A Visual Representation for Interaction Scenarios

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ABSTRACT
This paper proposes a visual formalism called the Learning Interaction Diagram (LID). This is a simple variant of Harrigan and Carey's MCCA Diagram [1], but one which shows ordering, onset time, and duration information clearly and explicitly, without perceived increase in diagram density or complexity.

INTRODUCTION
This paper proposes a visual formalism called the Learning Interaction Diagram (LID). The formalism is designed to aid the analysis and design of Interaction Scenarios in the context of Computer-mediated Learning systems. The new representation is a simple adaption of an existing visual formalism, MCCA diagrams, presented by Harrigan and Carey [1]. The MCCA system stems from Laurillard's Conversational Model for Mediated Learning Designs [2], which is in turn based on Pask's Conversational Theory.

LEARNING INTERACTION DIAGRAMS
LIDs are a simple spatial transformation of MCCA diagrams, and they can encode all of the information shown in MCCA diagrams. Figure 1 shows a possible LID corresponding more or less to the interaction shown in Harrigan and Carey's paper [1], using the information contained in Table 1 and Figure 2 of that paper (the details don't matter here). For purposes of illustration, imaginary specifically timed questions and replies have been added. Just as in an MCCA diagram, divided blocks, or other solid geometrical shapes are used to show the duration of activities/processes (figure 1). But LIDs also allow additional temporal information to be shown in a simple and intuitive way. In particular, they allow temporal ordering, onset times and durations of both processes and of conversational interactions to be made explicit. Temporal ordering of conversational interactions is shown naturally by the left to right ordering, and exact placement of events on the left-to right time axis can be used to give precise onset times for activities and conversational moves. In a very detailed view, grid marks to enable times to be read off precisely could be added to the four horizontal lines which represent the four modes of activity. In coarser-grained views, such marks would be unnecessary and undesirable.
At least two methods can be used to show the duration of conversational moves as opposed to activities (whose duration is aleady shown). In the most straightforward scheme, the duration of a conversational move can be read as the gap between the arrow showing the move's onset and the onset of the next activity or conversational move. For example, in Figure 1, the expert's first presentation of concepts does not come immediately after the students first query to the expert, from which we can read information about the duration of the conversational move. However, this scheme is not entirely adequate, as it does not take into account the fact that conversation and activity might overlap. Also, it would be hard to read off these durations from the diagram without grid marks.

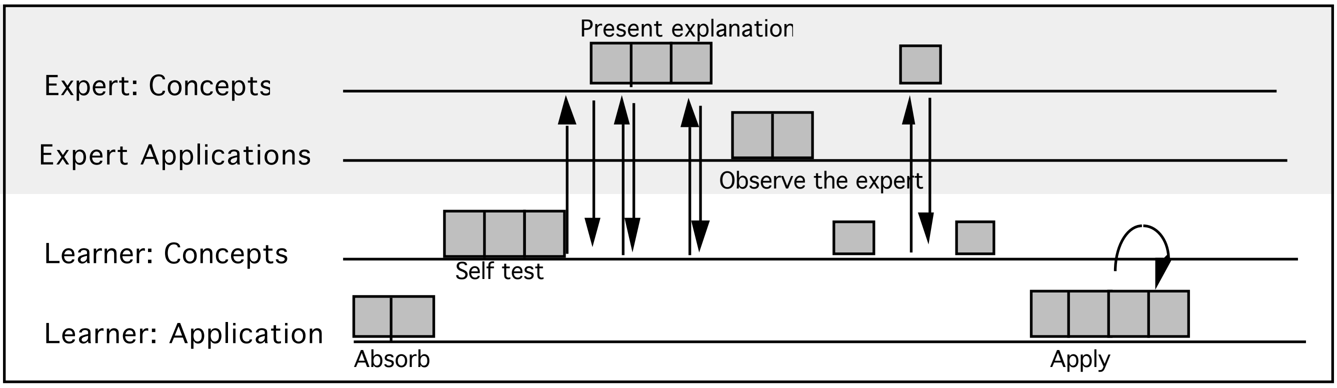

Figure 1: A LID for a sample learning scenario

The second scheme addresses these problems for situations where the duration of conversational moves do need to be shown. This scheme is shown in figure 2. It is very simple. The number of ‘beads’ threaded on an arrow represent the duration of the corresponding conversational move in a suitable unit, say units of 30 seconds. Note that the beads are horizontally aligned, even in the case of the reflective conversation, to help make precise visual comparison of lengths easy.
Figure 3 shows a LID for a very coarse grained view of a different educational interaction. The schematic interaction shown is drawn from Carey’s work [6] towards a pattern language for such interactions.
LID diagrams appear to have good scaling properties: that is to say, essentially the same formalism appears good both for giving coarse-grained overviews (which are useful in pattern work and for communicating gestaults to designers and analysts) and for giving fine-grained accounts of interaction scenarios. Such scaling is an important and desirable property of representations [3].

