that they can be easily followed. If the speaker performs this role badly by omitting stages, conveying stages in the wrong order, or performing any one of a range of other errors, then no-one would be surprised if a hearer is unable to follow the rules of a game or arrive at a particular destination at the end of a car journey. However, the rather mundane role of procedural discourse in everyday communication belies the cognitive and linguistic complexity of this form of discourse. In this section, that complexity is laid bare in an examination of the cognitive-linguistic skills that are needed to plan and produce procedural discourse. To illustrate the use of these skills, the procedural discourse of adults with no neurological impairment will be examined. This data will provide an important normative benchmark for the examination of procedural discourse in adults with RHD in section 4. But first, some introductory remarks are necessary about one particular procedural discourse task, the peanut butter and jelly sandwich task. By examining the stages in this task, it will be possible to delineate the specific cognitive-linguistic skills that speakers must possess in order to produce procedural discourse.

Imagine you are asked to explain to someone how to make a peanut butter and jelly sandwich. You might begin by describing the items you need to use such as a knife, a plate, and a jar of peanut butter. You might even go as far as saying where you would fetch these items from, such as the cutlery drawer for the knife and the cupboard for the jar of peanut butter. The type of knife to be used may also be further specified as not all knives will be equally efficient at spreading a substance of thick consistency like peanut butter. You will probably also say something further about the type of bread and peanut butter to be used. This may simply be an issue of preference in that you prefer brown bread over white bread, or smooth as opposed to crunchy peanut butter. Up to this point in the discourse, you have described features and conditions which are a prelude to the main activity of sandwich-making. The next step will be for you to think about the order in which various actions need to be undertaken. First, two slices of bread must be removed from a loaf and placed on a plate. Then, peanut butter is applied to one of these slices using a knife. Either the same knife or a spoon is used to spread jelly (jam) onto the other slice of bread. Finally, the two slices are brought together and cut into rectangles or squares. The entire procedure can be successfully communicated to a hearer in less than one minute. It appears that nothing could be simpler.

But this appearance is misleading. This is because what you have undertaken here is actually a high-level exercise in executive planning, mental state attribution (or theory of mind), and language encoding. To appreciate this, let us consider the cognitive-linguistic skills which are integral to this procedural discourse. Before a speaker produces his first utterance, he must engage in a type of mind-reading. The speaker must establish what his hearer already knows so that he can avoid communicating certain information to the hearer. For example, no speaker would see the need to describe what peanut butter is or to explain what a knife and a plate are. This shared or background knowledge can remain implicit in the discourse that the speaker produces. What cannot remain implicit and must be stated explicitly are the specific actions that constitute sandwich-making. This is where mind-reading or mental state attribution becomes a bit more complex. This is because the speaker may well *believe* or in some cases even *know* that the hearer already *knows* the actions that are needed to prepare a peanut butter and jelly sandwich. However, the requirements of the task demand that the speaker view the hearer as essentially ignorant – the hearer must be explicitly told how to make a sandwich. In short, there are at least two types of mental state attribution at work in this procedural discourse. One type involves withholding information which is known to the hearer. The other type involves making explicit information which is also likely to be known to the hearer. The speaker must simultaneously keep in play two opposing mental state relationships to the hearer.

Having decided what information should be explicitly communicated to a hearer, the speaker must then make decisions about the order in which that information is to be communicated. In any procedural discourse, some actions or steps must be communicated before other actions or steps. The order in which actions are expressed usually reflects temporal and causal relations between events. For example, peanut butter must be applied *before* the two slices of bread are placed together. Otherwise, a causal condition on joining the two slices of bread – that each slice has either jelly or peanut butter on it – has not been satisfied. It is executive function skills, and specifically the ability to plan and organize discourse, which enables a speaker to relate actions and steps to a hearer in a meaningful and logical order. When these skills are impaired, as they often are in adults with acquired brain damage, procedural discourse can appear disorganized and fragmented. In such a case, the steps in a procedure may not be related in the correct order. For example, a speaker may tell a hearer that the slices of bread are cut into squares before any jelly or peanut butter has been spread on the bread. Executive function skills are essential to procedural discourse in other respects. The ability to inhibit pre-potent information is another important executive function skill. Mention of peanut butter may prime other information or memories that are at best tangential to the procedural discourse task at hand. If this executive function skill is impaired, then we might expect to see the intrusion of irrelevant information into a speaker’s discourse.

Clearly, in the absence of syntactic and semantic structures, it is not possible to express the utterances that convey information to a hearer. So the production of procedural discourse also requires language encoding skills. In terms of syntax, knowledge of word classes, phrases and clauses is integral to discourse production. A speaker must be able to use compound nouns (*peanut butter*), count nouns (*knife*) and non-count nouns (*jelly*), as well as adjectives (*smooth, crunchy*), verbs (*spread, cut*), and prepositions (*on, out of*). Noun phrases (*a plate*), verb phrases (*spread the jelly*), and prepositional phrases (*bread on the plate*) are also integral to language encoding. Several types of clause may be used in the sandwich procedural discourse task. Examples of these clauses are shown below:

*I clean the knife which has peanut butter on it*. [Relative clause]

*I use a spoon to spread the jelly*. [Infinitive clause]

*I think that smooth peanut butter is best*. [Subordinate clause]

In terms of semantics, the speaker must be able to characterize the roles of various entities in a situation. These roles are called semantic or participant roles, and are associated with specific verbs in a sentence or utterance. Some of these roles are illustrated by the following examples:

*I [AGENT] take a jar of peanut butter [THEME] from the cupboard [SOURCE].*

*My wife [AGENT] spreads the jelly [PATIENT] with a spoon [INSTRUMENT].*

*Crunchy peanut butter [STIMULUS] thrills my grandchildren [EXPERIENCER].*

Of course, structural language skills alone will not result in meaningful discourse if the speaker cannot use cohesive devices. The use of these devices allows hearers to relate one utterance to other utterances in the discourse. Any discourse which lacks these devices can appear disjointed and is difficult for a hearer to follow. The following cohesive devices are some of the most common to be used:

*I like smooth peanut butter and put lots of it on the bread.* [Anaphoric reference]

*When I’m finished with it, I put the jar back in the cupboard*. [Cataphoric reference]

*My husband likes a sweet jelly, but I prefer a sour one*. [Lexical substitution]

*I cover the bread with peanut butter and place this slice to one side*. [Lexical reiteration]

By way of illustration of these cognitive-linguistic skills, let us now turn to an examination of the procedural discourse of two adults with no neurological impairment. Both adults were control participants in the studies of adults with RHD which were conducted at North Carolina Central University and Nazareth College in Rochester, New York. These studies will be examined further in section 4. In the meantime, an analysis of the procedural discourse produced by two adults with no neurological impairment in response to the sandwich task will further exemplify for readers the complex array of skills described above.

The first speaker (PAR) is a 54-year-old woman. She is right-handed, has 17 years of education, and is a monolingual English speaker. The recording, which was made in June 2016, begins with an instruction from the investigator (INV):

1 INV: Tell me how you’d make a peanut butter and jelly sandwich.

2 PAR: I would gather all my ingredients and put them on the counter.

3 PAR: Just a good way to start when you’re cooking.

4 PAR: I used to um do cooking.

5 PAR: And so I would uh have the bread the peanut butter the jelly a plate and a napkin

and a knife.

