Interview Approaches to Researching Embodiment

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ABSTRACT
The methods of data collection that we choose determine the kinds of data that we have access to, and thus shape analyses. In the context of novel interfaces where different modes, available through the environment and context, mediate the interaction, understanding methodological approaches is critical. This paper examines alternative methods of data collection for exploring student's embodied interaction with novel technology in a learning context. Specifically it analyses non-facilitated interaction in a tangible learning environment, in conjunction with three different post activity interview approaches: semi-structured interviews; semi-structured interview with video prompted recall; and interviews using the technology itself. Findings suggest that the different interview approaches change the nature of information elicited, and that non-facilitated interaction offers clearer insight into interpretation, both in terms of the meaning that emerges through, and is, therefore, embodied in the interaction, and in terms of representation, directly informing design.

Author Keywords
Research methods; Interview approaches; Tangible interfaces; Multimodality; Learning

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Recent interfaces have radically changed the nature of interaction, promoting more embodied forms of interaction; in terms of using our bodies differently in interaction, using objects and artefacts in new ways, and the whole interaction experience being embedded and embodied in the contextual reality of the everyday world. This brings new research questions, and calls for the re-examination and extending of methodological approaches to the research. Ubiquitous interfaces foster interaction that involves wider ranges of bodily movement than desktop computers, from whole-body interaction with mobile and sensor technologies to hands-on manipulation with multitouch and tangible interfaces. In the context of educational applications this raises questions around the relationship between bodily-based actions and meaning making. The need to develop research methods that effectively gain insight into this relationship, and the underlying mechanisms is crucial in informing both the design of learning environments, and their value for learning.

In HCI research exploring new interfaces often uses think-aloud protocols to look at learning [1] or a facilitator as a form of verbal prompting [e.g. 2; 3]. While this is useful where unfamiliarity with an interface requires some training for effective interaction, the guidance of a facilitator and think-aloud approaches change the nature of the interaction: notably the ways in which talk is produced alongside gesture. This research, being more concerned with intuitive forms of interaction and communication took a non-facilitated approach. A key question then is how to access student understanding, since students may not spontaneously articulate this sufficiently during interaction; and in particular, how to gather 'meaning' from physical activity as well as meaning from talk, and the relationship between them. While interviews are popular in social science research, they are primarily based on verbal report, reducing analytical focus on complex interactions with artefacts, social and cultural influences.

This paper examines the relative differences of three face to face interview approaches in accessing students' domain specific interpretation of interaction with a purpose built tangible tabletop to support learning about the physics of light. These comprised: semi-structured interviews; semi-structured interviews with prompted recall through video data of students' own interaction; and semi-structured interviews using the tangible interface for demonstration and explanation. The aim was to understand how these different methods shape data by enabling articulation in different ways, given that each provided the students with access to different resources to support their explanation, and provide different insights into student meaning making.

BACKGROUND
A multimodal theoretical approach focuses on interaction through a variety of communicational means. It supports a fine grained analysis of artefacts and interactions in which meaning is realized in the iterative connection between the meaning potential of a material semiotic artefact, the

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meaning potential of the social and cultural environment, and the resources, intentions, and knowledge that people bring to that encounter [4]. It therefore seeks to understand how the different modes available through the environment and context play out in the interaction, and in so doing to gain insight into students' collective or individual interpretation or understanding. The design of research methods for the collection and analysis of digital data and environments is central to achieving this, here a focus on modes made available in different interview approaches.

Gaining access to children's understanding and reasoning is important, yet complex. Interviews with children are increasingly being used for researching their everyday experiences [7], while changes in technology has led to the examination of differences between f2f, telephone, online and e-mail interviewing [8] but not different f2f techniques. Recent methods in child computer interaction largely attend to measures for evaluating sentiment [6], or children as participant designers [5], yet more approaches to evaluating children's learning with technology are needed. Video-stimulated recall is shown to be valuable in understanding children's perspectives [9], and has been implemented to examine children's maths learning [10]. This study builds on this to examine differences in alternative f2f interviews using different semiotic resources in digital environments.

THE TABLETOP ENVIRONMENT

The LightTable consists of a table with a frosted glass surface, illuminated by infrared LEDs. A variety of plastic objects, tagged with a 'fiducial' marker, are used as input devices. When placed on the surface objects are tracked by an infrared camera, recognized by the computer system and elicit programmed digital effects that are projected onto the table surface [11]. This application was designed to illustrate how objects reflect, refract and absorb light, according to their physical properties (shape, material and colour). A torch acts as a light source eliciting a digital white light beam when placed on the table, and the objects elicit digital effects only when placed in a digital light beam pathway (figure 1). Digital effects change when objects are directly manipulated, either by being taken off the table or altering their position, which causes the light beam to be interrupted or redirected. During studies, objects were placed on an area of the table that was not interactive. Students could choose objects at any time to use on the interactive surface.