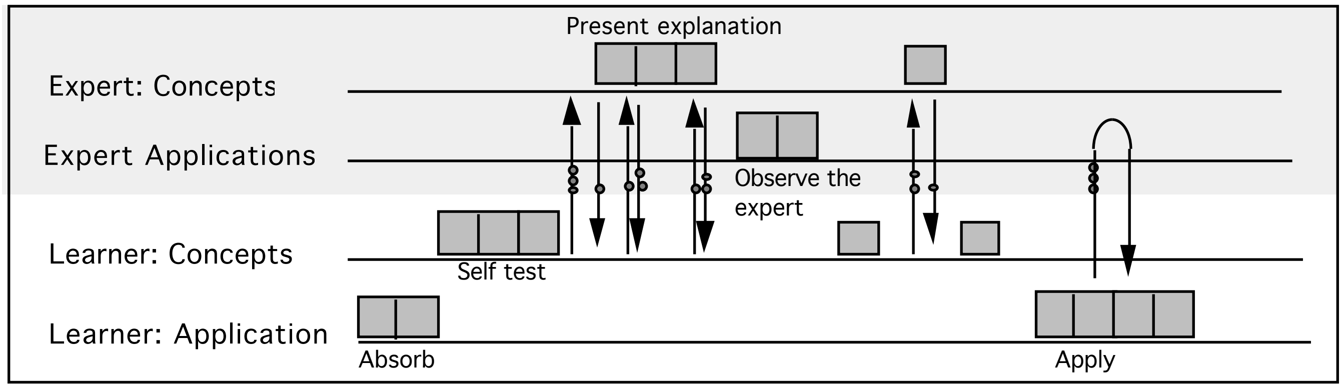

Figure 2: A LID showing the length of conversational moves using beads

The transformation of MCCA diagrams to the LID form was inspired by a similar trade-off between two diagram types found in the domain of object oriented design and analysis, namely data flow diagrams [4] and object interaction diagrams [5]. Laurillard’s original diagrams may be viewed as analogous to data flow diagrams. Data flow diagrams do not show (or do not easily show) the temporal order of the interactions. However, exactly the same information can shown by Object Interaction Diagrams, with timing information added, without extra complexity, density or clutter. Stephen Self [personal communication] reported that the substitution of Object interaction diagrams for Data Flow diagrams greatly improved the clarity of teaching about object oriented analysis.

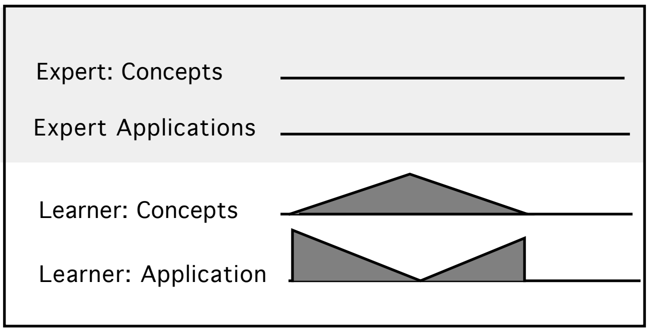

Figure 3: A course-grained LID

LIMITATIONS

One possible limitation of LIDs compared with MCCAs is that the two symmetries (left-right and top-bottom) between

- processes of user vs expert, and
- processes on concepts vs applications

that is so appararent in Laurillard’s diagrams and in MCCAs is less neatly apparent in LIDs. However, by differentiating the expert and learner part of the diagram in the LID (say by shading the expert part, as in Figures 1, 2 and 3), both of these symmetries can be communicated to the user albeit in a different way.

CONCLUSION

A visual representation has been presented for the analysis and design of machine-mediated learning scenarios. It is a straightforward variant of Harrigan and Carey’s MCCA approach [1] , but one which allows the order , duration and timing of both conversations and operations be shown clearly, explicitly and intuitively, without increasing diagram density or complexity. The representation has good scaling properties.

ACKNOWLEDGEMENTS

This paper is essentially a record of a table napkin scribble in response to a talk by Tom Carey on MCCAs, so would not have existed without all the previous work of him and his colleagues on MCCAs, or without his excellent talk. Tom also kindly commented on a first draft of this note, motivating some extra twists.

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