

# Designing User Interfaces from Analyses of Users' Tasks

Peter Johnson, Stephanie Wilson and Hilary Johnson

HCI Laboratory, Department of Computer Science

Queen Mary and Westfield College

University of London

Mile End Road

London E1 4NS UK

+44 (0) 171 975 5224

pete, steph, hilaryj@dcs.qmw.ac.uk

## ABSTRACT

This tutorial provides a detailed introduction to task analysis and task-based design. The focus of task analysis is the description of work tasks, while the focus of task-based design is designing interactive systems from the perspective of users' work. Techniques from psychology, ethnomethodology and sociology are used to analyse and describe users' current work tasks. A framework for modelling work tasks (Task Knowledge Structures) is used to represent relevant task information. Guidelines are provided to help the design team envision and reason about how current tasks might be changed and improved through the design of interactive systems. The envisioned task descriptions provide the focus for the design and development of interactive systems that will support the users' work.

## Keywords

Task analysis, task-based design, work analysis, model-based design, design guidelines, envisioning design, user interface design.

## INTRODUCTION

Task analysis is concerned with understanding work. Task-based design is concerned with developing interactive systems from the perspective of the users' work and usage of the designs. Task analysis is an important HCI technique that enables users to be involved in the design process and enables designers to understand users' work. Task-based design provides work-tasks as the "common ground" between designers and users [6]. It allows designers to understand users' work and users to understand designs. The aim of this tutorial is to provide HCI professionals with applicable knowledge of how to carry out task analyses, how to envision potential changes to users' work tasks and how to design interactive systems from the perspective of these tasks.

Task analysis can be used at multiple points in the design process, to identify and scope the situation of concern, to provide a well-grounded and detailed description of the current work situation, to identify scenarios of usage, to envision new ways of working and to provide benchmark tasks against which designs can be evaluated. Moreover, task analysis can be carried out at various levels of detail,

ranging from gaining an overview of the range and type of tasks in a given organisation to providing a detailed description of how a complex activity is carried out. Recent work, reported in [3], has shown that conducting a task analysis even after a design has been implemented is more effective in generating redesign requirements than discount usability approaches to evaluation. Task-based design allows the designer to focus the design of new interactive systems around users' current work tasks, as identified by task analysis, and around envisionments of how users' work might be in the future.

## MOTIVATION

This tutorial is intended for HCI professionals including designers and developers of user interfaces, human factors practitioners and researchers. The overall objective of the tutorial is to teach the benefits and use of task analysis and task-based design techniques. The motivation for the tutorial stems from a number of recent studies of design practice which indicate that there is poor take-up of task analysis and other HCI techniques, for reasons such as perceived cost and actual lack of expertise.

With respect to cost, it can be more cost-effective to introduce HCI techniques such as task analysis and prototyping into the design process (see for example, [7]). Moreover, [8] identified that designers consider obtaining information about users and tasks as a major contributor to the generation of design ideas. In surveying design practice, [1] found that designers believed that task analysis could contribute significantly to interactive system design and the resulting usability of the designed systems. Knowledge about how users perform tasks enables designers to reason about what aspects of work could or could not be supported, how they could be supported and what changes to the work will come about as a result of a new design. By envisioning how work tasks may be changed, designers and users will be able to consider and reason about the design of interactive systems from a user-work perspective, and to assess the quality of the design in terms of its likely effects upon the quality and performance of the users' work.

## TUTORIAL OBJECTIVES

The tutorial has three main objectives:

- To introduce the ideas of task analysis and task-based user interface design and to consider some of the advantages and limitations of such approaches.

© Copyright on this material is held by the authors

- To describe a selection of methods for analysing and modelling current tasks, envisioning new and changed tasks and developing user interface designs to support tasks.
- To provide practical experience in carrying out task analysis, task modelling and task-based user interface design.

