

Research Article

Question Use in Adults With Right-Hemisphere Brain Damage

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Purpose: Right-hemisphere brain damage (RHD) can affect pragmatic aspects of communication that may contribute to an impaired ability to gather information. Questions are an explicit means of gathering information. Question types vary in terms of the demands they place on cognitive resources. The purpose of this exploratory descriptive study is to test the hypothesis that adults with RHD differ from neurologically healthy adults in the types of questions asked during a structured task.

Method: Adults who sustained a single right-hemisphere stroke and neurologically healthy controls from the RHDBank Database completed the Unfamiliar Object Task of the RHDBank Discourse Protocol (Minga et al., 2016). Each task was video-recorded. Questions were transcribed using the Codes for the Human Analysis of Transcripts format. Coding and analysis of each response were conducted using Computerized Language Analysis (MacWhinney, 2000) programs.

Results: The types of questions used differed significantly across groups, with the RHD group using significantly more content questions and significantly fewer polar questions than the neurologically healthy control group. In their content question use, adults with RHD used significantly more “what” questions than other question subtypes.

Conclusion: Question-asking is an important aspect of pragmatic communication. Differences in the relative usage of question types, such as the reduced use of polar questions or increased use of content questions, may reflect cognitive limitations arising from RHD. Further investigations examining question use in this population are encouraged to replicate the current findings and to expand on the study tasks and measures.

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Information exchange is a necessity for effective communication. Personal, professional, and social activities of daily living, such as fostering friendships, interviewing for a job, and explaining medical symptoms to a health care professional, are difficult to accomplish without the exchange of information. Successful communication depends on the control of pragmatic skills and principles involved in evaluating the status of the speaker, the addressee, and the social context (Leech, 1983; Liu, 2000). Determining the meanings of words, adhering to the social rules of conversation, asking questions, and using the appropriate

language for the communicative situation are essential pragmatic skills for functional communication (Nofsinger, 1991). Pragmatic computations vary greatly in the demands they place on cognitive resources. For example, the production of simple greetings and fixed phrases involves little more than basic lexical lookup (Sidtis, 2014). However, the understanding of pragmatic devices such as irony and subtle humor can involve processes for computing perspective (Fauconnier, 1994), common ground (H. Clark, 1996), and turn-taking (Schegloff, 2007) that are cognitively complex and not universally available (E. Clark, 2014).

Right-hemisphere brain damage (RHD) may impair the effective exchange of information despite relatively preserved aspects of language production (syntax, morphology, fluency, and intelligibility; Blake, 2018; Tompkins, 1995). This impaired ability to exchange information can contribute to the pragmatic communication impairment associated with RHD (Blake, 2017; Bloom & Obler, 1998; Champagne et al., 2005; Gardner & Denes, 1973; Grice, 1975; Joannette & Brownell, 1990; Martin & McDonald, 2003; Prutting, 1982). Specifically, communication may lack the nuances found in neurologically healthy adults with respect to turn-taking (Kennedy et al., 1994), topic

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management (Brady et al., 2003; Kennedy, 2000; Gardner et al., 1983; Mackenzie & Brady, 2008; Mentis & Prutting, 1991; Myers, 1999), affective prosody (Weintraub et al., 1981), and nonliteral language use (Brownell et al., 1986; Eisenson, 1962; Van Lancker & Kempler, 1987). Difficulties may also arise when determining figurative meanings of words (Winner & Gardner, 1977), adhering to the social rules of conversation (Kennedy, 2000), and using contextually appropriate language for the communicative purpose, the listener, and the situation (Tompkins, 2012).

Implicit and Explicit Information Gathering

One aspect of information exchange is the ability to gather information. Information can be gathered either explicitly or implicitly. In this study, we define explicit processes as those that require an overt request for input from another, whereas implicit information gathering processes make no such requests. Implicit processes for gathering information involve the interpretation and use of facial expressions, gestures, actions, and intonation (Hird & Kirshner, 2003; Mackenzie et al., 1999). RHD can impede the ability to gather information implicitly (Brownell et al., 1986; Myers, 1994, 1999) through gestures and facial expressions. For example, adults with RHD may fail to terminate a conversation with a person who looks at their watch periodically, although the action can be implied to mean “it’s time for me to go.” An inability to gather information from nonverbal pragmatic actions like this can affect one’s perceived appropriateness as a communicator and thus affect social-communicative relationships.

