Object Manipulation In Educational Multimodal Systems for Contextual Learning

S. Anastopoulou, M. Sharples, C. Baber
Educational Technology group, School of Engineering, University of Birmingham

Learning does not need to be classroom based, but can occur in a variety of places and for a variety of reasons. This assumption is often referred to in terms of the context of learning. In this paper, we focus on multimodality, as a means of exploring contextual learning for children. By multimodality we mean the interaction between visual, actional and linguistic communication that can be employed in learning. The use of multiple modalities is believed that engages learners' interest and facilitates the process of learning.

The context in which learning occurs, influences the impact of different modalities upon learning. In science education, for example, aspects of multimodal communication become salient. Science shows an overriding importance of material things in relation to words; it connects with action through experiment and demonstration, and it uses images for knowledge representation (Kress et al., 2001). These issues support multimodality in science education as being beneficial to children.

The aim of the research reported in this paper is to explore user requirements for a multimodal educational system. In this process, the context of learning gives shape to decisions regarding which modalities to employ and when. It also affects the ways of illustrating representations to different modalities. In science education, the integration of haptics (that is the use of tactile and kinaesthetic information) with vision and language may be beneficial to learners.

The introduction of haptics to the context of learning is related to the artifacts or the learning objects. The objects and the ways they are employed by children are part of the learning experience and they are not perceived separately. When students write notes, for example, they do not perceive the pen as a separate entity but as part of the note taking. The pen will be the focus of attention only when there is a break down, e.g. when it runs out of ink or when they get cramp in an exam (Winograd and Flores 1986; Sharples 1999).

The objects used in a learning experience provide extra information when they are touched than when they are seen only. There is experimental support in psychology literature saying that vision and haptics use different perceptual pathways when encoded which are not competitive (Jeannerod, 1997).

On the other hand, it needs to be considered that physical objects have different importance in different learning tasks. Specific objects may offer a continuous engagement to learners and other objects may not add to the meaning construction. Research into haptic exploration of objects suggests that people employ stereotypical 'exploratory procedures' (Klatzky et al., 1989) and that these procedures are influenced by the properties of the object. In a like manner, we propose that the learning experience is constrained by the affordances of the physical objects. Affordances, according to Gibson (1979), are properties of the environment that offer actions to humans, e.g. a banana affords eating or a chair affords sitting. The focus on affordances illustrates the material features that are relevant for behaviour, which can be useful for the design of learning environments.

In the force experiments which occurred during this research, it is claimed that the manipulation of objects provides children with a clear view of the weight as a contact force. They discriminated weight from gravitational force, which is a distant force. Thus, the physicality of objects can provide learners with additional information and prohibit confusions. As a result, in educational multimodal systems, issues of object manipulation are important.

References

Gibson, J. J. (1979). The ecological approach to visual perception. Boston: Houghton-Mifflin.

Jeannerod, M., 1997, The Cognitive Neuroscience of Action, London: Blackwell

Klatzky, R.L., Lederman, S.J and Reed, C., 1989, Haptic integration of object properties: texture, hardness and planar contour, Journal of Experimental Psychology: Human Perception and Performance, 15, 45-47

Kress, G. and C. Jewitt, Ogborn, J., Tsatsarelis, C. (2001). Multimodal teaching and learning: the rhetorics of the science classroom. London, Continuum.

Sharples, M. (1999). How we write; writing as creative design. London, Routledge.

Winograd, T. and F. Flores (1986). Understanding computers and cognition. New Jersey, Ablex Publishing Co.