

A Functional Taxonomy of Discourse Moves for Conversation Management During Cognitive Clinical Interviews about Scientific Phenomena

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Abstract

Within cognitive science, clinical interviews have long been used as an instrument for studying cognitive development and conceptual reasoning in part because of their flexibility and improvisational nature. Yet, at the same time, those qualities invite the criticisms that the questioning and responses of an interviewer change the very cognition this tool is designed to study. We believe that is a valid concern, and suggest that analysis of clinical interviews must take into account that they are a form of conversational *interaction*. With that goal in mind, we identify and present nine conversational moves made in a corpus of 150 clinical interviews with middle school students on various science topics. These moves, we argue, function not only to produce rich data, but also to help in navigating some fundamental challenges inherent in clinical interviews. Identifying these moves represents an important first step for a cognitive and developmental research program that can better articulate how and when conceptual knowledge is expressed in these dynamic and often improvised interactions.

Keywords: clinical interviews; discourse analysis; science cognition

Introduction

Within the Cognitive Science community, there are numerous methods available for studying the development and decline of cognitive function ranging from paper and pencil tests and think-aloud protocols, to reaction time studies and neural imaging. One method in particular has been powerful and influential for cognitive science research that focuses on the development of conceptual understanding: the cognitive clinical interview.

Since this method's introduction into cognitive research by Jean Piaget's classic studies of young children's knowledge and understanding of the natural world (e.g., Piaget, 1927), researchers have employed clinical interviews as an instrument for probing children's conceptual development and understanding. Data from these interviews have been used as evidence of children's intuitive knowledge - they give researchers insight into the "complexities and dynamics of the child's mind" (Ginsburg, 1997).

How does the clinical interview unfold so as to allow such intimate access to the child's knowledge? An interview typically involves a researcher sitting down with an interviewee, establishing a comfortable and friendly conversational space, and then asking the child to complete a particular task or answer questions about a phenomenon of interest. During this time, the interviewer encourages the

child to discuss his thinking by questioning him about his task solution or explanation. Different props may be used, and the interviewee may be asked to do things as varied as drawing pictures, sculpting objects, sorting items into groups, and doing a pencil and paper computation.

The clinical interview, then, is semi-structured, in that while there may be a standard protocol, improvisation is also required on the part of the interviewer as she attempts to make sense of the child's thinking. The interviewer is always playing a 'guessing game' to infer how an interviewee is reasoning, and is in the moment carefully crafting immediate follow-up prompts. She must be sensitive to and maintain flexibility towards a range of possible interviewee responses. Some of the richest clinical interview data that captures the nuance of a child's thinking is the product of this kind of improvisation.

The improvisational quality that makes cognitive clinical interviews so powerful has also invited criticism. It has been suggested that the moves made by the interviewer significantly determine the way the conversation unfolds, thus rendering any data about the interviewee's cognition to be biased by how he interacted with the interviewer. As such, it is claimed that clinical interviews are not sufficiently standardized or rigorous to be considered a valid research instrument for studying children's cognition (see diSessa, 2007 for a discussion of this issue).

Concerns of this sort must be taken seriously. Cognitive clinical interviews, by their very nature, are not neutral instruments. Interviewers do improvise, and their questions and prompts inevitably have an influence on what happens during the conversation. However, we do not believe that this property makes clinical interviews flawed.

We suggest instead that we simply need to take the influential nature of the interviewer's discourse into account when considering clinical interview data. Given that clinical interviews are *interactions* in which what is said by the interviewee is influenced by what is said by the interviewer, it is important to make what is said by the interviewer an object of study in its own right. We need to know what discourse moves interviewers make and what role they play in the child's unfolding cognition.

We see this work as addressing largely the first point - what moves do interviewers make - with some preliminary speculations about the second - their role in emerging cognition. Unlike other work that examines mostly what a child says in an attempt to understand his cognition, here we look closely at what the interviewer says in an attempt to understand how the interaction plays out. We analyze the

clinical interview itself, studying the sequence of turns of talk that make it up.