Explicit processes for gathering information chiefly involve the use of questions. Asking questions contributes to positive social perceptions and facilitates activities of daily living (Chafe, 1972), such as sustaining a conversation (Kearsley, 1976) and learning (Flammer, 1981; Ram, 1991). Information-gathering questions can clarify details, elicit new and missing information, and confirm old information (Boyd & Heritage, 2006; Freed, 1994; Stivers, 2010). Questions can be used to explicitly gather information that may not be inferred or retrieved through implicit avenues of information gathering, such as shared knowledge (Flammer, 1981), facial expressions, or prosodic cues. Although there are several studies documenting deficits in implicit information gathering in adults with RHD, there is only one study examining question use, and that study (Kennedy et al., 1994) did not analyze the specific types and functions of questions, the demands they place on cognitive resources, or their effectiveness. The current study seeks to explore this issue.

Question Types

Three types of questions (see Table 1) that can be used to gather information are content questions, polar questions, and alternative questions (Stenstrom, 1984; Weber, 1993). Content questions may contain the words “what,” “when,” “who,” “where,” “why,” or “how” depending on the type of information sought. Polar questions are yes/no

questions that may include tags (e.g., “So this is used in the home, right?”). Alternative questions contain wording that restricts the possible responses by proposing a closed set of answers within the question structure with traditional forms of (a) “A or B” (e.g., “Do I use this in the kitchen or outside?”) and (b) “A or not A” (e.g., “Is this a utensil or not?”). This second type of alternative question is described as a combination of polar and content questions.

The use of each type of question depends on the communicative context. For example, in a situation where a receptionist has stated a date and time for a follow-up appointment and the individual has heard and comprehended the message, the decision to use a polar (yes/no) question for confirmation (e.g., “Did you say Tuesday at 9 a.m.?”) is better suited to the communicative situation than is a content question (e.g., “When is my appointment?”). In this instance, the use of a polar question suggests that the speaker strongly believes the day and time are as stated, while the use of a content question suggests that the speaker has minimal knowledge about the day and time for the appointment (see Heritage, 2008, 2010). The polar question, then, serves to seek confirmation of a hypothesis (Bolinger, 1978), namely, that the day is Tuesday and the time is 9 a.m. In a more structured task, where participants ask questions to determine the purpose of an object, for example, one might expect more use of “why” content questions (e.g., “Why does it have three different colors?”) and polar questions (e.g., “Do you use this in the kitchen?”) to constrain the possible options. Both the decision to pose a question (i.e., to clarify the date/time of an appointment) and the question type are influenced by the nature and availability of the knowledge being desired (Kearsley, 1976).

Polar questions are used more frequently than content and alternative questions by neurologically healthy English-speaking adults in conversational contexts (Stivers, 2010). Studies examining strategic question use in aging adults and adults with frontal lobe damage have focused on the use of polar questions (Denny & Denny, 1973; Klouda & Cooper, 1990; Marshall et al., 2003; Upton & Thompson, 1999). In these studies, participants are either presented with a pictorial array of common objects or provided with a verbal prompt in the absence of pictures (e.g., “I am thinking of an animal”) and are then tasked with identifying a target object by using questions. Success in this task depends on thinking strategically about how to identify the target. Polar questions facilitate successful identification of an object by allowing the elimination of groups of objects based on categories. Findings show a reduction in the use of polar questions that eliminated one or more categories (e.g., “Is it a living thing?”) for both aging adults and adults with frontal lobe damage.

Conceptual Framework for Question-Asking After RHD

Failure to use questions to request information is a recognized deficit in the conversational behavior of adults

Table 1. Question types and examples.

Semantic structure	Examples
Content	
What	<i>What are the dimensions?</i>
When	<i>When was it made?</i>
Who	<i>Who would it help?</i>
Where	<i>Where is it used?</i>
Why	<i>Why is it red?</i>
How many/much	<i>How much does it cost?</i>
Polar	<i>Is this a new type of grill?</i>
Alternative	<i>Would this be something used by adults or children?</i>

with RHD (Kennedy et al., 1994). Kennedy et al. (1994) engaged 12 adults with RHD in a first-encounter conversation with explicit instructions to get to know the other person. These conversations between an adult with RHD and an unfamiliar student were video-recorded, transcribed, and coded to describe each turn of talk. Findings showed that participants with RHD demonstrated a greater number of turns of talk, reduced topic switching, a greater number of comments that stated facts or opinion, and fewer questions than healthy controls (Kennedy et al., 1994). This contrasts with the expectation that questions will be asked to achieve the conversational purpose of getting to know the other person. No specific analysis of question types was reported.

