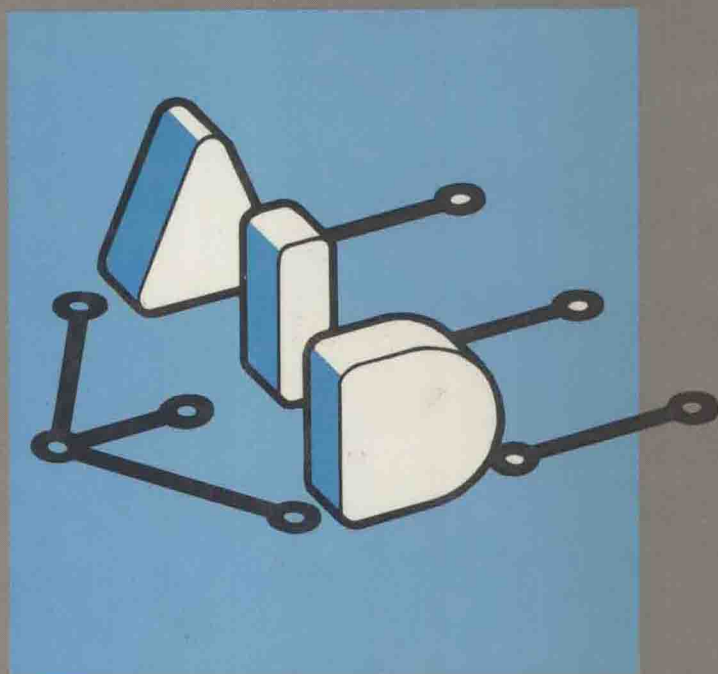


# Adaptive User Interfaces



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# Adaptive User Interfaces

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**ACADEMIC PRESS**

*Harcourt Brace Jovanovich, Publishers*  
London San Diego New York  
Boston Sydney Tokyo Toronto

ACADEMIC PRESS LTD.

24/28 Oval Road,  
London NW1 7DX

*United States Edition published by*

ACADEMIC PRESS INC.  
San Diego, California 92101-4311

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*British Library Cataloguing in Publication Data*

Is available

ISBN 0-12-137755-5

# **Adaptive User Interfaces**

# Computers and People Series

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## Preface

It is widely believed that "everyone should be computer literate" and as a consequence vast human and financial resources are being expended internationally on training individuals to adapt to using computers within their lives. The premise of the research that is reported in this volume is that "computers should be user literate". Comparatively small resources have been devoted to building flexibility into computers; flexibility which would enable computers to adapt to the diverse needs of the individuals who use them.

The research reported here was part of a project which looked at the problem of designing adaptive computer interfaces. An adaptive computer interface is one which can change its behaviour to suit the individual or group using it. This can range from an interface which switches fonts to suit the preference of a user, to an interface which builds and evaluates a model of the user in order to improve the effectiveness of communication between the computer and the user.

The Adaptive Intelligent Dialogues project, also known as the AID project, was a four-year project which researched and developed techniques for designing and building adaptive computer interfaces. The AID project was part of the United Kingdom's Advanced Technology Alvey Programme. The collaborators on the project were: STC Technology Ltd, Data Logic Ltd, British Telecommunications plc, The University of Hull, The University of Strathclyde and The University of Essex.

Special mention should go to the project managers Phil O'Donovan and his successor Paul Cooper of STC Technology Ltd who managed to keep the project on course. We would also like to thank Tom Stewart of System Concepts Ltd who was the external monitor for the project. His contributions at workshops were always very positive, apt and well received.

