

in the first question, and was actively engaged in reasoning while evaluating the evidence in the second.

During the first question the pauses in Misha's speech are primarily grammatical during his answers to the first question, indicating more cognitive activity dedicated to speech planning. This suggests he has already arrived at his answer prior to "reasoning" to the answer he eventually states. In the 30 seconds between the time he finishes reading the question and the time he announces his answer there are five pauses, all grammatical.

His verbal report in the second question has a similar structure; Misha reads the question, provides evidence to support or negate answers, and then states his choice. In this case there are 45 seconds between his reading the question aloud and then stating his answer. Those 45 seconds contain 8 pauses, and this time only 3 of the 8 are grammatical, indicating speech planning. The other 5 are ungrammatical pauses, which indicate active information processing and/or retrieval [6]. The fact Misha is actively processing or retrieving information during these ungrammatical pauses suggests he is reporting an active reasoning process, not reporting a past reasoning process. The second question also contains pauses of greater length, consistent with Goldman-Eisler's conclusion that the more cognitively challenging the task, the longer the speech pauses [11].

Misha's gestures in question two also suggest increased cognitive difficulty and a change in his problem-solving pattern. His answer to question two includes the greatest number of gestures of any of his questions. The increased gesturing we see in question two suggests on-going problem solving or reasoning, as well as heightened cognitive difficulty [8], which is consistent with the interpretation of the pause-type patterns in the questions. Considering this evidence together we infer that despite the fact the structure of the talk is the same, in question one Misha has decided on his answer before he begins speaking and in question two his verbalizations correspond with an active figuring-out process.

We argue that based solely on the text of the transcript researchers would not distinguish between these two possible interpretations. Misha's pauses and gestures, however, indicate he has reasoned to his answer before beginning his verbal report in the first question and is actively constructing his answer during his verbal report in the second question.

IV. CONCLUSION

Our analysis is of TAP as a methodology for studying cognitive processes. We tentatively claim that the interpretive validity of TAP analysis is improved by attending to multiple elements of speech performance. These features include the investigation of linguistic markers of expectations, gestures, and pauses within the think-alouds. Through the example of Misha we have illustrated that attending to multiple aspects of speech performance in analyzing TAP data can provide a more accurate depiction of the cognitive process than simply attending to the transcript for the participant's description of thinking.

In Misha's case we believe that an analysis of only the transcript, as traditional TAP analysis would do, could provide an inaccurate interpretation of his reasoning. The structure of his verbal report is similar in questions one and two. If a researcher were looking only at the transcript they would have no reason to think there was a difference between the reasoning in the two problems.

Why does this matter? We treat Misha's response to the second question as a more accurate description of reasoning because it may actually be a concurrent report. We give less value to his response to question one (and three and four) because it appears to be an after-the-fact construction. A post-facto description he has constructed is more likely influenced by his expectations about the context. So our attention here is ultimately to the intersection of interpretive and contextual validity concerns.

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