In this paper, we first describe several challenges the interviewer faces that may motivate (either explicitly or implicitly) his interaction choices. We then identify several different types of interviewer moves we have observed in our own clinical interviews that we believe have an impact on how the interviewee is reasoning in the moment. Our approach in this early work is mainly phenomenological: we describe what happens in clinical interview interactions and make only tentative speculations about the roles those interactions play in the dynamics of cognition.

Fundamental challenges in managing clinical interview conversations

There is extensive literature on the methods and theoretical perspectives associated with analyzing talk (e.g., Clark & Schaefer, 1989). However, much of that work takes a generalized approach by attempting to identify principles and patterns from communication in everyday, casual settings, with the presumption that such samples capture the fundamental or “primordial” form of talk-in-interaction (Goodwin & Heritage, 1990; Sacks, Schegloff, & Jefferson, 1974; Schegloff, 1999). For our proposed program to succeed, we believe it is necessary to account for some of the unusual conditions or features of the interview interaction. There has been some work that has concentrated specifically on these kinds of interactions, such as those studies of interviews conducted by television news anchors (Clayman, 1988), or transactions between doctors and patients (Tannen & Wallat, 1987; West, 1988), though much of this work centers on syntactic features, like turn-taking organization. We distinguish our program in that, while we acknowledge that an accounting of syntactic features has significant value, we are also equally concerned about the *function* of particular turns as they relate to the research goals that specific discourse moves serve.

For cognitive clinical interviews, we have reason to suspect that these functions will exhibit some uniqueness because of fundamental differences to other kinds of conversational interactions or even other forms of interview. These include, but are not limited to, the conversational goals of each participant, the perceived roles of the participants, and the expectations of background knowledge possessed by each individual. For example, in cognitive clinical interviews, an interviewee often expects that the interviewer already knows the normative answer but is choosing not to reveal it; yet rather than allow this premise to impede communication, the successful interviewer works to instead pose questions and responses such that the interaction will emulate a kind of mutually collaborative inquiry (diSessa, 2007). Ultimately, however, this interaction is an experimental endeavor, and maneuvering it such that data that is rich enough for study of underlying cognition presents three major challenges.

Eliciting elaborated interviewee contributions. Clinical interviews typically involve questions and tasks that are new

and challenging for students, but not totally unfamiliar. The interviewer must create and maintain a comfortable conversational environment where the interviewee feels able to approach a given task, considers the task sensible, and is encouraged to continuously vocalize his online thinking. In order for an interview to yield the kind of rich data that is useful for making claims about cognition, the interviewee needs to be an active participant in the conversation. The interviewer must get the interviewee to start talking and also get him to ‘keep talking’ about his ideas.

Maintaining topical focus. Not only do interviewers need to keep students talking, but with interviews about scientific phenomena in particular, they also need to keep students talking *about the right kind of thing*. Cognition about scientific phenomena, particularly with novices, draws on a large pool of unstructured commonsense prior knowledge. Because of that, interviews with students or novices always run the risk of topical digression or cuing of unexpected modes of reasoning. The interviewer must not only keep the interviewee talking, but also constantly check that the interview is covering the conceptual territory under investigation.

Rapid online diagnosis of interviewee’s thinking. An interviewer must work quickly to infer the intended meaning of an interviewee’s comment. She must decide what the interviewee is trying to convey and take steps to confirm that assumption. If she infers incorrectly, she may derail the interview and be forced to begin a new line of questioning.

We imagine that navigating these challenges in the moment of the interview impacts, at least in a tacit way, the particular discourse moves the interviewer uses. As such, a framing question for this paper is: What discourse moves do interviewers use to negotiate and manage these challenges?

Interviewer discourse moves

Our analysis draws on data from a set of clinical interviews we designed to study students’ thinking about science before and after classroom science instruction. We collected interviews with middle school students (grades 6-8) on topics including the causes of the seasons, the nature and behavior of light, the human body’s intake and expenditure of energy, and chemical reactions. In total, thirteen different interviewers were involved in conducting and collecting video recordings of 150 interviews, each lasting approximately 40 minutes in duration. Although these interviews were not collected for the purpose of studying interviewer discourse, we nonetheless found them to be a rich source of the interviewer moves we wished to examine.