We would like to acknowledge the contribution of all those that worked on the project, whether it was for four weeks or four years. In keeping with the spirit of the venture, we will simply list their names without mentioning affiliation, position or time on the project:

Ebby Adhami, Jim Alty, Bruce Anderson, Stuart Anderson, Farhat Arshad, Bob Benton, Len Botacci, Peter Boucherat, Liz Boyle, Pamela Brody, Andrew Brooks, Dermot Browne, Nigel Cliffe, Ian Clowes, Gilbert Cockton, Ian Cole, Stephanie Cookson, Martin Cooper, Paul Cooper, Tony Cox, Colin Davenport, Graham Dunkling, Tony Fountain, John Friend, Andrew Hockley, Colin Hopkins, Bernard Horan, Safwan J'Affra, Peter Jones, Neil Lawrence, Richard Lawrence, Graham Leedham, Pat Leisner, Hamid Lesan, Andrew Marshall, Terry Mayes, Phil McEachen, Swapan Mitra, Linda Moxey, Dave Moynaghan, Brian Murphy, Mike Norman, Phil O'Donovan, Robin Pyburn, Paul Rautenbach, Dave Riches, Colin Robertson, Osnat Ron, Nigel Seel, Briun Sharratt, Andrew Stewart, Mike Thornton, Peter Totterdell, Robert Trevellyan, Alan Wilkinson, Romualdas Viliunas, Albert Wong.

We would also like to acknowledge the support provided by Alvey and SERC in part funding the AID project. STC Technology would also like to acknowledge International Computers Ltd for their support.

One caveat, although much reference is made to work from within the project, the thoughts and ideas expressed here are the responsibility of the editors and authors alone and do not necessarily reflect the views of all the individuals and organisations involved in the project. Some of the ideas reported here have been reported elsewhere - in papers, journals, workshops and conferences - but this volume is intended to bring together the results of the project under one cover.

It is hoped that the work will be of interest to anyone who is seriously interested in Human Computer Interaction; both the issues and the practice.



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# Chapter 1

## Introduction

**P. Totterdell**

*The following chapter is an introduction to the Adaptive Intelligent Dialogues (AID) project which was the source of the research reported in this book. The chapter begins by describing the objectives, participants, and development of the project. During the course of the project a number of adaptive interfaces appeared as a result of work outside the project. Some of these interfaces are briefly reviewed in this chapter. The editors then describe what it is they hope to achieve by disseminating the results of the AID project to a wider audience, and hence they describe what you the reader might hope to gain. The chapter ends with a brief summary of the contents and rationale of other chapters.*

This book is the result of a four-year collaborative venture between three industrial and three academic partners who, with the help of government funds, allowed a group of researchers to tackle the problem of designing adaptive user interfaces for computers. An adaptive user interface is an interface which can change its behaviour to suit an individual or group of individuals.

Our account concentrates on the technical outcomes of this venture but an equally interesting account could have described the sociological development of a project of this type. Indeed we might have chosen to illustrate the processes of adaptation by referring to the course of change within the project itself. But we start more mundanely with some details of the project.

### **The AID Project**

The Adaptive Intelligent Dialogues (AID) project was part of the United Kingdom's Advanced Technology Alvey program which sponsored collaborative computing and information technology projects involving both industry and academia in the UK. The AID project was the largest project of the Man-Machine Interface (MMI) section of the Alvey programme. The project ran from October 1984 to September 1988. The collaborators on the project were: STC Technology Ltd, Data Logic Ltd, British Telecommunications plc, The University of Hull, The University of Strathclyde and The University of Essex.

The project was originally set up to "research the techniques appropriate to the development of user interfaces that adapt to a particular user's ability and knowledge of a given system". The term adaptive referred both to self adaptive and user tailored systems (terms which will be explored in depth later on). The justification for the project was that with computers becoming more widespread and having to accommodate a wider range of users, it was no longer satisfactory for designers to aim the level of interaction at an average user because nobody conformed to the stereotype of the average user.

The specific objectives of the project were to:

- i) Research the principles underlying intelligent adaptive interaction.

- ii) Build software exemplars to demonstrate this research.
- iii) Evaluate the effectiveness of the exemplars.
- iv) Produce tools to assist in developing adaptive user interfaces.

The project was divided into three phases. The first phase developed an adaptive interface to an electronic mail system using the (at the time) state-of-the-art tools and techniques. The second phase of the project researched the key issues of adaptive interaction. As well as producing theoretical frameworks for understanding adaptation, the second phase also produced a number of software exemplars. The third phase of the project consolidated the research by building improved exemplars which illustrated general techniques for constructing adaptive interfaces. The final phase also developed tools to facilitate future development of adaptive interfaces.