6 PAR: I would take the bread out of the bag, put it on the plate.

7 PAR: Get the peanut butter.

8 PAR: Rub it on one side.

9 PAR: Take the jelly out with a clean knife.

10 PAR: Because you don’t want to cross contaminate.

11 PAR: Put the jelly on the other side.

12 PAR: Put (th)em together.

13 PAR: And put (th)em on the plate so...

14 INV: Mkay.

This speaker’s discourse is informative, well organized, and comprehensible. Each of the three sets of skills discussed above is employed to good effect by the speaker. In terms of mental state attribution, the speaker has correctly attributed two mental states to the mind of the investigator. The first mental state is that the investigator *knows* what objects like a plate and napkin are. As a result, this information can remain implicit in the discourse as shared or background knowledge between the speaker and the investigator. The second mental state is that the investigator probably knows how to make a peanut butter and jelly sandwich but nevertheless *wants* the speaker to give an explicit description of the procedure involved. So the speaker knows that she must explicitly communicate that peanut butter is applied to one slice of bread (line 8) and that jelly is applied to the other slice of bread (line 11). Having assessed the investigator’s mental states, and established the information to be conveyed, the next issue for the speaker is the order in which that information is to be presented. At this point the speaker’s executive planning skills comes to the fore. The speaker knows that she must remove slices of bread from the bag *before* peanut butter and jelly can be applied to the slices. This sequence of events is faithfully related by the speaker in line 6 (remove bread), line 8 (apply peanut butter), and line 11 (apply jelly). The speaker’s ability to plan her discourse is also evident in line 5 when she lists the items that will be needed to carry out the actions described in lines 6 to 13.

In terms of language encoding, the speaker makes effective use of grammatical and semantic structures during discourse production. All major and minor word classes are employed including nouns (*counter*), verbs (*gather*), adjectives (*clean*), adverbs (*together*), prepositions (*out of*), determiners (*all my ingredients*), and conjunctions (*because*). The speaker uses complex noun phrases (*a good way to start*) and verb phrases (*don’t want to cross contaminate*). Several prepositional phrases are used. These phrases express meanings such as location (*on the counter*) and means (*with a clean knife*). The speaker produces clauses which are linked by means of coordinating and subordinating conjunctions:

*I would gather all my ingredients and put them on the counter.*

*Take the jelly out with a clean knife because you don’t want to cross contaminate.*

The speaker also uses *to-*infinitive clauses (*I used to do cooking*) and *wh-*clauses (*a good way to start when you’re cooking*). Many of the speaker’s utterances take the form of imperative sentences (e.g. *Take the jelly out with a clean knife*). This is to be expected as the speaker is conveying a set of instructions. Utterances are also interrelated through the use of cohesion. There are several uses of anaphoric reference in this speaker’s discourse:

*I would gather all my ingredients and put them on the counter.*

*I would take the bread out of the bag, put it on the plate.*

*Get the peanut butter, rub it on one side.*

These cohesive links allow the hearer to follow the speaker’s discourse by tracking the items that are essential to sandwich-making across utterances. Notwithstanding these various discourse strengths, even adults with no neurological impairment can have lapses in their production of discourse. For example, this speaker conveys irrelevant information in line 4 when she states that she used to do cooking. She also omits information at the end of the discourse when she neglects to say that the sandwich should be cut in order to eat it. However, we will see in section 4 that these anomalies are very minor compared to the much greater problems with information on the part of adults with RHD.

The second speaker is a 64-year-old man. He is right-handed, has 16 years of education, and is a monolingual English speaker. Like the first speaker, he has no neurological impairment. He was recorded in October 2016.

1 INV: Tell me how you would make a peanut butter and jelly sandwich.

2 PAR: Uh provided that I had the peanut butter ah and jelly?

3 PAR: Okay I would uh take out two pieces of bread.

4 PAR: And I would put uh peanut butter on one side of the bread.

5 PAR: And jelly on the other side of the bread.

6 PAR: Except that I if I have a peanut butter and jelly sandwich I love to have butter on

my peanut butter and jelly sandwich.

7 PAR: I don’t know why that is.

8 PAR: But I’ll I would probably put the butter under the peanut butter.

9 PAR: And then either put the jelly on the the peanut butter or put it on the other side of

the bread.

10 PAR: And then press them together.

11 PAR: And then uh cut the cut it in half before I ate it.

12 INV: Great.

Like the first speaker, this speaker has produced an informative, well organized, and comprehensible discourse. There are a couple of qualitative differences between the first and second speakers, however. The first speaker enumerated the items that she would need to make a sandwich. The second speaker omits this information altogether. In lines 6 to 8, the second speaker expresses an individual preference in how he prepares a jelly and peanut butter sandwich. No such preferences are expressed by the first speaker. But aside from these differences, the second speaker displays comparable skills in mental state attribution, executive planning, and language encoding during the production of this discourse. The speaker makes reference to his own mental states in lines 6 and 7 when he says that he *loves* to have butter on his sandwich (line 6) and that he doesn’t *know* why this is the case (line 7). The mental states expressed by these utterances are desire and ignorance, respectively. Aside from self-attribution of mental states, the speaker is also able to attribute mental states to the mind of the investigator. It is this second type of mental state attribution that allows the speaker to foreground the steps that are integral to sandwich-making, and to leave implicit in the discourse the knowledge which the investigator may be assumed to share with the speaker.

In terms of executive planning, the speaker’s discourse is well organized. Actions are related in the order in which they occur during the preparation of a sandwich. So in lines 10 and 11, respectively, the speaker describes how he presses the two slices of bread together and then cuts them in half. In line 9, the speaker appears to forget that he said in line 5 that he puts the jelly on the other side of the bread. This is less a sign of a lapse in working memory (another important executive function skill) and more a clarification of his earlier statement in line 5 – the jelly can *either* be put on the peanut butter *or* on the other side of the bread. This speaker uses a range of syntactic and semantic structures in his discourse. In line 6, a *to-*infinitive clause (*I love to have butter…*) is used, while in line 7 the speaker uses a *wh-*clause (*I don’t know why that is*). In line 8, the speaker is clearly aware of the argument structure of the verb *put*. This verb requires three semantic or participant roles, namely, agent, patient and location:

*I [AGENT] would probably put the butter [PATIENT] under the peanut butter [LOCATION].*

The discourse is also easy for a hearer to follow on account of skilled use of cohesion by the speaker. In line 7, the demonstrative pronoun *that* refers to the preference which the speaker has expressed in line 6 (the speaker loves to have butter in his sandwich). In line 7, the speaker uses anaphoric reference to refer to the jelly. In lines 10 and 11, the pronouns *them* and *it* refer to sides of bread and sandwich, respectively:

Line 7: *I don’t know why that is.*

Line 9: *And then either put the jelly on the peanut butter or put it on the other side of the bread.*

Line 10: *And then press them together.*

Line 11: *And then cut it in half before I ate it.*

It emerges that both of these adults with no neurological impairment are able to employ mental state attribution, executive planning, structural language skills, and cohesion to good effect in the production of procedural discourse. The result in each case is a clear, coherent, and informative discourse that any hearer could easily follow. In section 4, the sandwich-making discourse of adults with RHD will be examined in detail. It will be shown that these adults exhibit a range of pragmatic and discourse anomalies. To help us understand these anomalies, we turn in the next section to examine typical characterizations of the language disorder in adults with RHD. What we will find is a lack of agreement among clinicians on the linguistic features that constitute this elusive language disorder.