Below, we present descriptions and examples of some of the most prominent interviewer moves from our data corpus. Our goal with these descriptions is to introduce a vocabulary for describing interviewers’ discourse moves. Here, we focus on the interviewer’s *improvisational* moves. In all cases, our interviewers began with a primary list of questions and follow-up prompts. What we wanted to

capture was the improvisation that the interviewer did around this core protocol in order to better draw out or even challenge answers given by an interviewee. The examples we present come from a range of content areas and were selected for their clarity in exemplifying each move.

Insertion of new information

After posing the initial task or phenomenon to the interviewee, interviewers may later provide the interviewee with new information that has not yet been discussed or highlighted in the conversation. This move may have several functions. There are often times when an interviewee may stop and hesitate, declining to answer an especially challenging prompt. In response, an interviewer may improvise and provide additional, more familiar information as a hint to the student. At other times, the interviewer may introduce new information to test the robustness of a student's explanation by offering a gentle challenge.

We present an example of the latter type. Angela¹ has just been asked to explain the seasons. In response, Angela answers incorrectly, saying that the seasons are caused by the changing proximity of the Earth to the Sun.

A: See, that's what winter would be like, the Earth orbits around the sun (she motions over the oval shaped orbit she has drawn). Like summer is the closest to the sun. Spring is kind of a little further away, and then like Fall is further away then spring but not as far as winter, and then winter is the furthest.

The interviewer follows up on Angela's response by introducing new information that functioned as a challenge: Australia experiences a different season from the one experienced in North America at the same time. From Angela's demeanor, and the responses that follow, it became clear she saw that this new information posed a grave difficulty for her initial response:

I: mm hmm, okay. So that makes a lot of sense. **One thing I wanted to ask you though about was, one thing that you might have heard is that at the same time, and you can tell me if you've heard this, when it's summer here, it's actually winter in Australia.** Have you heard that before?

A: Mm hmm.

I: So I was wondering if your picture the way you drew it can explain that or if that's a problem for your picture.

A: Umm, I need another picture.

In this example, the interviewer's insertion of new information served to encourage Angela to reconsider her initial response, which provided the interviewer with more information about her thinking. In particular, it allowed him to assess the knowledge she has drawn on in constructing that explanation as well as the stability of her explanation.

¹ All students' names are pseudonyms.

Selective Restatements

Another common interview move is to revisit previously discussed ideas by restating what the interviewee has recently said. Sometimes these restatements are verbatim repeats of the students' actual words, sometimes they are only partial restatements, and sometimes they are complete rephrasings delivered as a question or declarative statement by the interviewer. These variations in form (i.e., how close the restatement is to the exact content of the student's utterance) appear to affect the impact they have on the subsequent conversational turns. Below we outline several kinds of restatements, beginning with those that are most verbatim and moving towards the more interpretive.

Closing repeat. In these restatements, the interviewer repeats the last several words of a student's utterance verbatim. If the student's statement was sufficiently short, the interviewer may repeat it in entirety.

We suspect that these kinds of repeats convey to the student that the interviewer understood the student's comment and that the comment is in the appropriate conceptual territory for the discussion. Clark and Schaefer (1989) similarly describe these kinds of moves in everyday conversations as providing evidence of understanding that accept the previous speaker's contribution and indicate that the speaker should continue. Doing so in moderation may encourage the student continue describing his thinking because he knows the interviewer is listening, paying attention, and following his thinking.

Definitional clarification. Domains such as science often have an extensive technical vocabulary where terms have specific meanings that differ from their everyday use. When a student uses such a word, it is often necessary for an interviewer to question him about the meaning he ascribes to term.

Thus far, we observed two forms of requests by the interviewer for definitional clarification. One is simply to restate the word, and rely on a mutual understanding that the word has a special status and requires clarification. In the other approach, the interviewer explicitly asks for clarification by embedding exactly what the student said in a query about their meaning.