To better understand the cognitive demands imposed by question formulation, we need to consider its position within the larger domain of discourse production. Discourse production involves computations from multiple sources of information on multiple levels (Frederiksen et al., 1990; Sherratt, 2007; Sherratt & Bryan, 2012). According to models such as those of Levelt (1989), a conceptual representation leads to sentence generation with cognitive–linguistic processes of information selection, memory, and pragmatic judgment, driving the selection of information that is topic/task sensitive. Within this framework, effective use of questions to gather information requires a host of cognitive capabilities including recognizing the need for information (Taylor, 1962) and an ability to attend, interpret, and organize new information while recalling information from the past (Kearsley, 1976). Question-asking, then, is triggered when there is just enough information to warrant formulating a question but not too much as to negate the need to ask (Miyake & Norman, 1979). Thus, the recognition of an information need is followed by determining the best method for obtaining the information (Flammer et al., 1981).

To the degree that neural damage in RHD impacts cognitive processing, the burden placed by these cognitive demands could lead to an overall reduction in question-asking after RHD. Furthermore, these burdens or limitations can shape the specific type of the questions posed by adults with RHD (Flammer, 1981). For example, polar questions require the generation of a hypothesis that limits the response to two possibilities. The integration of multiple sources of pragmatic information is required to arrive at a

question that is specific to the communicative context and goals. By contrast, content questions arguably do not systematically require the same hypothesis-driving restriction.

Suppose, for example, that a young girl is sitting on a curb, holding her knee, and crying. As you walk toward her, you see a piece of wood with an exposed nail. Pragmatically, the decision to ask a question is based on one's ability to link crying to an injury, to observe where the girl is located, and to be aware of what seems to be obvious world knowledge that an injury can occur from an exposed nail in a piece of wood. The interpretation and integration of nonverbal information, world knowledge, and situational context is the basis of inferencing to produce a question. Two questions that might be asked given the situational context, world knowledge, and nonverbal pragmatic information available are (a) "Did you fall on the nail?" or (b) "What happened?". While both are felicitous, the integration of pragmatic information should result in the asking of Question (a) rather than (b). If, however, integration of information and inferences about the situation are incomplete or insufficient, Question (b) may be the resulting question. Given the cognitive skills required for question-asking and cognitive–communication impairments associated with RHD (inference generation, attention, etc.), it stands to reason that adults with RHD may display differences in question-asking when compared to participants without RHD. In this exploratory study, we will quantify these potential differences by comparing question types employed during the Unfamiliar Object Task (see Procedure section), a structured task with a defined purpose and an explicit request to ask questions. The use of a structured task is a means of eliciting comparable quantities of questions from both groups of participants. While this choice reduces the burden of the pragmatic integration of situational context and nonverbal cues inherent in naturalistic discourse, the use of unfamiliar objects still requires participants to integrate world knowledge in order to generate questions about the use of each object.

Questions are an essential aspect of pragmatic language use (Dogett et al., 2013) that is easily quantified. Although the role of pragmatic deficits in RHD has been widely recognized (Brownell et al., 1990; Gardner et al., 1983; Hewetson et al., 2017; Hough, 1990; Myers, 1994; Parola et al., 2016; Tompkins, 1995), there has been little research examining the role of question use in the overall

profile of pragmatic deficits. The purpose of this study was to explore the production of questions during a structured task to test the hypothesis that adults with RHD differ from neurologically healthy adults in the use of different question types. Specifically, we examine the following question: Do adults with RHD use questions differently from neurologically healthy adults, based on question type? That is, do these groups use content questions, polar questions, and alternative questions with different frequencies when performing a structured task designed to elicit questions? We hypothesize that the use of a structured task will facilitate question production and that, despite the use of a pragmatically simplified task, the frequency of question types will differ across groups. Specifically, we predict that adults with RHD will be less adept at producing polar questions. We propose that challenges with polar questions may arise because of the need for participants to integrate deeper real-world knowledge to generate hypotheses for polar question formulation.