**3. Characterizing language disorder in RHD**

The publication in 1979 of a paper by Penelope Myers1 was the first formal study to be undertaken of discourse-level communication disorders in adults with RHD. That paper arose out of the author’s observation that stroke patients with RHD, who were receiving clinical treatment for dysarthria (a motor speech disorder) and who had intact language skills, were nevertheless communicating inadequately. Specifically, these patients produced ‘irrelevant and often excessive information’ and seemed ‘to miss the implication of [a] question and to respond in a most literal and concrete way’ (Myers, 1979: 38). When attempting to respond to open-ended questions, these patients ‘wended their way through a maze of disassociated detail, seemingly incapable of filtering out unnecessary information’ (38). The components of a narrative, although available to these patients, could not be assembled into a narrative. There was difficulty ‘in extracting critical bits of information, in seeing the relationships among them, and in reaching conclusions or drawing inferences based on those relationships’ (39). Although the detail provided by these patients was related to the general topic, its appearance seemed irrelevant because it had not been ‘integrated into a whole’ (39). Although Myers never used the term ‘pragmatics’ in relation to these communicative problems, it is clear from today’s pragmatically informed standpoint that these discourse and conversational impairments were part of a pragmatic disorder on the part of these patients with RHD.

Myers’ clinical characterization was followed by a number of other attempts to capture the essence of the language disorder in RHD (see Joanette *et al.* (2014) and Blake (2017) for detailed discussion). There are certainly echoes of Myers’ characterization in these later accounts. However, none of them fully replicate her findings. Some accounts have even emphasized features such as paucity of speech which may be considered to be inconsistent with Myers’ early observations. Consistent with Myers’ characterization, Roman et al. (1987) reported that adults with RHD produced scripts which contained tangential information when they were asked to produce the sequence of steps which comprise two common activities. Additionally, these adults also displayed a tendency to terminate their script productions prematurely. In a major review conducted by McDonald (1993), the discourse of adults with right-hemisphere lesions was described as verbose, disorganized, and confabulatory.2 Łojek-Osiejuk (1996) used a number of tasks to study discourse production in 15 patients with RHD. These clients displayed considerable informational difficulties which went beyond those reported by Myers. Patients with RHD used a markedly reduced total number of units of information. Information from the setting, the action, and the end of a story was omitted. These patients also produced a large number of order errors in all the texts produced. Inappropriate comments and remarks also compromised the structures of stories and scripts. Mackenzie *et al.* (1999) studied two groups of adults with RHD, one group aged less than 75 years and one group aged over 75 years. During a picture description task, these adults produced less interpretive information, fewer words, and proportionally more extraneous information than their non-brain-damaged peers.

Since 2000, there has been an increase in the number of clinical studies of discourse in clients with RHD. However, earlier variability in clinical characterizations of discourse has continued to be a feature of these studies. Bartels-Tobin and Hinckley (2005) reported no differences in procedural discourse between seven participants with RHD and a non-neurologically impaired control group. However, significant group differences arose on four informational measures of narrative discourse. These measures were number of correct information units (CIU), CIU/minute, total main concept points, and number of absent main concepts. Problems with information content and coherent and cohesive aspects of narrative production were reported by Marini *et al.* (2005) in a study of 11 patients with RHD during picture description tasks. In a study of eight adults with RHD, Blake (2006) reported that tangentiality, egocentrism, and extremes of discourse (verbosity or paucity of speech) were clinically relevant characteristics of discourse. Mackenzie and Brady (2008) reported that during the procedural discourse task ‘how to make a sandwich’, individuals with RHD displayed topic deviations. None of the non-brain-damaged participants in the study deviated from the discourse task. Johns *et al.* (2008: 1039) stated that:

“Discourse processing deficits following unilateral RHD may be broadly characterized as falling into two overlapping areas: impaired sensitivity to the macrostructure of discourse, including disorganized topic coherence and management; and diminished ability to successfully negotiate the inferential processes necessary to maintain discourse coherence and facilitate comprehension.”

Johns *et al.* state further that the inferential processes of their second area underpin the interpretation of figurative and non-literal language. More recently, Agis *et al.* (2016) examined Cookie Theft picture descriptions in 33 patients with acute ischaemic stroke in the right hemisphere. Relative to sex- and age-matched controls, these patients produced fewer total content units and content units per minute. As with other studies, these findings confirm a tendency towards the production of under-informative discourse in adults with RHD.

It emerges that a plethora of terms have been used to characterize discourse in adults with RHD. This discourse has been described as confabulatory, verbose, egocentric, under-informative, tangential, incoherent, and disorganized. Some studies have reported no significant difference in the discourse of adults with RHD and adults without brain damage (e.g. Brady *et al.*, 2005). RHD discourse in these studies is not judged to be deviant in terms of parameters like topic use, for example. What are clinicians and researchers to make of such a discrepant set of findings? For some investigators, variability in the discourse findings of adults with RHD can be explained by the fact that interest in communication and the right hemisphere has had a shorter history than the study of aphasia, and that there has been less opportunity to collect data and refine methodology in consequence (Mackenzie *et al.*, 1999). Mackenzie and Brady (2008) state that ‘[t]he accruing of firm evidence with regard to topic skills in RHD has been limited by the use of […] qualitative rating scales, or by analyses of single cases or small groups, with inadequate control data from the non-brain-damaged peer population’. Tompkins (2012) also remarks on the factors that may contribute to the variability of research findings in the RHD population. She states that:

“[T]here is great diversity in this population’s presentation of cognitive-communication problems […] This diversity derives from many factors, no doubt including lesion site and premorbid individual differences. The stereotypical view of the patient with RHD probably results in part from sampling bias: patients in research studies often are, or have been, receiving rehabilitation services. As a result, these individuals are likely to be more impaired than the population as a whole.” (S61)

It may prove to be the case that all these factors play a role in explaining the diverse research findings that have been obtained in clients with RHD to date. But there is also the possibility that the language impairment in RHD is going to resist the type of consistent characterization that has been possible in clients with aphasia, for example. To the extent that this may turn out to be the case, clinicians who work with this population of clients need to become adept at characterizing multiple manifestations of the language disorder in RHD across different clients. In the next section, we make a start in this direction by examining the procedural discourse of seven clients with RHD. It will be seen that this discourse embodies the same variability that has been observed in the studies reported in this section. It will be argued that this variability reflects the complex array of cognitive-linguistic impairments in the RHD population, and is not simply a consequence of biased sampling and other methodological concerns.

