Intelligent Systems for Speech and Language Impaired People: A portfolio of research

Alan F. Newell, John L. Arnott, Alistair Y. Cairns, Ian W. Ricketts and Peter Gregor

University of Dundee, Dundee DD1 4HN, UK.

This is an abstract of an article published in:

Extra-ordinary Human-Computer Interaction: *Interfaces for users with disabilities*

by Alistair D.N. Edwards (editor), Cambridge University Press (first pub. 1995), Chapter 5, pp. 83-101.

ISBN: 0-521-43413-0

URL: Publisher's site:

http://www.cambridge.org/gb/academic/subjects/computer-science/computing-and-society/extraordinary-human-computer-interaction-interfaces-users-disabilities?format=HB&isbn=9780521434133

Abstract: Human communication impairment covers a wide range of problems, with many and varied forms. Developers of communication prostheses to address these problems face significant challenges to provide efficient and effective solutions for the complex range of difficulties which people can experience. This chapter describes a set of research projects at Dundee University investigating the development of communication prostheses for people with speech and language problems. The adopted design concept is that of an integrated communication system for a person without speech, and the communication needs of such a person have been divided into three major types: *unique* conversation, *formulaic* conversation and *reusable* conversation. Different approaches are being taken to tackling these types of need, often using the concept of prediction. Different levels and styles of prediction can be utilized depending on particular requirements. *Unique conversation:* The research on unique conversation uses a word-level predictive text entry system which was initially developed to help physically disabled people to enter unique text. Word prediction algorithms based on frequency and recency of usage and syntax have been studied in this context. The system has been found to be very useful amongst a wide range of clients with physical and intellectual problems with writing as well as people without speech. There is associated research on spelling correction for very poor spellers which is related to the work on text prediction. *Formulaic conversation:* A large amount of conversation, important for social bonding, is formulaic and relatively predictable. Using ideas and techniques from discourse and conversation analysis, the aim is to predict appropriate conversational moves sufficiently accurately to enhance the speed and effectiveness of the user's formulaic conversation. Systems designed for this are based on computer models of human conversational patterns. *Reusable conversation:* Much conversation essentially consists of repeating things which have been said in the past. The storage and retrieval of material for reuse in conversation is therefore being investigated as a support for users of computer-based communication systems. *User interfaces:* Interface methods such as gesture recognition (for input to a communication system) and emotion in synthetic speech (for output from a system) are also described, as is research on extraordinary human-computer interaction. *Development:* Integration of the various ideas in systems configurable for different groups of users or users with different disabilities presents a further significant challenge. Although parts of the research have been successfully implemented in realistic situations, the work described here marks only a start to tackling the overall problem and there remains much important and exciting research to be conducted in this area.

Citation for published article:
Intelligent systems for speech and language impaired people: A portfolio of research. A.F.Newell, J.L.Arnott, A.Y.Cairns, I.W.Ricketts and P.Gregor. In: *Extra-ordinary Human-Computer Interaction: Interfaces for users with disabilities,* edited by A.D.N. Edwards, Cambridge Series on Human-Computer Interaction (managing editor J. Long), Cambridge University Press, 1995, Chapter 5, pp.83-101.

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