In the example below, Emmett uses what is possibly technical vocabulary to explain why vinegar and baking soda bubble when mixed. In response, the interviewer probes Emmett's language choice.

E: Um, two, two different chemicals mix and they um, when they interact with each other it's a negative reaction. So um, (Emmett chuckles) that's what happens.

I: That's what happens. **What do you mean it's a negative reaction? Tell me what's that means.**

E: Um, it means that it um, they don't um, the chemicals don't adapt to each other. Not adapt but like uh, (Emmett chuckles) I don't wanna say they don't like each other but...

Emmett's use of the term "negative reaction" could be either technical or intuitive; he may be using short-hand to describe a complex molecular phenomenon or he may be invoking a more everyday sense of negativity. The interviewer's move here is an attempt to tease apart those two possibilities – it contributes to his attempt to diagnose Emmett's thinking.

Though helpful for the interviewer's diagnosis, overuse of this move may undermine efforts to keep the student talking in the right conceptual territory. Focusing too much on definitional clarification may implicitly communicate to the student that the interview is about using appropriate vocabulary rather than about clearly expressing one's own thinking.

Select and Zoom. Another type of selective restatement occurs when the interviewer selects one aspect of a student's multifaceted explanation and asks the student (either implicitly or explicitly) to explain that part more fully. Unlike a definitional clarification, it is not the student's terminology that is in question but rather the actual substance of one of his many ideas.

For example, a student Gavin is posed a general question at the start of his interview. After his response to that prompt, the interviewer selects one part of what Gavin says and 'zooms' in on it.

I: I want to give you this hypothetical situation first. Let's say this kid your age is trying to stay healthy. Can you say the types of things he should do in his everyday life to stay healthy?

G: Yeah, okay. Well, he could exercise, eat right. Like, I guess that's about it. Not take a lot of risks I guess.

I: Okay. **What sort of things would he eat to be eating right?**

G: Well he would eat not a lot of packaged food, like frozen food and stuff.

V: What's wrong with those things?

G: They've got like guar gum and stuff, like preservatives and stuff that is not good for you. They could eat a lot of stuff like grains and vegetables and fruit and stuff and not so much the junk.

Here the interviewer restates a portion of what Gavin says ("eat right") in order to redirect his reasoning toward a specific topic of interest for the interviewer. In this portion of the interview, the interviewer is trying to understand Gavin's knowledge related to nutrition and energy intake. As a result, although Gavin mentions a number of other ideas, the interviewer chooses to first follow up his comment about eating. It is not that the student's other comments are wrong or irrelevant, but at this moment the interviewer wants to have the student unpack one part of these comments.

This move may seem counterproductive to the goal of getting students to keep talking – perhaps Gavin would have much to say about the exercise portion of his answer. However, it helps steer the conversation towards the conceptual territory the interviewer hopes to cover at that moment.

Pruning. There are, however, occasions in which students begin to include extraneous information that, if followed by the interviewer, could easily lead to a drift toward topics that are not relevant to the research goals. As the above interview with Gavin continued, the interviewer made a move to disregard some of what the student offered in order to maintain focus on the conceptual knowledge in question.

I: Ok, and you said exercising too, what sort of things do you do?

G: Well you could play sports, or run.

I: And what would those do for him to keep him healthy?

G: Well that would keep him he so wouldn't be as fat, so he'd have less risks of diabetes and stuff, and heart disease.

I: **How do those things, running and stuff, keep you from being fat?**

G: It burns calories so they don't turn into fat

Though Gavin continues to reason about health, he begins to mention specific benefits of exercise ("have less risk of diabetes and stuff, and heart disease"). These comments, while relevant for an interviewer interested in Gavin's understanding of exercise, are not important for this interviewer who wants to know about Gavin's understanding of the body's use of energy. Thus the interviewer ignores Gavin's comments about disease, narrowing the conceptual space (or 'pruning') that Gavin should consider. This discourse move serves to implicitly convey to the student the 'right kind of thing' to discuss.