**4. Procedural discourse in RHD**

Data from seven clients with RHD will be examined in this section. Four of these clients were self-identified volunteers of the Right Brain Stroke Research Registry, a national registry and subset of the Right Hemisphere Disorder Project, part of the North Carolina Central University Speech and Hearing Clinic. The other three clients were assessed in the Brain Injury Clinic which is housed in the York Wellness and Rehabilitation Institute at Nazareth College in Rochester, New York. Five subjects were male and two were female. They ranged in age from 53.7 to 81 years and had between 15 and 24 years of education. Each subject had sustained a right-hemisphere stroke, was right-handed, and was between 1.8 and 7.1 years since onset. With one exception, all participants were retired. The one working participant was a pharmaceutical consultant. Among the prior occupations of the retired participants were a speech-language pathologist, a mechanical engineer, a clinical manager for an assessment team, a school bus driver, an English teacher, and an employee at a newspaper/hypnotherapist. Each participant was asked to complete a number of discourse production tasks. One such task required them to tell the examiner how they would make a peanut butter and jelly (jam) sandwich. The resulting procedural discourse for each participant will be examined below.

The first speaker with RHD is a 68-year-old woman. She has 18 years of education and is 7.1 years since stroke onset:

1 INV: Tell me how you would make a peanut butter and jelly sandwich.

2 PAR: Uh get two slices of bread and a jar of jelly and a jar of peanut butter.

3 PAR: And open them.

4 PAR: And spread peanut butter on one slice of bread.

5 PAR: And I prefer crunchy.

6 PAR: And spread your jelly on the other slice of bread.

7 PAR: Put them together.

8 PAR: And then I like to slice mine in half.

9 PAR: Since I’m one handed I like to slice diagonal pieces.

10 PAR: And enjoy your peanut butter and jelly sandwich.

11 INV: Alright.

This speaker’s discourse is short but informative. In line 2, the main items necessary for the task (bread, peanut butter, and jelly) are mentioned, but a knife and a plate are omitted. The speaker expresses a preference for crunchy peanut butter in line 5 and her need to cut the sandwich into diagonal pieces in line 9. This information is relevant to the task and does not dominate the discourse as it might do in an egocentric speaker. Information is presented in the order in which actions must be performed. Also, successive utterances are linked through the following cohesive devices:

*Anaphoric reference:*

Line 3: *And open them* (referring to jars of peanut butter and jelly)

Line 7: *Put them together* (referring to slices of bread)

Line 8: *And then I like to slice mine in half* (referring to sandwich)

*Ellipsis:*

Line 5: *And I prefer crunchy [peanut butter]*

The speaker displays no structural language impairments. Several utterances take the form of subjectless imperative sentences. This reflects the fact that the speaker is conveying a set of instructions on how to perform a task. In short, the discourse is similar in all respects to one that might be produced by an adult without brain damage.

The second speaker is a 56-year-old man. He has 15 years of education and is 3.1 years since stroke onset:

1 INV: Tell me how you would make a peanut butter and jelly sandwich.

2 PAR: Well I wouldn’t (*laughs*).

3 PAR: Hideous substance (.) known to man, I think.

4 PAR: Um I uh as a guess, I think I would (.) um want to spread my peanut butter first.

5 PAR: Now in my case I have a little excuse me a little plastic um aid.

6 PAR: But has a sort of uh a ledge that allows me to support the bread in one corner.

7 PAR: And that which allows me to spread the bread without it moving or sliding all over

the place on the basis that I can’t really move my left arm very well.

8 PAR: And so I would put my peanut butter on first because that’ll keep it nice and close

to the sandwich.

9 PAR: Um making sure that I um remove any surplus peanut butter from my knife before

I dunk that into my jelly or jam.

10 PAR: I don’t know what the difference between a jelly and a jam is but I’m sure one of

these days somebody will tell me.

11 PAR: Um and then put that on next uh and then probably grip the other half of the

sandwich the next piece of bread and put that over the top.

12 PAR: I wouldn’t, I wouldn’t peanut butter that.

13 PAR: I wouldn’t be bothered with it.

14 PAR: It’d just be one layer of each between the two sandwiches.

15 PAR: Goodness me and then I’ll probably shout to my wife.

16 PAR: “Darlin(g) can you possibly make me a peanut butter and jelly sandwich (be)cause

I’m I’m screwing this up (*laughs*) probably?”

This speaker’s discourse is longer than the discourse of the first speaker. It also displays significant qualitative differences. The speaker’s personal perspective is more forcefully brought to bear on the extract than was the case with the first speaker. In lines 2 and 3, he expresses his view that he wouldn’t make a peanut butter and jelly sandwich as it is a ‘hideous substance’. In lines 5 to 7, he describes how the procedure has to be modified to accommodate the weakness of his left arm. The first speaker conveys the adjustment necessitated by her physical disability in a single line. In lines 15 and 16, the second speaker refers to his wife, again signalling a personal perspective. In line 10, the speaker, who is from the UK, digresses to say that he doesn’t know what the difference is between a jelly and a jam. Alongside these features, the speaker omits information. He does not mention the different items that he will need to make the sandwich, or that he will need to cut the sandwich in order to eat it. The speaker is somewhat less fluent than the first speaker, and there are several fillers throughout his discourse (e.g. *Um I uh as a guess, I think I would (.) um want to spread…*). Like the first speaker, this speaker succeeds in linking utterances through the following cohesive devices:

*Ellipsis:*

Line 2: *Well I wouldn’t [make a peanut butter and jelly sandwich].*

*Anaphoric reference:*

Line 7: *And that which allows me to spread the bread without it moving or sliding …*

Line 8: *And so I would put my peanut butter on first because that’ll keep it nice and close …*

Line 9: *I remove any surplus peanut butter from my knife before I dunk that into my jelly ...*

The speaker’s structural language skills are intact, and he makes extensive use of mental state language, as the following examples illustrate:

Line 3: *Hideous substance (.) known to man, I think.*

Line 4: *Um I uh as a guess, I think I would (.) um want to spread my peanut butter first.*

Line 10: *I don’t know what the difference between a jelly and a jam is but I’m sure one of these days somebody will tell me.*

In summary, the speaker’s discourse is not noticeably aberrant in terms of any of the features that have been addressed. One can easily imagine how these same features might occur in the discourse of an adult who has no brain injury.

The third speaker is a 53-year-old woman. She has 18 years of education. It has been 5.5 years since stroke onset:

1 INV: Tell me how you would make a peanut butter and jelly sandwich.

2 PAR: A couple slices of bread.

3 PAR: (*clears throat*) um put peanut butter on one side and jelly on the other side.

4 PAR: Put the slices together.

5 PAR: Cut off the crusts (*laughs*).

6 INV: (*laughs*).

7 PAR: Finicky that way.

8 INV: Mhm (*laughs*).

9 PAR: That’d be it.

10 INV: Mkay.

This is the shortest procedural discourse of any speaker with RHD. It has a pithy style which may reflect the speaker’s pre-morbid communication. Alternatively, the speaker may be exhibiting paucity of speech. Either way, the discourse is under-informative from a hearer’s point of view. The source of the bread in line 2 is not mentioned (e.g. bag, cupboard) and the speaker does not state that the bread should be placed on a plate or equivalent. In line 3, the speaker does not say that a knife or a spoon is used to apply the peanut butter and jelly to the bread. In line 5, she expresses her preference for removing the crusts but not that the sandwich must be cut in order to be eaten. The speaker assumes that these details will be understood by the hearer and that they can, therefore, remain implicit in the discourse. But in doing so, she fails the requirement for explicitness that is demanded by the procedural discourse task. In line 3, the speaker uses the word *side* as a synonym of *slice of bread*. This is not a lexical error but a common conflation of these expressions, which was also evident in the discourse of control participants in the same investigation (see the discourse of the two speakers with no neurological injury in section 2). The unelaborated nature of this speaker’s discourse sets it apart from the discourse of the other six speakers with RHD. In order to establish if this speaker’s paucity of speech is a feature of her pre-morbid communicative style or is symptomatic of post-stroke language disorder, information would need to be obtained from informants who are family members and friends of the speaker.