### TUTORIAL CONTENT

The tutorial lasts one full day and involves interactive presentations, demonstrations and small-group exercises. The interactive presentations introduce the concepts and techniques of task-based user interface design. The demonstrations include a video of a task-based design case study. The group work focuses on taking the participants through an analysis of an activity as it is currently performed, envisioning how it might be changed to improve the situation and producing a design for a user interface to a system to support those tasks in an improved situation. This involves participants constructing various task and interaction models and using design guidelines to develop a user interface. One design problem is used as a running example throughout the tutorial: designing a system to support the querying of airline flight information and booking a flight.

A significant portion of the tutorial is devoted to understanding the TKS approach to task analysis and task modelling [2] and [4], and the approach to task-based design developed by the Adept project [5], [9] and [10]. Participants will be provided with hands-on experience of analysing and modelling work tasks, envisioning new and changed forms of tasks and using this as the basis for designing a user interface. The tutorial is structured into four major sections described below.

#### Part 1: Introduction

The tutorial starts by providing participants with an overview of task-based design. The aims and motivations of task-based design and some of its advantages and limitations in relation to other design approaches are considered. A demonstration is given of a complete task-based design process, from the analysis of tasks in radiography to the design of a user interface to an X-ray machine.

#### Part 2: Analysing and modelling work tasks

This part of the tutorial teaches participants the concepts of task modelling and the methods of task analysis. It introduces the Task Knowledge Structures framework for modelling and analysing tasks. Practical experience is given in selecting and using one or more methods to analyse the task of querying and booking flights.

#### Part 3: Envisioning work and uses

In the third part of the tutorial, participants are taught how to envision and reason about changes to tasks, and are provided with guidelines to follow when considering which

aspects of tasks to change. Group exercises again offer participants the opportunity to practice these techniques.

#### Part 4: Designing the user interface

The final part of the tutorial provides participants with techniques and guidelines for developing a user interface design from an envisioned task model, and gives them practical experience in applying these to develop a prototype design for a user interface to the flight booking system. The tutorial closes with a plenary discussion and feedback session.

### REFERENCES

1. Johnson, H. and Johnson, P. Integrating task analysis into system design: Surveying designers' needs. *Ergonomics*, 32, 11, 1989, 1451-1467.
2. Johnson, H. and Johnson, P. Task knowledge structures: Psychological basis and integration into system design. *Acta Psychologica*, 78, 1991, 3-26.
3. Johnson, H. Generating user requirements from task analyses and evaluations. *1st International Conference on Cognitive Ergonomics and Engineering Psychology*, UK, October 1996.
4. Johnson, P. and Johnson, H. Knowledge analysis of tasks: task analysis and specification for human-computer systems. In A. Downton (ed), *Engineering the Human Computer Interface*, McGraw-Hill, 1991.
5. Johnson, P. Johnson, H. and Wilson S. Rapid prototyping of user interfaces driven by task models. In J. Carroll (ed) *Scenario-Based Design*, John Wiley Inc., 1995.
6. Johnson, P. Models that shape design. *Human Factors in Computing Systems, Proceedings CHI96*, ACM Press, 1996.
7. Mantei, M.M. and Teorey, T.J. Cost/benefit analysis for incorporating human factors in the software lifecycle. *Commun. of the ACM*, 31, 1988, 428-443.
8. Rosson, M.B., Maass, S. and Kellogg, W.A. The designer as user: Building requirements for design tools from design practice. *Commun. of the ACM*, 31, 1988, 1288-1298.
9. Wilson, S., Johnson, P., Kelly, C., Cunningham, J. and Markopoulos, P. Beyond hacking: a model-based approach to user interface design. *People and Computers VIII, Proceedings of HCI'93 Conference*, Cambridge University Press, 1993, 215-231.
10. Wilson, S. and Johnson, P. Bridging the generation gap: From work tasks to user interface designs. In J. Vanderdonckt (ed.) *Computer-Aided Design of User Interfaces, Proceedings of CADUI'96*, Presses Universitaires de Namur, 1996, 77-94.