Substituting words for gestures. Students occasionally have difficulty describing their thinking in words, but are able to demonstrate their meaning with gestures or actions (Church & Goldin-Meadow, 1986). When this happens in interviews, the interviewer makes a substitution by restating the student's gestures, and the words that accompany them, in one coherent and articulate statement. For example, in the following excerpt Samantha explains what happens to light on the wall when the light source is moved away from the wall.

S: Okay, when you're close to it, like the light is right there so it's kinda small. And and as you walk away it kind of expands, cause its covering a broader area. I guess the light expands on the wall. (Student is holding her hands in front of her making a circle and gradually moves her hands apart to make a larger circle.)

I: **So like the circle it's making gets bigger?**

S: Yeah.

At no point in her explanation does Samantha say anything about a circle getting bigger. However, the interviewer replaces her gestures (the circle she is making with her hands) and the words that accompany them ("light expands"), with a single clear statement that ("the circle it's making gets better.") In this case the move serves to help the interviewer diagnose her thinking, but it does not get Samantha to elaborate on that thinking.

From the perspective of studying student cognition, this move runs the risk of inferring too much from a student's

gestures, thus ‘putting words into their mouths’ or ‘ideas into their heads’ that were not actually there. Although in this case it seems fairly straightforward to infer Samantha’s thinking, we can imagine other cases when it would not be. It is important to recognize when interviewers use this move so that we can look closely at the surrounding discourse to see whether the inference was appropriate or whether the interviewer was in fact inserting new information into the conversation with his rephrasing.

Imposition of Coherence. Interviewers may impose coherence on the interviewee’s thinking by taking several aspects of the student’s thinking that may or may not have been intended to relate to one another and stating them as one coherent explanation. The interviewer may take what the student provides as listed, fact-like propositional information and restate it as though they are connected. Often the connection is related to the overarching topical focus of the interview.

Consider what happens after Gavin discusses fat, calories, and exercising in succession in an interview designed to probe students understanding of the body’s energy use.

- I: So calories turn into fat, and exercising burns calories.
G: Calories, yeah.
I: **So does that mean that exercising turns fat into calories?**
G: What?
I: **You said that calories can turn into fat, so can fat be turned back into calories?** I’m confused.
G: I dunno.
I: Ok. We’ll leave that.

Gavin suggests both that calories can become fat and that exercise gets rid of calories. However, the interviewer takes those two ideas and folds them into a single idea that presupposes a relationship among all three entities. The relationship the interviewer suggests ties all of Gavin’s ideas back to the original energy focus of the interview.

The interviewer imposes coherence on Gavin’s statements in an attempt to clarify his own understanding of Gavin’s thinking (as indicated by the interviewer’s own admission “I’m confused”). However, Gavin’s response indicates that he was not thinking of the phenomenon in that way. Although this discourse move momentarily stops the student’s flow of talk, it maintains a focus on the original task of the interview and disconfirms a tentative diagnosis of student knowledge and reasoning.

Constrained Choice Prompts

An alternative to restatements and introductions of new information is the constrained choice prompt. In these moves the interviewer provides a student with a number of possible answers to a question and allows the student to choose one. Here we have in mind constrained choice prompts that the interviewer constructs in the moment as a means of testing hypotheses about what a student is thinking.

In this example, a student Samantha is trying to explain what happens when light travels very far.

- I: So I guess what I’m trying to understand is exactly what you mean by absorbing light. What’s doing the absorbing?
S: I guess the fact that the wall’s black. I dunno, just how large the room is and how much the light’s contained in the room. When it’s so close it only has to go so far. And when it’s further away it has to go in a broader area, it has to expand.

I: **So it has to expand to cover more of the wall or is it kind of the air in between that’s absorbing or is it more of the wall?**

S: I guess the air.