The fourth speaker is a 55-year-old man. He has 20 years of education. His stroke occurred 2.2 years ago:

1 INV: Tell me how you would make a peanut butter and jelly sandwich.

2 PAR: First I would get out a couple slices of bread.

3 PAR: Um I’d get out the peanut butter and jelly and a utensil to spread both of them.

4 PAR: Now these days I don’t actually I I can’t spread peanut butter.

5 PAR: Because uh it’s a little too thick.

6 PAR: But if I mean normally what I would do is hold the peanut butter jar.

7 PAR: And uh scoop out some peanut butter.

8 PAR: Spread it on one one piece of bread.

9 PAR: Um then I would get the jelly and spread it on the other piece of bread and slap

them together.

10 PAR: Probably cut it in half and eat it.

11 INV: Okay.

This speaker’s discourse is clearly sequenced and informative. In lines 2 and 3, the speaker describes the different items that will be used in the making of the sandwich. In lines 4 to 6, the speaker explains that he is no longer able to spread peanut butter but that he intends to describe what he would ordinarily do to make a sandwich. This is an appropriate contribution to the discourse and is not a sign of tangential or egocentric discourse. None of the actions involved in sandwich-making are omitted and so the hearer’s informational needs are fully addressed. The speaker’s utterances are linked through the repeated use of anaphoric reference. This single cohesive device allows the hearer to track the referents of all the speaker’s pronouns in the discourse:

Line 3: *Um I’d get out the peanut butter and jelly and a utensil to spread both of them.*

Lines 4 and 5: *Now these days I don’t actually I I can’t spread peanut butter because uh it’s a little too thick.*

Lines 7 and 8: *And uh scoop out some peanut butter. Spread it on one one piece of bread.*

Line 9: *Um then I would get the jelly and spread it on the other piece of bread and slap them together.* (The pronoun *them* refers to pieces of bread)

Line 10: *Probably cut it in half and eat it.* (The pronoun *it* refers to the sandwich)

This speaker’s discourse satisfies the need to be informative and relevant, and cannot be distinguished from the discourse of adults with no neurological injury on any dimension.

The fifth speaker is a 62-year-old man. He has 20 years of education. It has been 6.83 years since he had his stroke:

1 INV2: I want you to tell me how you would make a peanut butter and jelly sandwich.

2 PAR: Okay.

3 PAR: Two slices of wheat bread.

4 PAR: Uh crunchy peanut butter.

5 PAR: And my wife’s special apple almond pi pear jam (.) on on top of the peanut butter.

6 INV: Mm.

7 PAR: Put the two slices together.

8 PAR: And eat.

9 PAR: With a drink of water.

10 INV: (*laughs*).

11 INV: Alright.

This speaker’s discourse is over-informative in some respects and under-informative in other respects. The speaker chooses to specify the type of bread (*wheat* bread), the type of peanut butter (*crunchy* peanut butter), and the type of jam (*my wife’s special apple almond pear* jam) that is used in sandwich-making. In line 9, the speaker states that he has a drink of water with the sandwich. None of this information is essential to the procedure that the speaker is attempting to describe and is over-informative for this reason. This additional information also relates entirely to the preferences of the speaker and may be indicative of egocentrism in discourse. The speaker’s discourse is also under-informative in that a considerable amount of information is omitted. In lines 3 and 4, the speaker does not mention where he gets the bread and peanut butter from in order to make the sandwich. Key utensils like a knife and a plate are omitted. In order to make sense of the information in line 5, the hearer is forced to infer that the peanut butter and jam have been applied to the bread. But the speaker has not provided this information at any point. In line 7, the use of the definite noun phrase *the two slices* presupposes that the slices have already been mentioned when this is not the case. Between lines 7 and 8, the speaker also fails to state that the sandwich has to be cut in order to be eaten. This speaker’s significant difficulties with information management not only distinguish his discourse from the discourse of adults with no brain injury, but also from the discourse of other adults with RHD in this investigation.

The sixth speaker is a 68-year-old man. He has 24 years of education. It has been 2.2 years since he had his stroke:

1 INV: Tell me how you would make a peanut butter and jelly sandwich.

2 PAR: I’d make it thick.

3 INV: How would you, how would you make it?

4 PAR: Slices of bread.

5 PAR: Um uh get a nice uh fat butter knife.

6 PAR: So you can spread real well.

7 PAR: Eh um my favorite peanut butter comes from um Whole Foods.

8 INV: Mhm.

9 PAR: It’s uh no additives at all, just the peanuts.

10 PAR: And and I’ve got the whole sh I’ve got a huge shelf full of that peanut butter.

11 PAR: (Be)cause um I used to go back to Rhode Island.

12 PAR: Which was where eh where the nearest Whole Foods that I knew of.

13 PAR: And I would buy uh I would stock up on stuff that they have.

14 PAR: And this is when I was living like last time I did that I was living in Cooperstown.

15 PAR: I would go back to visit my friends in Rhode Island.

16 PAR: Eh so I could go shopping at Whole Foods.

17 PAR: Now I don’t have to do that.

18 PAR: Because now there’s one here I think.

19 PAR: Yep.

20 PAR: I haven’t been there yet.

21 INV: Hm.

22 PAR: I’m lookin(g) forward to it.

23 PAR: Um and so this the best peanut butter and I use strawberry jam.

24 INV: Mhm.

25 PAR: And I like a nice thick I think I said this all once already.

26 PAR: Uh like a nice thick layering.

27 INV: mhm.

28 PAR: Yeah.

29 PAR: So first the peanut butter then the jam then another slice of bread.

30 PAR: I pat it down a little bit.

31 PAR: Make sure it’s pretty compact.

32 PAR: So there’s nothing go dribbling out when I eat it.

33 INV: Mhm.

34 INV: Okay.

35 PAR: And that’s how I do it.

36 INV: Okay.

This is the longest procedural discourse of any of the discourses produced by the speakers with RHD. But it is also one of the least informative on account of its largely tangential content. In line 7, the speaker commences a lengthy digression related to his favourite peanut butter. He only returns to the task in hand in line 23 when he states that he uses strawberry jam. The intervening discourse is irrelevant and over-informative. It suggests a strong tendency to egocentrism on the part of this speaker as his personal perspective dominates the discourse at this point. Because the speaker has spent so long developing this irrelevant discourse, he forgets that he has already communicated in line 2 that he likes a thick sandwich. As a result, he repeats this information in lines 25 and 26. Even when the speaker finally gets back on task, he omits important information. For example, he does not state that the peanut butter and jam is spread on the bread, or that the sandwich is cut before it is eaten. Notwithstanding the speaker’s significant difficulties with informational content, he displays strong structural language skills. He also uses cohesive devices like anaphoric reference and substitution to link the utterances in his discourse. Examples of these forms of cohesion are displayed below:

*Anaphoric reference:*

Lines 7 and 9: *My favorite peanut butter comes from um Whole Foods. It’s uh no additives at all, just the peanuts.*

Lines 16 and 17: *Eh so I could go shopping at Whole Foods. Now I don’t have to do that.*

*Substitution:*

Line 18: *Because now there’s one here I think.* (*one* is a substitute for *Whole Foods*)

The seventh and final speaker with RHD is an 81-year-old man. He has 19 years of education. It has been 1.8 years since his stroke:

1 INV: And I want you to tell me how you would make a peanut butter and jelly sandwich.

2 PAR: Uh it’s easy.

3 PAR: I eat it.

4 INV: (*laughs*).

5 PAR: (*laughs*) uh let’s see.

6 PAR: First I like my peanut butter and jelly.

7 PAR: I like the bread toasted.

8 PAR: And I put the uh peanut butter (*unintelligible*).

9 PAR: And I did that this morning.

10 PAR: But I didn’t have peanut butter.

11 PAR: I use elderberries which gives you immunity against flu.

12 INV: Mhm.

13 PAR: Um I’ve used it for years.

14 PAR: There’s a lot of things that give you immunity against flu.

15 INV: Hm.

16 PAR: Um but I use elderberry jam.

17 PAR: It was delicious.

18 INV: (*laughs*).

19 INV: Alright so is that everything?

20 PAR: Yeah.

21 INV: Okay great thank you.

This speaker’s discourse is even less informative than the previous speaker’s discourse. Whereas the previous speaker succeeds in describing some of the actions that are needed to make a sandwich, albeit after a long digression, this speaker does not convey any of these actions. In line 11, he begins to digress when he describes how he eats elderberries to give him immunity against flu. From this point onwards, the speaker does not return to the task in hand. Even the investigator’s prompt in line 19 does not succeed in getting the speaker back on track. Instead, the speaker confirms that he has said everything that he wants to say and the task is concluded. The digression reflects the speaker’s personal perspective and is an indication of possible egocentrism. The speaker’s personal perspective is evident even before he digresses in line 11. In line 7, he states that he likes the bread toasted. In line 9, the speaker says that he ‘did that’ this morning. There is no sense on the part of this speaker that he is describing a procedure that does not wholly relate to his personal circumstances and preferences. The speaker is able to introduce humour at the beginning of his discourse. He also uses anaphoric reference successfully as a cohesive device (an exception occurs in line 13 when he uses the pronoun *it* to refer to elderberries). Along with intact structural language skills, these features create the impression that this speaker has a higher level of discourse competence than is actually the case.

Characteristics of the procedural discourse of all seven speakers with RHD are summarized in Table 1. For two speakers, their discourse was essentially indistinguishable from that of adults with no brain damage. The remaining five speakers displayed a range of more or less severe discourse anomalies. Most of these anomalies involved problems with information management, including the omission and repetition of information, and the use of irrelevant or tangential information. This resulted in under-informative and over-informative discourse. Egocentrism was a feature of discourse for four speakers and was particularly evident during extended digressions. The variable discourse profiles of these speakers are consistent with the findings of clinical studies of adults with RHD. It will be argued in the next section that these different profiles reflect the cognitive and linguistic heterogeneity of the RHD population. It is this heterogeneity which gives rise to different manifestations of the language disorder in adults with RHD. The classical aphasia syndromes with their consistent and stable features are an inadequate model for the variable presentations of language disorder following RHD. A model which emphasizes constellations of impairments, which can have varying degrees of prominence in particular speakers, is presented in the next section as an alternative way in which to conceive of the language disturbance in RHD. Also, the diagnostic significance of procedural discourse tasks such as the sandwich-making task is considered within a wider clinical language evaluation.

|  |  |
| --- | --- |
| **CLIENT WITH RHD** | **PROCEDURAL DISCOURSE** |
| Speaker 1 | Essentially ‘normal’ discourse |
| Speaker 2 | Egocentrism; omission of information; not markedly deviant |
| Speaker 3 | Possible paucity of speech; under-informative |
| Speaker 4 | Essentially ‘normal’ discourse |
| Speaker 5 | Over-informative and under-informative; egocentrism |
| Speaker 6 | Tangential; over-informative; egocentric; repetitive; omission of information |
| Speaker 7 | Under-informative; tangential; egocentrism |

**Table 1:** Characteristics of the procedural discourse of seven speakers with RHD

**5. A model of discourse in RHD**

In this section, the somewhat elusive character of the language disorder in RHD is related to the complex cognitive-perceptual substrate that underlies this disorder (Cummings, 2017). This substrate includes theory of mind skills, executive function skills, and visual-spatial and perceptual skills. Each of these sets of skills has been the focus of clinical studies, some of which will be described in this section. These studies reveal that impairments of cognitive and perceptual skills are highly variable in nature, with some adults with RHD exhibiting marked deficits in one or more areas, and other adults possessing intact skills. It will be argued that it is the fluid nature of this cognitive-perceptual substrate that contributes to the variable discourse problems of adults with RHD. In order to capture the relationship between discourse and its cognitive-perceptual substrate, a concentric model is developed. In this model, the central impairment in the discourse of adults with RHD is reduced informational content. The emphasis on informational content reflects the fact that when discourse is omitted or repeated, or is tangential or egocentric, it is its capacity to convey meaningful content that is most compromised. The relationship between reduced informational content, the specific discourse anomalies that contribute to reduced content, and the cognitive-perceptual substrate upon which discourse production depends is represented by means of differing tiers in the model. It will be argued that a concentric model best reflects the variable nature of the language and communication disorder in RHD. The section concludes with some thoughts about the inclusion of procedural discourse tasks in a clinical language evaluation.

For some years, speech-language pathologists have described the language disorder in adults with RHD as a cognitive-communication disorder. This disorder is so-called on account of the role of cognitive factors in the onset and maintenance of language disorder in this clinical population. So what exactly are the cognitive deficits in adults who sustain RHD? There is some evidence that clients with RHD have impaired theory of mind (ToM) skills (see Cummings (2013, 2014, 2015) for detailed discussion of ToM). Hamilton *et al.* (2017) used a visual-affective measure of social understanding to investigate ToM in patients with right-hemisphere (RH) stroke and left-hemisphere (LH) stroke. RH stroke was associated with impaired ToM ability, but there was no association between LH stroke and ToM. The difficulties of RH stroke patients on this ToM measure could not be explained by deficits in executive functioning. Yeh and Tsai (2014) examined cognitive and affective ToM in 34 patients with stroke. These patients were significantly impaired in both cognitive and affective ToM even after controlling for basic cognitive function and emotional processing. Patients with RH stroke had poorer performance on the cognitive component of non-verbal ToM than those with LH stroke. Weed *et al.* (2010) reported that participants with RHD displayed a bias towards reduced mental state ascription in an experimental condition in which animated triangles were represented as intentional agents with mental states. In an earlier investigation, Weed (2008) found that individuals with RHD have impairments on tasks that involve ToM cognition, although evidence for a specific ToM impairment was inconclusive.