## Phase 1

Phase 1 of the project designed and built an adaptive front end to the British Telecom electronic mail system Telecom Gold. It was hoped that the existing interface to the application would provide a suitable baseline against which to measure the performance of the adaptive interface. The application also had the advantage that it was a "real world" rather than a "toy" application and would therefore be a good test of the adequacy of current Human Computer Interface (HCI) wisdom and computer technology.

The adaptive interface was built in a single design, build and test cycle, with no opportunity for redesign. A description of the interface architecture and its components can be found in later chapters but essentially it comprised a dialogue controller (which interacted with the user), a user model and an application expert. The application expert interfaced the whole system to the application via a modem. The phase 1 system adapted along a number of dimensions, the most important of which was the level of help it gave a user. The system was effective in as much as it provided user assistance related to user competence, but this was at the expense of unacceptably high response times.

It has been said that the sum of the components in the phase 1 system was greater than the whole. And certainly one of the

successes of the system was the design of the application expert. With hindsight one might question whether the design effort required to interface the system via a slow and noisy telephone line to an application with unknown states might have been better spent on designing the user interface to an easier application. But as with any research, the spinoffs are often as valuable as they are unanticipated; and the application expert was a valuable spinoff.

Evaluation of the phase 1 system proved difficult and it became apparent that adaptation is of superficial value unless the non-adaptive components of an interface are also of sufficient design quality. In an effort to make a controlled comparison with a non-adaptive version of the interface, the designers of the phase 1 system had neglected this requirement and had built adaptive facilities on top of a rather poor user interface.

## Phase 2

Phase 2 of the project ran from January 1986 to September 1987. The original objective for phase 2 had been to produce a commercially viable exemplar. However, following the experience of phase 1, it was clear that phase 2 needed to address some very fundamental issues concerning the characteristics and classification of adaptive systems. This included looking at the use of the concept of adaptation in other disciplines such as biology and cybernetics, and led on to a clarification of its usage within the field of HCI.

In phase 2 adaptation took on the meaning of an approach to design rather than being seen as a universal architecture. In particular it was viewed as a framework for deferring design decisions. A theory-based approach to the design and evaluation of adaptive systems via metrics also emerged in this phase.

It was decided after a few months of the phase that the project needed a single domain for its exemplars and experiments. This was seen as a way of bringing various strands of work together. The project chose document preparation as its domain because it seemed to offer problems requiring adaptive solutions. The exemplars which followed seemed to offer alternatives to the cognitive user modelling approach which had dominated the first phase. They demonstrated that in some cases adaptation can be provided without a sophisticated model of the user. This is important given that the bandwidth of



communication between user and interface is sometimes too narrow to justify an elaborate user model.

### Phase 3

The final phase of the project used the groundwork of phase 2 to produce improved exemplars. Again the exemplars were within the domain of document preparation and they were chosen to illustrate more general techniques for constructing adaptive interfaces. The exemplars showed considerable diversity in their demonstration of adaptation. For example: the Task Organiser adapted to linguistic context, Groupie 2 adapted to the help preferences of a community of users, Reference Information Provider adapted to relevance, and Adaptive Menu Structure adapted to frequency of use. These exemplars as well as others are described in later chapters, especially Chapter 5.

Phases 1 and 2 had shown that it was hard to identify user or task variability, the sources for adaptation, in the course of using conventional system design techniques. What was needed was a method of systematically assessing situation specific requirements to see whether or not they could profitably be realised at run-time by an adaptive interface. The method also needed to address the practicality of using an adaptive solution. The computer has only limited access to the user's situation and can therefore only detect and monitor a limited set of stimuli. A method called MAID (Methodology for Adaptive Interface Design) was developed to satisfy these needs. This was complemented by using the evaluation experiences of the project to devise a detailed protocol for formative and summative evaluation of adaptive interfaces.

Phase 3 also delivered some tools to support the construction of adaptive interfaces. The ideas of application modelling developed in phase 1 were later incorporated into a tool (HIFI) for integrating user interface design with system functionality. And two other tools, Deferred Design Tool (DDT) and Task Description Language (TDL) were developed to support the project's design method.