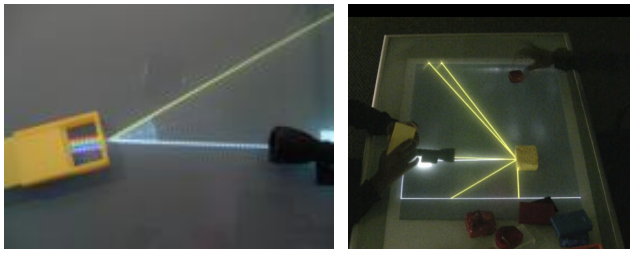

Figure 1. The LightTable and input devices

METHOD

Participants, tabletop study

Participants were aged 10-11 years from a London primary school. Out of twelve pairs invited to participate, 10 pairs and 1 triad took part. Data reported here is based on the 10 student pairs (F=12, M=8). Pairs were selected by the teacher on the basis of being able to work well together.

The LightTable was set up in a large university room. Students could freely access three sides of the table, the fourth, where the computer and electronics were situated, being blocked off for safety reasons. Video cameras were positioned around the room and overhead to record different views of participant interaction.

Prior to interaction students were reminded how a white light beam splits into different colours when shone through a prism, that a white light beam is made of several different colours which are key to understanding the behaviour of light with different coloured objects. Each pair of students spent approximately 20 minutes interacting with the LightTable, undertaking three tasks consecutively *(i)* to explore how light travels from the torch, to find out what is happening to the white beam of light with the different 'things' on the table, *(ii)* to explore what happens when using the same coloured things on the table, *(iii)* to investigate how and why different textures reflect light differently. A non-facilitated approach was taken. i.e. no guidance or facilitation was given, only the explanation of the consecutive tasks.

Interview procedure

After interaction with the tabletop interviews were conducted with each pair of students by a researcher, not been present during student interaction with the table. One of three interview approaches was used: *(i)* 'straight forward' face to face verbal interview, which took place in a separate room, with students seated adjacent to one another; *(ii)* face to face interview with video playback of the interaction. This was trialed with students seated adjacent to one another, in front of a table with the video displayed through a computer screen, and using a handheld video camera to review their interaction: the former being the most productive, primarily as the computer screen set-up enabled the interviewer to also see the video, which was useful in shaping the interview; *(iii)* interview where students could use the LightTable itself to explain or demonstrate. The interviews sought to elicit what the objects felt like, looked like, what students did with them, what happened when they moved them; and what they understood about light behaviour. All interviews took a semi-structured approach using the same set of base questions, e.g. Can you tell me what you have been doing with the table? Can you tell me about how light interacts with different objects? What happened when you used 'x'? Why do you think 'x' happens? Interviews lasted between 10-20 minutes, and were video recorded for analysis.

Analysis

All interview data were transcribed to provide detailed description of verbal utterances, gestures, and actions with objects. The following categories were used for examining patterns in the data: similarities or differences in talk, gesture and demonstration, and the interaction between these across the interview approaches: verbal descriptions of actions; verbal descriptions of configurations of objects on the table; scientific explanations; reflective thinking; gestural expression; and action with objects. The level of detail of descriptions and explanations given were also taken into consideration.

FINDINGS AND DISCUSSION

While all interview approaches elicited information about students understanding, the findings illustrate how different interview approaches shape data, offer different perspectives on understanding interaction, and showed differences in the kind of information they made available.

The straight interviews primarily consisted of student verbal descriptions of their own actions, and of gestured re-enacted example configurations made on the table, but were less insightful in terms of what the students were thinking about at the time of interaction with the LightTable. While this interview approach prompted rich verbal descriptions of what happened when moving blocks around, these were limited to aspects they particularly remembered. Perhaps this is not surprising since this interview necessitates students articulating their activity through words, but not through physical demonstration, as with the table, nor through visual demonstration as with the video. This interview approach is inherently disembodied and dislocated from their experience: providing no external resources to support a link back to their activity. Gesturing, however, enabled them to generate their own communicative resources, these being particularly explicit when describing the placing of objects or direction of reflecting beam pathways.

"So for example if that was blue, that was the blue rainbow box one, and the light was going that way, and you put the yellow one there, you wouldn't see that side – blue. You only see the line over here" *[gesturing to indicate locations and light pathways with imaginary objects]*

Verbal interviews may therefore be a useful approach when seeking to elicit gestural forms of expression, most notably spatially related ideas.