Another set of cognitive skills that plays an important role in procedural discourse production is executive functions. Executive functions regulate goal-directed behaviour, and include skills such as planning and organization, working memory, impulse control, attention, initiation of activity, mental flexibility, and problem-solving. Clinical studies have demonstrated that adults with RHD have executive function deficits. Kopp *et al.* (2014) observed a relation between a measure of behavioural (dis-)organization and right frontal brain lesions in 32 stroke patients. Rainville *et al.* (2003) reported a severe executive function syndrome in a patient with lesions in the subcortical structures of the right hemisphere. Executive functions have also been found to be associated with specific pragmatic and discourse deficits in adults with RHD. Martin and McDonald (2006) found that impaired executive function played a significant role in explaining the poor performance of adults with RHD on an irony comprehension task. Saldert and Ahlsén (2007) reported that problems with inference revision in a group of 14 individuals with RHD were related to sustained attention. Zimmermann *et al.* (2011) studied seven adults with RHD who were found to have impairments of working memory and verbal initiation. These executive function impairments were related to deficits in conversational discourse and narrative discourse tasks. Barker *et al.* (2017) found cohesion and coherence impairments in connected speech in subjects with RH stroke relative to controls. Aspects of cohesive and coherent speech were associated with better performance on attention tasks and a test of executive function.

Visual-spatial and perceptual deficits are common neurological sequelae of RHD (Carter *et al.*, 2017; Kato *et al.*, 2012). These deficits contribute to the hemispatial neglect that is experienced by many patients with right-hemisphere brain damage.3 Neglect can compromise discourse production tasks which involve the use of visual stimuli such as picture description (expository discourse) and the use of a picture book to tell a story (narrative discourse). Even when adults with RHD have no visuospatial deficits on standardized neuropsychological testing, it is clear that the visual demands of these tasks can result in discourse problems for these clients. Marini *et al.* (2005) presented three story description tasks to 11 patients with RHD who had no language, visuospatial, memory, or conceptual deficits on standardized testing. The three tasks required participants to retell previously read stories, to tell stories which were depicted in cartoon-like fashion, and to tell stories which were depicted by unordered pictures. Within-sentence (lexical selection and syntactic complexity) and between-sentence (cohesion and coherence) abilities of these adults across all three tasks were examined. Adults with RHD performed well on within- and between-sentence measures in the first task which contained no visual demand. However, in the two tasks that required subjects to process visual information in pictures, adults with RHD performed more poorly than normal controls in terms of information content and coherent and cohesive aspects of narrative production. Marini *et al.* concluded that adults with RHD were impaired in deriving a mental model of a story from visual information in pictures.

To reflect the relationship between this complex cognitive-perceptual substrate and discourse production, a model is needed in which several components are interlinked across multiple levels. This model must be able to capture the difficulties of the client with RHD whose discourse exhibits reduced informational content because he omits information on account of hemispatial neglect. It must also be able to represent the difficulties of the client with RHD whose discourse exhibits reduced informational content because he repeats information on account of a working memory deficit. The model in Figure 1 permits different constellations of impairments to assume prominence across different speakers with RHD. In one speaker with RHD, it may be the large number of tangential utterances and executive function deficits which reduces the informational content of discourse. These same features may play little or no role in the discourse difficulties of another speaker with RHD in which case they will simply recede into the background of the model. The model in Figure 1 confers equal significance on all the factors that play a contributory role in the discourse difficulties of adults with RHD, whilst allowing that one or two of these factors may have greater prominence than other factors in a particular case. We saw in section 4 how speakers with RHD may exhibit more than one discourse problem. These speakers may also have several, co-occurring cognitive-perceptual difficulties. It is these different possibilities that account for the variable manifestation of language disorder in RHD. Each of these possibilities reflects the complex interplay of factors depicted in the model in Figure 1.

**REDUCED INFORMATIONAL CONTENT**

Egocentric discourse

Verbose discourse

Confabulatory discourse

Executive function deficits

Theory of mind deficits

Visual spatial- perceptual deficits

Paucity of

speech

Tangential

discourse

Disorganized Repetitive

discourse discourse

**Figure 1:** Model depicting the relationship between discourse and its cognitive-perceptual substrate in adults with RHD

By way of conclusion, we return to the procedural discourse task from which this discussion set out. That task required subjects to tell an investigator how they would make a peanut butter and jelly sandwich. This procedural discourse task has hidden depths which became apparent as soon as we began to explore the complex cognitive-linguistic skills which it could be used to examine. No other language task with the ecological validity4 of discourse production can so readily reveal such an array of high-level language and cognitive skills. To this extent, procedural discourse tasks have been a somewhat neglected resource in the clinical language evaluation toolkit of speech-language pathologists. I believe that reconsideration of the contribution that procedural discourse tasks can make to clinical language evaluation is now necessary. Rather than being viewed as a supplement to language tests, conducted only when clinical time is available, procedural discourse and other discourse production tasks should be the centre of a clinical language evaluation. This is nowhere more important than in the assessment of clients with cognitive-communication disorders. For it is in clients with RHD, traumatic brain injury, and dementias that language dysfunction is related to an impaired cognitive-perceptual substrate. By placing discourse production tasks at the centre of clinical language evaluation, clinicians can then use findings from these tasks to determine which cognitive-linguistic skills require further, detailed assessment. The proposed reversal of the standard relationship between language tests and discourse production tasks in clinical language evaluation will, in time, lead to a much deeper understanding of language and communication disorders in adults with RHD.

**NOTES**

1. Myers presented her paper in May 1979 at the Clinical Aphasiology Conference (CAC) held in Phoenix, Arizona. It is a sign of the significance of this paper that it was published again in 2005 as a CAC classic in the journal *Aphasiology*. The reader is referred to Myers (2005).

2. Confabulations are false or erroneous memories that occur involuntarily in individuals with a neurological amnesia. As well as completely or largely erroneous memories, the patient may report real memories which are jumbled up and retrieved out of context. Confabulated memories are often autobiographical. In general, the patient is unaware of his or her condition.

3. In hemispatial neglect, patients fail to be aware of or acknowledge items on their contralesional side (the left side in patients with RHD). They may be unaware of large objects and people in extrapersonal space and even their own body parts. Contralesional limbs may not be used even when they have little or no weakness (known as motor neglect). Patients with neglect may be unaware that they have these problems (so-called anosognosia) (Parton *et al.*, 2004).

4. Ecological validity describes the extent to which tasks used in a language evaluation resemble everyday communication. In general, formal language assessments such as commercially available tests have poorer ecological validity than informal language assessments such as a recording of spontaneous conversation.

**BIBLIOGRAPHY**

Agis, D., Goggins, M. B., Oishi, K., Oishi, K., Davis, C., Wright, A., Kim, E. H., Sebastian, R., Tippett, D. C., Faria, A., & Hillis, A. E. (2016). Picturing the size and site of stroke with an expanded National Institutes of Health Stroke Scale. *Stroke, 47*, 1459-1465.

