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Gesture and Sign Language in Human-Computer Interaction

International Gesture Workshop
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Preface

Human-computer interfaces define the frontier between the computer world and the real world. More and more researchers and practitioners emphasize the aspect of humanizing computer interaction, thus calling for more intuitive interfaces. Reaching this goal will rely heavily on software systems which can relieve users from technical detail of their working environments. The user should be able to behave in a natural way and bring into action natural modes of expression such as gesture and speech. Whereas speech has been the subject of research in human-computer interaction for many years, gesture and sign language have become a recent focus in advanced interface design. A further challenge is to integrate the human modes of speech and gesture in multimodal interfaces. Very powerful and intelligent techniques are needed to employ these expression modes in human-computer interaction. Artificial intelligence, neural networks, pattern recognition, and agent techniques have a significant impact on this area of research and are the focus of this book.

Resulting from a three-day international workshop in Bielefeld, Germany, with fifty participants from eleven countries all over the world, this book presents state-of-the-art contributions on Gesture and Sign Language in Human-Computer Interaction. The workshop was held – following a first international Gesture Workshop at the University of York 18 months earlier – from 17 to 19 September 1997 at Bielefeld University's Center for Interdisciplinary Research. Its purpose was to bring together researchers working on gesture-based interfaces, gestural interaction, and sign language. Besides two invited papers from the keynote lecturers, *Alan Wexelblat* of MIT Media Lab and *Alistair Edwards* of the University of York, the book contains a total of 23 reviewed articles in six further sections, covering diverse aspects of gesture and sign-language recognition and synthesis, gesture semiotics, gesture and speech integration, and several approaches aimed at applications.

The section on the *Semiotics of Gesture and Movement* presents four contributions concerned with: a description system for both spontaneous co-speech gestures and sign language; a classification system for gestures in two-dimensional interfaces; the impact that synthetic gestures of an anthropomorphic agent have in human-computer interaction; and the recognition of grasping gestures in non-rigid object manipulation.

The next section comprises three papers that employ *Hidden Markov Models* for the recognition of gestures and sign language: a camera-based technique for the real-time recognition of complex dynamic hand and head gestures; the recognition of hand and finger movements from a continuous stream of sensor-glove input data; and the visual recognition of manual parameters in the Sign Language of the Netherlands (SLN).

The four papers in the section on *Motion Analysis and Synthesis* deal with: the analysis of hand-arm movement for sign-language communication; context-dependent analysis for visual recognition of human hand gestures; the automatic

estimation of moving body regions from digitized video images; and finally, the generation of 3D synthetic hand gestures as line drawings.

The section concerned with *Techniques for Multimodal Interfaces* comprises four papers dealing with: redundancy in speech and 2D gesture input systems; the signal-to-symbol transformation of 3D upper-limb gestures in multi-modal utterances; a fast agent-based method for embedding distant pointing gestures in a multimodal virtual reality system, and an experiment with a two-handed gestural interface in a virtual reality design application.

A set of four papers in the section on *Neural Network Methods* are concerned with: a hierarchical neural network approach for locating the position of the fingertips in hand movement sequences, two approaches to gesture-based interaction between robots and human users; and adaptive models for image-based recognition of gaze direction by tracking head and eye orientation.

The final section is devoted to approaches which lead into *Applications*. The four papers in this section address: the development of a dialogue system understanding and synthesizing Japanese Sign Language (JSL) to help the hearing impaired communicate with normal-speaking people; further, an experiment in which JSL recognition is used at a window in the post office; a gesture recognition system for controlling appliances in home environments; and a prototype planning tool for use in construction and design tasks.

The editors of this proceedings volume are grateful to the authors of the papers, the reviewers, and, last but not least, the local organizers for their hard work, which were the basis for a successful workshop. Special thanks go to the Center for Interdisciplinary Research, the Graduate College "Task-oriented Communication", and the Collaborative Research Center "Situated Artificial Communicators" for personal and financial support. The editors hope that the book will serve as a timely and comprehensive reference for researchers who are involved in any of the related disciplines, as well as for practitioners who are concerned with putting gesture and sign language to work in human-computer interaction.

February 1998, Bielefeld

Ipke Wachsmuth, Martin Fröhlich

Notes

Proceedings of the Gesture Workshop '96 were published as: *Progress in Gestural Interaction* (P.A. Harling, A.D.N. Edwards, eds.), Springer-Verlag London 1997.

Web pages for the Gesture Workshop '97 and links to related activities can be accessed under <http://www.TechFak.Uni-Bielefeld.DE/GW97/>.

A third Gesture Workshop will take place in France in March 1999; information to be found at <http://www.limsi.fr/GW99/>.

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