Materials and Method

Participants

The study sample included 29 adults who sustained a single right-hemisphere stroke (as evidenced by a radiology report or self-report) and 21 neurologically healthy controls (NHCs) from RHDBank. RHDBank is a shared database of multimedia interactions for the study of communication in people with RHD. The database includes a growing corpus of discourse samples elicited using the RHDBank Discourse Protocol (Minga et al., 2016). Links to the language samples used in the current study are available at the RHD website (<https://rhd.talkbank.org/access/English/NonProtocol/Minga.html>).¹ All participants spoke English as their primary language, had at least a high school diploma, and had functional hearing and vision. NHC participants had no history of stroke, psychiatric impairment, or neurological impairment. The institutional review boards of North Carolina Central University and Nazareth College approved this study.

Procedure

Questions were elicited using the Unfamiliar Object Task (Minga et al., 2016). This task was developed to elicit a variety of question types. Participants were asked to view images of objects that had an everyday purpose. All objects were validated as unfamiliar using a separate rating study (see Stimulus Selection for Unfamiliar Object Task section; Minga, 2014). After viewing each object, participants were asked to generate questions to determine the purpose of each object. Instructions were “Now I’d like you to participate in a task of gathering information. For this task I’d like you to look at different objects. Ask me at least three

questions that would help you figure out about the purpose of the object. I won’t actually answer your questions, but I’m interested in hearing at least three questions you would ask to find out what the object is for. Here is the first object.” If participants did not respond in 10 s or had a puzzled expression, they were given the following prompt: “What are three questions you could ask to figure out what this object is for?”

The Unfamiliar Object Task was video-recorded in the home of the participant or in a Speech and Hearing Clinic either at North Carolina Central University or Nazareth College. The first three questions were transcribed using the Codes for the Human Analysis of Transcripts format, which allows for automated coding and analysis of the transcript using the Computerized Language Analysis programs (MacWhinney, 2000).






Coding System

Cross-linguistic studies of question-asking have made use of the question–response coding scheme developed by Stivers and Enfield (2010). The coding scheme is divided into 24 dimensions for characterizing questions and responses to questions during social interaction. Criteria are provided for what constitutes a question–response sequence. Dimensions 1–4 address the formal dimensions of question type and lexical, morphological, and syntactic marking. The type of each question is characterized as polar, content, or alternative. Specific features of polar questions are coded in Dimensions 5–8. The type of content question and the social action of content questions are coded in Dimensions 9–12. Speaker selection and response dimensions are coded in Dimensions 13–24.

The current study used Dimensions 3, 6, and 9 of Stivers and Enfield’s (2010) Question–Response Coding Scheme, as these provide the most relevant information for the research task and research questions. Dimension 3 coded each question as polar, alternative, or content. Dimension 6 further coded polar questions as either positive (e.g., “Is that a handle?”) or negative (e.g., “Isn’t that a handle?”). Dimension 9 coded content questions as involving “what,” “how,” “who,” “when,” “where,” and “why.” Coding was based on semantic criteria regarding the type of information elicited by the question, not necessarily the actual question word used. For example, the question “What profession would use it most often?” was categorized as a “who” question. Three trained graduate clinicians in speech-language pathology and the first author (J. M.) independently coded each question. Interrater reliability for coding was calculated by dividing the total agreements by the sum of agreements and disagreements and then multiplying by 100. Reliability was 97.5%. For additional qualitative analysis, one trained graduate clinician, a certified speech-language pathologist, and the first author (J. M.) independently coded “what” questions based on the type of information that could be elicited by the question based on known information about the objects. Specifically, we asked ourselves whether the question

¹RHDBank membership is required for access to password-protected participant data. To become a member, see the instructions at the top of the RHDBank webpage (<https://rhd.talkbank.org/>).

Table 3. Unfamiliar objects and average ratings of familiarity by survey respondents.

