

Preface

For approximately 25 years research and development projects around the world have been aimed at adapting the communication and interaction between human and machines (HMI) to the needs of human beings, and not vice versa. However, considerable progress in the transfer of the findings has only been achieved in the last 10 years with the development of certain means of interaction, e.g. speech processing and visualization. This led to the question of whether further, easy-to-use multimodal user interfaces with high market potential could be developed.

This was the starting point for the interdisciplinary work on six large joint strategic projects (lead projects) on human-machine-interaction involving scientific as well as industrial partners, that originated from the proposals, which successfully participated in an ideas competition started by the German government in 1998. They were financed with public funds amounting to 82.4 million Euro (with additional own investments of 69.6 million Euro) between July 1999 and September 2003. The results of these lead projects should allow humans to control technical systems in a multimodal fashion and to use them for manifold tasks in their private and professional environment by means of natural human interaction modes, such as language, gestures, facial expressions, and grip or pressure movements. Ergonomics and user acceptance for the new interaction modes were crucial criteria to the development of prototypes, which needed both high scientific attractiveness and high market potential.

One of these lead projects is MORPHA (interaction, communication und cooperation between humans and intelligent anthropomorphic robot assistants), which dealt with possibilities of human-machine interaction. The project was as a joint venture of six well-known (industrial) companies, six small and medium-sized companies, three research establishments, and two universities. MORPHA was lead by Demia GmbH, Fellbach and coordinated by GPS Stuttgart, under the scientific leadership of the Forschungsinstitut für Anwendungsorientierte Wissensverarbeitung (FAW) in Ulm. The goal of the

project was to develop powerful communicative, interactive and behavioral mechanisms, enabling a future generation of robots to cooperate with and assist a human master and partner under his or her control.

At the end of the project it can be concluded that the ambitious objectives of MORPHA have been exceeded thanks to the engagement of all project partners. In the seminal field of service robotics, key technologies have been developed that may ensure a leading position for the German robot industry in this growing market - both in the traditional production robotics and the young industry in the field of service robotics. Among other approaches, complementary solutions for user-friendly control and programming of robots have been developed. The selection of the objects to be handled by the robot and of their associated locations is done either with laser pointers, natural pointing gestures or by marking the objects on a teach panel. The robot is able to interpret and imitate motion sequences done by a human being. A team of human and robot can move throughout a busy concourse hall while avoiding fixed obstacles and moving people.

Nine patent applications were filed to protect the know-how of the German industry, 19 prototypes were realized using a component-based architecture that is adaptable for either private or industrial appliance. Furthermore, 12 spin-off products were developed and four spin-off companies were founded. A total of 153 publications were produced and 43 diploma and doctoral theses were finished in the scientific sector. This places MORPHA among the most successful lead projects of the German federal ministry for education and research (BMBF).

The BMBF supported MORPHA from July 1999 until June 2003 with a grant of 12.4 million euro. The total cost including the investments of the industrial partners amounted to 22.2 million euro.

The report presented here delivers a comprehensive impression of the various results of this research and development project. I express my gratitude and acknowledgement to all those involved in the project, particularly to the professional project management led by Mr. Klaus Lay (Delmia GmbH) and Dr. Erwin Prassler (GPS Stuttgart/FAW).

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