The anatomy of an Active Multimodal Presentation in educational contexts.

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The Anatomy of an Active Multimodal Presentation in Educational Contexts

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Abstract

This paper presents a methodology for analyzing gestures within Active Multimodal Presentations (AMP) which are designed to produce coherently integrated communications within educational contexts. The methodology is focused on a semantic integration of the visual, verbal and gestural modalities. We identify three representational forms - a time based transcript, that is extracted from presentations to produce a speech mark-up; a concept based semantic analysis of the content; and a representation of gestures which distinguishes visual depictions of their icons, their trajectories, referents, and functions that link the verbal and visual modalities of the presentations. Our experiments are showing the utility of the analyses giving guidelines that can aid the design of AMPs within educational contexts.

1. Introduction

Ongoing research shows an increasing interest in incorporating gestures within e-learning environments and this poster presents an approach for investigating the roles of gestures within AMPs and seeks to understand how they can support the communication process. The integrative role of gestures is potentially important as the visual and verbal modalities require different cognitive processing (the former holistic, the latter sequential and structural), and gestures can be used to link the modalities by directing attention, locating and emphasizing properties, illustrating principles and processes, and conveying the presenter’s attitudes and empathic links with the audience [1][2].

2. Background

The use of computers in education has led to the development of multimodal instructional materials. Mayer [3] has set out design principles in multimedia learning based on how the learner builds mental representations. These principles give advice on the types of materials which are best assigned to different modalities.

Appropriately assigning types of materials to modalities is important but so are mechanisms which achieve a coherent integration between the modalities during a presentation. Work by McNeil, Kress [1] [2] illustrates that gesture is useful in achieving these objectives. David McNeill [1] distinguishes between the so-called semantic gestures: iconic, deictic, metaphorical, and beats. Iconic gestures represent or signify objects or events; metaphorical gestures represent an abstract idea, deictic gestures are concerned with pointing, while beats are gestures which emphasize words or phrases within the narrative. However, these classifications underplay the pragmatic intentions of communication, namely the affective involvement of the presenter with the material, and the empathic space which is shared with the audience. Accordingly we have extended the analysis to include the functional roles of gestures. Deictic gestures are locative, iconic and metaphorical and illustrative. ‘Beating’ shows emphasis and the affective and empathic functions of gestures are also classified.

3. Experimental studies

A series of experiments is examining gestures within multimodal presentations which are delivered in three ways. First, the visuals are displayed on a board with the presenter referring to them via gestures when the spoken content is delivered. Second, the viewpoint is over-the-shoulder onto a work desk on which the visuals are placed, and the presenter, gesturing as appropriate, delivers the spoken content as in an individual tutorial. The third display method shows the visuals on a computer screen with the mouse being the gesture icon which is moved by the presenter as the spoken content is delivered.

The subject topics, taken from school science, are focused on principles (e.g. Cable Suspension Bridges, and Hot-Air Balloons), and process (e.g. the Heart-Lung System), and instructions (e.g. Assembly Tasks, and using a Hand Pump). Each presenter delivers their
content in the three presentation modes, which are video-recorded, in random order. Presenters are asked to include a priming section (to capture interest) and descriptions and explanation to assist the children’s understanding.

The analysis notes the physical attributes of the gestures. It classifies its iconic form, (e.g. pointing finger, open, flat or cupped hand) also the trajectory dynamics of the icon (e.g. locating, underlining, following or grouping), its time span in relation to the verbal content, and its referents (the visual, the presenter’s mental model, his affective state, and the empathic link to the audience). To this is added a judgement on the functions of gestures within AMPs. These distinguish between the syntactical (e.g. beats that contour emphases and phrasing) the semantic (e.g. locative and illustrative functions) and the social (e.g. affect and empathic).

The analysis is undertaken by a panel of three experts who make independent classifications from the video recording and then discuss differences in order to arrive at a consensus. A transcription is made of the spoken content and a rhetorical clausal analysis is undertaken. Also marked on the transcript are prosodic features e.g. stress and intonational features, and changes in the tempo of the narrative. Other expressive forms are noted e.g. present/past tense (indicating whether a process is continuing or is completed), and whether a concept is concrete/visible or abstract/virtual (e.g. the tension in the suspension cable of the bridge). The symbolic representations of the gestures are placed on the time-lined verbal transcript thus showing the start, paced development (the stroke) and the completion of each gesture.

4. Discussion of results

The data clearly show that gestures are not merely adjuncts to what is spoken, but play an active role in directing attention to what is perceivable, illustrating the properties of objects, and virtual processes, and displaying affect and empathy. There are differences between the presentation modes where over-the-shoulder views tone down the range and movement of the hand gestures, and the mouse movement presentation which essentially performs animated telepointing. However, within each type of sense episode the same functional aims are apparent even though the form of the gesture varies.

To summarise these data, in the Priming episode the objective is to introduce the topic in ways which stimulate interest. The visuals are displayed, but it is the spoken delivery and its content which carry the objectives and show the presenter’s interest in the topic. Gestures are well-used but the majority is syntactic-beats which contour the speech, emphasizing the points being made. The open hand, in contrast to the cutting motions of the beats, in its trajectories invites the audience to regard the visual features and indicates affect with some empathic linking.

These integrative features are more pronounced in the Descriptive episodes where the functions and the gestures patterns change. Most gestures are locative, identifying objects and the components spoken about, but also using the trajectories to identify and illustrate their properties. For example, in the suspension bridge the supporting function of the suspender cables—upward flat-hand movement; and necessary conditions such as the secure embedding of the parapets—pressing down hand movements. During these descriptive acts the speech slowed and sometimes paused so that the gestures were centre stage and had time to direct attention and play their illustrative roles.

During the Explanation sequences the rhetorical predicates emphasize cause and effects, conditions and consequences, but many of these effects cannot be directly perceived since they are forces (e.g. tensions and compressions in the suspension bridge). The presenters use strong actions illustrative of these constructs, e.g. on the visual, supporting the weight of the roadway with a repetitive cupped hand movement; indicating the tension in the cable with a repetitive pulling motion on the parapets and anchor points to indicate (with the use of present tense) that the tension is a continuing effect. Briefly, the gestures gave an animation of the processes, coordinated with speech tempo and intonation to regulate attention and interlink the visual and verbal components. Also, the idiosyncratic signatures of presenters’ gestures, when equivalent content is expressed, still have a recognized and interpretable function in the descriptive and explanatory episodes. Further work will examine the effects of the different modes of presentation on student learning.

5. References