	Object 1	Object 2	Object 2	Object 4	Object 5
					
Mean (SD) rating	1.76 (1.03)	1.29 (1.06)	1.67	1.3	1.76 (1.19)
Object purpose	Add moisture to room air	Mount iPad or iPhone	Organize computer cables	Provide cushion while kneeling in the garden	Slice bananas

Note. Order of administration is as pictured left to right.

was significantly different between groups was the content type “what,” which was used more frequently and extensively by the RHD group.

Content Questions

Use of content questions to gather contextual information is fundamentally related to the information sought and the knowledge available (Flammer, 1981; Kearsley, 1976). Both groups used a variety of content questions, although adults with RHD used the “what” content question more frequently than any other form. Of the content questions used, “who,” “where,” and “when” questions were used less frequently by both groups than “what” and “why.” In comparing the information that could be elicited from the different “what” questions, most of the adults with RHD used “what” questions to focus on details of the object, while most of the adults in the NHC group used “what” questions to focus on the purpose. The “what” questions that focused on details rather than purpose addressed physical attributes of the objects: “What are the dimensions?”, “What other color styles does this come in?”, and “What material is this made of?” Focusing on minute

details rather than the larger picture is not uncommon after RHD (Blake, 2018). Adults in the NHC group appeared to use “what” questions differently such as “What is it?” and “What do you use it for?” Only one NHC group member asked “what” questions that related to physical properties. Misplaced focus on details, specifically physical attributes, yields information that is not productive for the task, which is to find out the purpose of the object.

Polar Questions

As hypothesized, adults with RHD demonstrated reduced polar question use. In normal conversation, there is a distributional bias toward the use of polar questions, such that polar questions have been reported to occur 70% of the time in conversations of neurologically healthy adults (Stivers, 2010). As such, polar questions are used strategically during tasks of gathering information and are the most frequently used form of question in dyadic communication. Even though this was not a conversation task, the NHC group in this study was consistent with this pattern, with 82% of their questions qualifying as polar questions. In contrast, adults with RHD used polar questions only 53% of the time.

As discussed above, polar questions necessitate that a speaker constrain the content of the question such that a direct response is a choice between two possible answers. In conversation, polar questions are used for making requests (e.g., “Can you lift that for me?”), rhetorical contributions (e.g., “Could I possibly love you more?”), invitations (e.g., “Do you want a drink?”), conversation starters (e.g., “Did you hear about the accident on the news?”), and drawing inferences (e.g., “Is it something that you use in a garden?”). In our study task, it is the inference-drawing polar questions that are infrequently produced by adults with RHD. Examples of polar questions from participants with RHD include “Is one pink for girls?”, “Is this a new type of grill?”, and “Is it made of plastic?” In contrast, the NHC group asked polar questions such as “Is it a seat or something that you sit on?”, “Is it used in the garden”, and “Can you use it for automechanics?” Positive polar questions comprised most of the sample with only a few being negative (e.g., “Does it not open?”). The significant

Table 4. Sociodemographic characteristics by group.

	RHD (n = 29)	NHC (n = 21)
Age, M (SD)*	52.86 (12)	49.19 (9)
Sex, n (%)		
Female	13 (48%)	21 (81%)
Male	17 (57%)	5 (19%)
Education, n (%)		
High school	1 (3%)	2 (7%)
Undergraduate	21 (72%)	12 (46%)
Graduate	8 (27%)	12 (46%)
Race, n (%)		
Black	6 (20%)	7 (27%)
White	23 (77%)	19 (73%)
Other	1 (3%)	0 (0%)
Years post stroke, M (SD)	4.84 (3.2)	n/a

Note. RHD = right-hemisphere brain damage; NHC = neurologically healthy control; n/a = not applicable.

* $p < .05$.

Table 5. Average number of questions for each question type by group.