Samantha gives an uncertain and equivocal response with multiple possible mechanisms. In order to tease apart these possibilities, the interviewer suggests two choices from which Samantha can choose. This move serves two functions. First, it highlights for Samantha an aspect of her reasoning that is unclear or imprecise – an aspect that she may or may not have been aware of. Second, it allows the interviewer to learn whether Samantha’s thinking about absorption is a vague intuition about stuff being dissipated, or whether she is thinking of a particular mechanism that can be articulated by one of the choices he has provided.

This discourse move may be used to diagnose student reasoning that is otherwise vague or unclear. However, its overuse can undermine the goal of eliciting student contributions if students merely pick one of the given choices without elaborating on why they chose it.

Meta-conversational moves

During the course of a cognitive clinical interview, the interviewer may make meta-conversational moves that comment on how that conversation is playing out in the moment, or where that conversation is headed in the immediate future. These moves reference the status of the interview rather than the content of the interviewee’s ideas. They may be used to indicate transition points to a student, or to reorient the student to the overall purpose or flow of the interview. These kinds of moves may also indicate what Tannen and Wallat (1987) call frame shifts.

In the following excerpt, Angela describes what happens when a light source is moved away from a wall. The interviewer responds by explicitly stating his desire to transition the discussion to a different, but related topic. His goal is to continue discussion related to the phenomenon, but to gently push Angela to consider the causal mechanisms at work.

- A: Yeah, the light gets faded and it covers more [area].
I: So it gets faded, you said it gets less and less bright. **Uh-huh, all those things sound right to me. So now I want to get to those hard why questions.** Why do you think it starts to get blurrier and less bright as I walk away. Do you have any guesses about that?

Here, the meta-conversational move is preceded by a restatement of Angela's ideas and some encouragement. We suspect this coupling of a positive evaluation to the meta-statement is an attempt to put the student at ease by conveying that the interview is not changing directions because her explanation was inadequate but rather because of the goals of the researcher.

This kind of statement itself serves as a transition point; it tells the student where the interview is headed next and implicitly closes the previous discussion. The interviewer explicitly reveals his own goals and motives in making the transition, thus establishing a friendly and relaxed rapport where each participant knows all the rules of the interaction. At the same time, the meta-statement does the work of getting Angela focused on the conceptual territory that is being studied, namely, her understanding of the mechanism underlying the phenomenon.

Discussion

There has been no shortage of people talking about talk. Discourse and conversational analyses have been a subject of rigorous study within cognitive science for a number of years. In that work, researchers have largely focused on how informal, everyday conversational interactions play out. What does it take to have a successful conversation, either at home, in the workplace, or in a restaurant? How do people contribute to these conversations? How do people convey information and understand information that is presented to them? What inferences do people make when engaged in casual talk?

Our focus in this paper has been on a special form of interaction – cognitive clinical interviews - that exhibit some fundamental differences from everyday talk, or even other forms of interview. Clinical interviews have long been used to study cognition and its development. Their flexibility and conversational nature affords tremendous power for the researcher. At the same time, these qualities have made the method a subject of critique; it has been suggested that the spontaneous and improvised statements of the interviewer alter the very cognition that is under study. In this paper, we made a preliminary attempt to explicitly account for how these discourse moves are used improvisationally to influence the conversation.

From our corpus of data, we identified nine different moves interviewers use, and we discussed how these moves aid in the navigation of some of the central challenges an interviewer faces during a clinical interview. What we present is not meant to be exhaustive; there are likely many more moves used by individual interviewers in other contexts and content areas. However, we believe that the moves we have identified so far represent a promising start.

One of the most obvious next steps in this program of research is to examine frequency and to begin to model the cognitive impact of these various interviewer moves. In addition, the vocabulary of discourse moves we present may provide us footing for systematically testing the effects of specific discourse moves on the presentation and generation

of explanations, particularly about scientific phenomena. This latter has the potential to inform cognitive and educational research on similar forms of dyadic knowledge-eliciting and diagnostic interactions such as Socratic questioning or tutoring conversations (e.g., Chi, et al. 2001; Graesser & Person, 1994). Future work can explore in more detail those overlaps and the extent to which these discourse moves aid in designing and enhancing this class of conversations.

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