Barker, M. S., Young, B., & Robinson, G. A. (2017). Cohesive and coherent speech deficits in mild stroke. *Brain and Language, 168*, 23-36.

Bartels-Tobin, L. R., & Hinckley, J. J. (2005). Cognition and discourse production in right hemisphere disorder. *Journal of Neurolinguistics, 18*, 461-477.

Blake, M. L. (2006). Clinical relevance of discourse characteristics after right hemisphere brain damage. *American Journal of Speech-Language Pathology, 15*, 255-267.

Blake, M. L. (2017). Right-hemisphere pragmatic disorders. In L. Cummings (Ed.), *Research in clinical pragmatics* (pp. 243-266). Cham, Switzerland: Springer.

Brady, M. C., Armstrong, L., & Mackenzie, C. (2005). Further evidence on topic use following right hemisphere brain damage: Procedural and descriptive discourse. *Aphasiology, 19* 731-747.

Carter, A. R., McAvoy, M. P., Siegel, J. S., Hong, X., Astafiev, S. V., Rengachary, J., Zinn, K., Metcalf, N. V., Shulman, G. L., & Corbetta, M. (2017). Differential white matter involvement associated with distinct visuospatial deficits after right hemisphere stroke. *Cortex, 88*, 81-97.

Cummings, L. (2013). Clinical pragmatics and theory of mind. In A. Capone, F. Lo Piparo, & M. Carapezza (Eds.), *Perspectives on linguistic pragmatics* (Series: Perspectives in pragmatics, philosophy & psychology, Vol. 2, pp. 23-56). Cham, Switzerland: Springer International Publishing AG.

Cummings, L. (2014). Pragmatic disorders and theory of mind. In L. Cummings (Ed.), *Cambridge handbook of communication disorders* (pp. 559-577). Cambridge: Cambridge University Press.

Cummings, L. (2015). Theory of mind in utterance interpretation: The case from clinical pragmatics. *Frontiers in Psychology*, *6*, 1286.

Cummings, L. (2017). Cognitive aspects of pragmatic disorders. In L. Cummings (Ed.), *Research in clinical pragmatics* (Series: Perspectives in pragmatics, philosophy & psychology, Vol. 11, pp. 587-616). Cham, Switzerland: Springer International Publishing AG.

Hamilton, J., Radlak, B., Morris, P. G., & Phillips, L. H. (2017). Theory of mind and executive functioning following stroke. *Archives of Clinical Neuropsychology,* to appear.

Joanette, Y., Ferré, P., & Wilson, M. A. (2014). Right hemisphere damage and communication. In L. Cummings (Ed.), *Cambridge handbook of communication disorders* (pp. 247-265). Cambridge: Cambridge University Press.

Johns, C. L., Tooley, K. M., & Traxler, M. J. (2008). Discourse impairments following right hemisphere brain damage: A critical review. *Language and Linguistics Compass, 2*, 1038-1062.

Kato, H., Seki, M., Shindo, J., Yamazaki, T., Sato, Y., Utsumi, H., & Nagata, K. (2012). The relationship between visuospatial ability and cognitive function in patients with right-hemisphere infarction. *Journal of the Neurological Sciences, 322*, 129-131.

Kopp, B., Rösser, N., Tabeling, S., Stürenburg, H. J., de Haan, B., Karnath, H. O., & Wessel, K. (2014). Disorganized behavior on Link’s cube test is sensitive to right hemispheric frontal lobe damage in stroke patients. *Frontiers in Human Neuroscience, 8*, 79.

Łojek-Osiejuk, E. (1996). Knowledge of scripts reflected in discourse of aphasics and right-brain-damaged patients. *Brain and Language, 53*, 58-80.

Mackenzie, C., Begg, T., Lees, K. R., & Brady, M. (1999). The communication effects of right brain damage on the very old and the not so old. *Journal of Neurolinguistics, 12*, 79-93.

Mackenzie, C., & Brady, M. C. (2008). Communication difficulties following right-hemisphere stroke: Applying evidence to clinical management. *Evidence-Based Communication Assessment and Intervention, 2*, 235-247.

MacWhinney, B., Fromm, D., Forbes, M., & Holland, A. (2011). AphasiaBank: Methods for studying discourse. *Aphasiology, 25*, 1286-1307.

Marini, A., Carlomagno, S., Caltagirone, C., & Nocentini, U. (2005). The role played by the right hemisphere in the organization of complex textual structures. *Brain and Language, 93*, 46-54.

Martin, I., & McDonald, S. (2006). That can’t be right! What causes pragmatic language impairment following right hemisphere damage? *Brain Impairment, 7*, 202-211.

McDonald, S. (1993). Viewing the brain sideways? Frontal versus right hemisphere explanations of non-aphasic language disorders. *Aphasiology, 7*, 535-549.

Myers, P. S. (1979). Profiles of communication deficits in patients with right cerebral hemisphere damage: Implications for diagnosis and treatment. In *Clinical aphasiology conference* (pp. 38-46). Phoenix, AZ: BRK Publishers.

Myers, P. S. (2005). Profiles of communication deficits in patients with right cerebral hemisphere damage: Implications for diagnosis and treatment. *Aphasiology, 19*, 1147-1160.

Parton, A., Malhotra, P., & Husain, M. (2004). Hemispatial neglect. *Journal of Neurology, Neurosurgery & Psychiatry, 75*, 13-21.

Rainville, C., Giroire, J. M., Periot, M., Cuny, E., & Mazaux, J. M. (2003). The impact of right subcortical lesions on executive functions and spatio-cognitive abilities: A case study. *Neurocase, 9*, 356-367.

Roman, M., Brownell, H. H., Potter, H. H., Seibold, M. S., & Gardner, H. (1987). Script knowledge in right hemisphere-damaged and in normal elderly adults. *Brain and Language, 31*, 151-170.

Saldert, C., & Ahlsén, E. (2007). Inference in right hemisphere damaged individuals’ comprehension: The role of sustained attention. *Clinical Linguistics & Phonetics, 21*, 637-655.

Tompkins, C. A. (2012). Rehabilitation for cognitive-communication disorders in right hemisphere brain damage. *Archives of Physical Medicine and Rehabilitation, 93 (Suppl 1)*, S61-S69.

Weed, E. (2008). Theory of mind impairment in right hemisphere damage: A review of the evidence. *International Journal of Speech-Language Pathology, 10*, 414-424.

Weed, E., McGregor, W., Feldbaek Nielsen, J., Roepstorff, A., & Frith, U. (2010). Theory of mind in adults with right hemisphere damage: What’s the story? *Brain and Language, 113*, 65-72.

Yeh, Z. T., & Tsai, C. F. (2014). Impairment on theory of mind and empathy in patients with stroke. *Psychiatry and Clinical Neurosciences, 68*, 612-620.

Zimmermann, N., Gindri, G., de Oliveira, C. R., & Fonseca, R. P. (2011). Pragmatic and executive functions in traumatic brain injury and right brain damage: An exploratory comparative study. *Dementia e Neuropsychologia, 5*, 337-345.