Question type	All (N = 50), M (SD)	RHD (n = 29), M (SD)	NHC (n = 21), M (SD)	t (df)	p value
Total	15.5 (2.54)	15.97 (2.57)	14.86 (2.41)	-1.54 (48)	.13
Alternative	1.2 (1.62)	1.55 (1.78)	0.71 (1.23)	-1.85 (48)	.07
Alternative	0.54 (1.05)	0.69 (1.11)	0.33 (0.97)	-1.18 (48)	.24
Incomplete	0.68 (1.42)	0.86 (1.68)	0.43 (0.93)	-1.16 (45)	.25
Content***	4.26 (4.62)	5.9 (4.59)	2 (3.66)	-3.22 (48)	.002
Who	0.3 (1.21)	0.48 (1.57)	0.05 (0.22)	-1.47 (29)	.152
What***	2.2 (2.47)	3.31 (2.54)	0.67 (1.28)	-4.83 (44)	.00002
Where	0.3 (0.91)	0.34 (0.77)	0.24 (1.09)	0.41 (48)	.69
When	0.02 (0.14)	0.03 (0.19)	0 (0)	-1.0 (28)	.33
Why	0.68 (1.62)	0.97 (1.78)	0.29 (1.31)	-1.48 (48)	.15
How	0.7 (1.34)	0.76 (1.21)	0.62 (1.53)	-0.36 (48)	.72
Polar***	10.08 (4.16)	8.52 (4.2)	12.24 (3.06)	3.45 (48)	.001
Positive***	10 (4.2)	8.45 (4.27)	12.14 (3.05)	3.57 (48)	.0008
Negative	0.08 (0.34)	0.07 (0.37)	0.1 (0.3)	0.28 (47)	.78

Note. RHD = right-hemisphere brain damage; NHC = neurologically healthy control.

*** $p < .005$.

Figure 1. Distribution of question type by group. There is a significant difference in the “Polar” and “Content” question types between the neurologically healthy control (NHC) and right-hemisphere brain damage (RHD) groups. While outliers are present as indicated on each graph, the significant difference remains even if the outliers are removed.