The video interview aided students' narrative construction, with recall being greater. In contrast with the straight interview, students talked in more detail about more aspects of the interaction. For example, while those in both interview approaches talked about angles, these students gave more detail about the sizes of the angles. They were more specific about what they were trying to find out in particular instances and with particular blocks, and provided insight into what they were thinking while they were working on the table. Furthermore, the video replay, being taken from a different angle than the students' own view at the table, enabled a more objective 'third person' view of their own interaction, sometimes prompting them to re-interpret their action or thinking during the activity. For example, one pair of students had initially interpreted the LightTable as representing the sun and moon, but during the video supported interview they spontaneously re-interpreted the context (in this case the learning domain) differently, claiming that they had 'got it all wrong'. They observed that watching the video helped them 'get more', to see their activity differently, and realize their interpretation during the activity was different from what they were seeing on the video. This suggests that this interview approach offers the opportunity to be reflexive, through the potential for objectification of the self [12]. Students also spontaneously talked about their own positioning, how they placed or moved blocks to look at the particular phenomena they were exploring, suggesting that this approach better facilitates elicitation of ideas around their learning.

"From this angle I can see a lot more. Its like… its like… you know when you try something for the first time and go off and learn more about it and get better and better… if I watch it from this angle and see what's going on, I feel that I've got a better understanding of what's going on."

Spontaneous interpretation and meaning making emerges through, and is, therefore, embodied in the interaction. As indicated above, one pair of students interpreted activity on the LightTable in relation to planetary interaction. This is consistent with Dourish's 'interactional model of context', which proposes that context is an outcome of interaction [13]. Only during the video interview did they perceive and think about their interpretation differently. The conceptual distance realized by their change in role from active participants to 'objective viewers/commentators' perhaps provided this space.

The interview using the LightTable generated more talking, explanation and action than both the video prompted and straight interviews, eliciting a wider range of responses and explanations. In general, students displayed detailed level explanations of the differences in behavior between all objects and their interaction with the torch, highlighting specific interpretations of the interface. Direct access to the resources enabled them to demonstrate what happens with each object and multiple objects; and presence at the interactive site enabled them to explicitly show how important their body positioning was in seeing what each other was seeing. However our initial findings suggest that they tended to be less reflexive than those in the prompted video interview, providing subjective, rather than objective narratives of their activity. How they physically interacted with the objects was more apparent than with the other interviews, as demonstration necessarily involved a lot of rotating, placing, replacing and removing.

"we tried lots of different objects of the same colour, and I made different angles like this [*demos with red objects*]. So you turn the shape round and it changes the angle"

Thus, this interview is particularly good for examining the role of action and manipulation in verbal articulation, and better provides a narrative of the physical forms of engagement that took place in the study, acting as a kind of repeat of activity coupled with a narrative.

This comparative analysis of interview design suggests that the nature of information elicited differs. Students have access to a different set of resources to recall, link to, and describe their physical embodied experience, and so the work that they are engaged in within the interviews becomes different. In the straight interview they have to transform their physical experience into a verbal narrative, which cannot represent the same things. It requires precise verbal articulation, mostly eliciting descriptive narrative, accompanied by some gesture. In contrast the video interview is situated within an evidentiary record of the specific interaction with the table. Students get a view of their own embodied experience, while at the same time getting a different embodied experience by viewing their real body experience, which is dislocated in time and space. This 'third-person' perspective on their interaction can be instrumental in triggering re-interpretation of their activity. Interviews using the interface itself comprised a subjective re-enactment of interaction, which was fully located through an embodied physical experience, but which could vary from their first experience. This prompted discussion on a wider range of 'behaviors' experienced with the LightTable, supported through access to all resources, together with explicit expression through action.

Furthermore, this analysis shows that different interview approaches also make different information available to the interviewer. A video stimulated-recall approach offers visual evidence of actions that might be of interest to the interviewer enabling opportunities of deeper interrogation. Similarly, using the technology provides access to observation of actions that can be foregrounded by the interviewer. In contrast the straight interview relies solely on the verbal reporting and verbal recall of the students for developing the interview.

CONCLUSION

While this analysis is based on a small sample, and is applicable to paired interviewing, it does offer a guide to which interview method to use. It indicates the advantages and limitations of different approaches, offering clear gaps in the different techniques, that inform the design of interviews to elicit certain forms of information. For example, if demonstration using the technology is important, as well as examining reflexive thinking, then explicit questions or strategies to elicit this should be designed into the interview. Future work could examine the degree to which the different interviews enabled students to derive more general abstract views of their interactions with the table, to explore gender differences, and examine their scientific understanding in more detail.

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