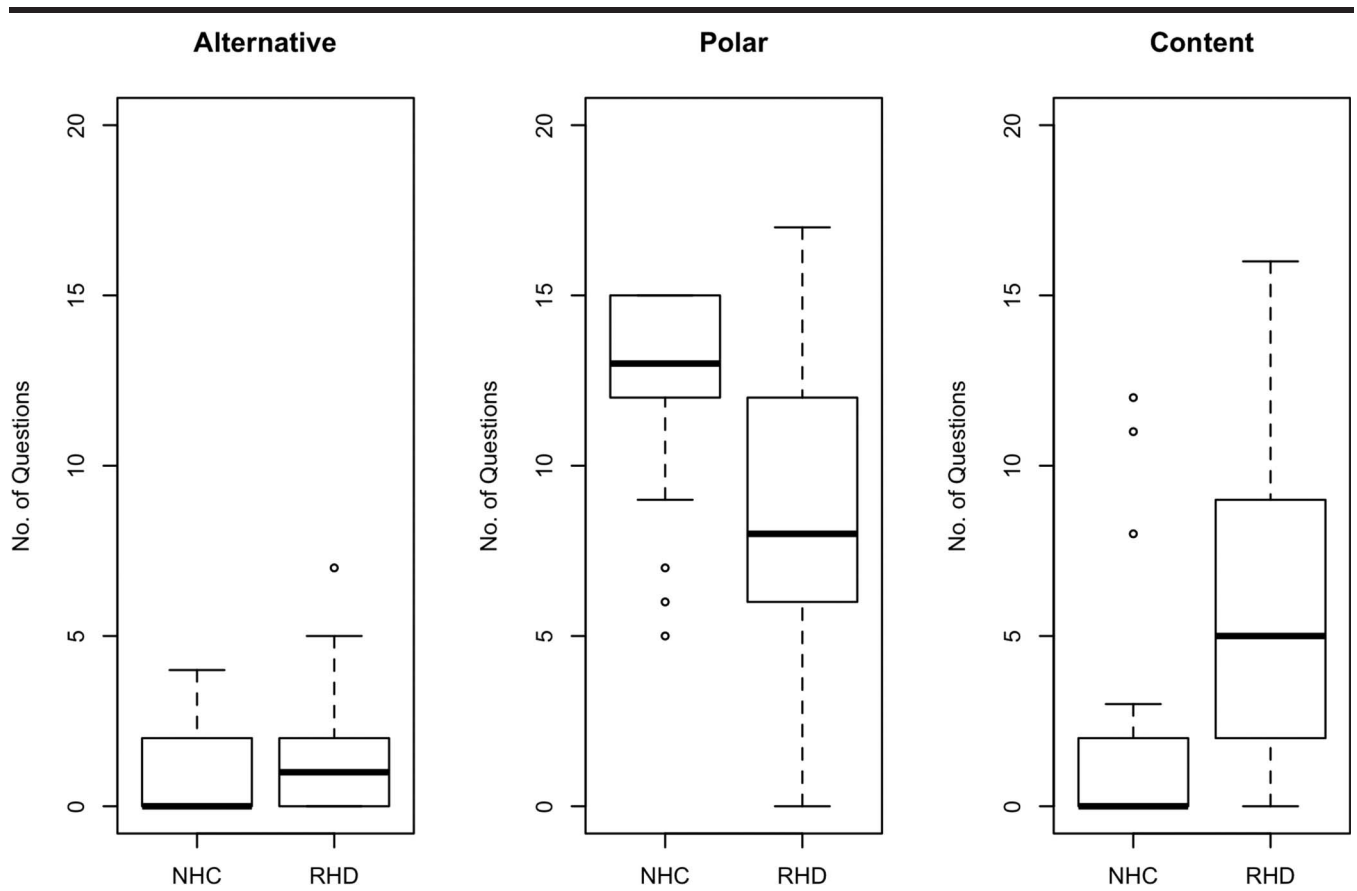
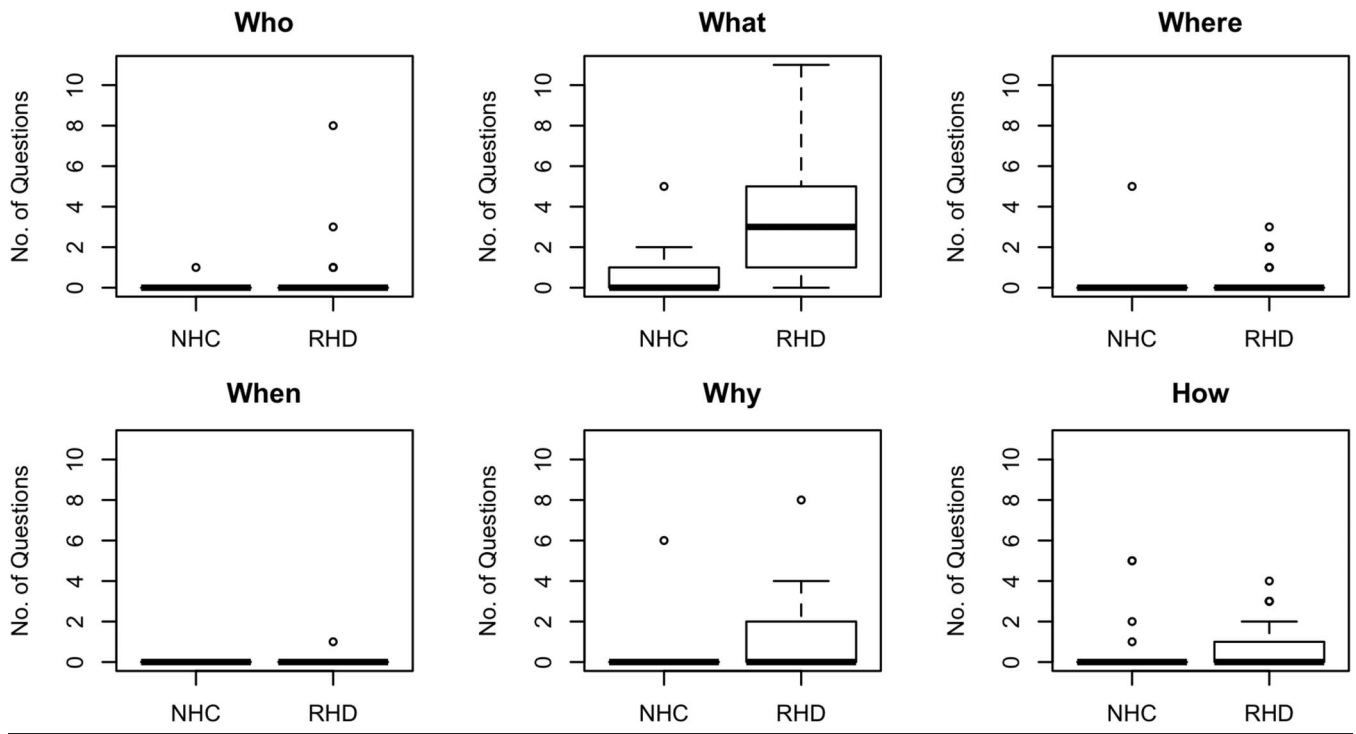


Figure 2. Distribution of content questions by subtype for each group. There is a significant difference in the “what” questions. NHC = neurologically healthy control; RHD = right-hemisphere brain damage.



difference between the groups in the frequency of polar question in particular may relate to the overall differences observed in question use during conversation (Kennedy et al., 1994). That is, reduced use of questions during conversation may reflect specific challenges with polar question use, since polar questions are used most frequently during conversation (Enfield et al., 2010).

Clinical Implications

The differences identified in this study indicate the potential of question use as a diagnostic indicator of pragmatic language use impairments in RHD and also as a potential target for intervention. Specifically, treatment that is focused on improving polar question use may positively

impact the perceived communicative competence and pragmatic capabilities of adults with RHD. In other populations with pragmatic disorders, such as autism spectrum disorder, intervention studies have sought to increase question use for gathering information to improve conversational interaction. In these studies, question use increased and generalized to nonexperimental communicative environments and conversations with maintenance of the skills (Doggett et al., 2013; Palmén et al., 2008). Thus, there is precedence for treatment focusing on question use. The findings of the current study also emphasize the distinction between productivity of language use and function. Adults with RHD are linguistically fluent (Brady et al., 2003; Sherratt & Bryan, 2012), but the language produced may be functionally deficient.

Table 6. Type of information elicited by what questions by group.

Group	Proportion of group	Total questions	Type of information elicited		
			Purpose	Features	Other
RHD	24/29	93	49	43	3
NHC	3/21	7	3	4	0
	Examples		<i>What is this for?</i> <i>What does it do?</i> <i>What is it?</i> <i>What is the object?</i>	<i>What kind of material is this?</i> <i>What's this made of?</i> <i>What kind of design is this?</i> <i>What other colors does it come in?</i>	<i>What is this telling me?</i> <i>What is this saying to me?</i>

Note. “What” questions were produced disproportionately more in the RHD group than the NHC group. RHD = right-hemisphere brain damage; NHC = neurologically healthy control.

Future investigations will examine question use in a larger cohort of adults with RHD in both structured and unstructured tasks. By sampling a wider variety of tasks, contexts, and stimuli, we can gain a deeper understanding of the underlying cognitive processes needed to formulate specific types of questions and the way or ways that these may modulate the pragmatic skills of patients with RHD. In the absence of an agreed-upon measure for overall pragmatic aspects of language use in RHD, a tool to assess question-asking is likely to provide relevant and useful information and enhance our understanding of pragmatic abilities after RHD.

Limitations

Although the current study has a small sample size, we were nevertheless able to identify statistically significant differences in question use, an important aspect of pragmatic language use. Increasing the sample size may permit further differentiation of group differences in question use. The use of a structured task to elicit a pragmatic aspect of communication may be considered a limitation because the patterns of questioning in a structured task may differ from those that occur during unstructured dyadic communication. However, the use of a structured task allows for better experimental and stimulus control, and it is noteworthy that, even with the pragmatically simplified structured question task, participants with RHD showed a striking difference with respect to the percentage of both content and polar questions when compared to non-RHD participants. As with all controlled studies such as this one, a fuller understanding of information-gathering abilities in adults with RHD will require the integration of data from both additional experimental work and observational tasks.

Conclusion

Question-asking is an important aspect of communication that may provide insights into pragmatic language impairments after RHD. The results of this study showed that, while adults with RHD and the NHCs can produce questions when explicitly asked, the RHD group displayed a markedly different distribution of question types during a structured task. Observational studies report a reduced overall quantity of questions for adults with RHD. The structured task used in the current study revealed important differences in the types of questions used, rather than the overall quantity. These two sets of findings are complementary, indicating variations in question use that depend on the nature of the task. Future studies need to replicate these findings and expand on the study tasks and measures. The results of this study also suggest that future observational studies should carefully examine the relative distribution of question types, in addition to comparing the overall quantity of questions used by participants with RHD and NHCs. Finally, more information is needed to understand the influence of cognitive processes on question use and to explore the potential clinical utility of questions as

diagnostic indicators of impairments in pragmatic language use.

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