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Designing and Assessing Interactive Systems Using Task Models

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Abstract

This two-part course takes a practical approach to introduce attendees to the principles, methods and tools for task modelling. **Part 1:** A non-technical introduction demonstrates that task models can be the corner stone of successful design of interactive systems. **Part 2:** A more technical interactive hands-on exercise of how to "do it right", such as: How to go from task analysis to task models? How to assess that a task model is correct? How to identify complexity of user tasks and how to reduce it? How to allocate tasks between operators and with automation? How to address user errors in task modelling? And more...

Author Keywords

User Interaction Design, Tasks description and modelling, User Interfaces and Interaction Techniques Assessment.

ACM Classification Keywords

D.2.2 [Software] Design Tools and Techniques, H.5.m. Information interfaces and presentation (e.g., HCI).

Introduction

Task analysis is meant to identify user goals and tasks when using an interactive system. In the case of users performing real life work, task analysis can be a cumbersome process gathering a huge amount of unorganized information.

Task Models (TM) provide a mean for the analyst to store information gathered in an abstract way that can be further detailed and analyzed if needed. A task model allows HCI researchers and practitioners to record in a systematic, complete and unambiguous way the set of user goals and the way those user goals can be performed on an interactive system. Reasoning about the Task Models produced supports the assessment of effectiveness of an interactive system (which is one of the most difficult dimension of usability to assess).

Task models have also proven being of great help for structuring user documentation, designing and assessing a training program, assessing the complexity

of the users' work. If used for analysis, they can also provide support for identifying types, location and likelihood of human errors. When used for design they also provide precious support for identification of good candidates for task migration towards automation.

Contribution and benefit

This course intend to provide newcomers with a background in task modeling. It provides an overview on how the recent advances in task description techniques can be exploited to design and assess interactive systems.

As task models can be large, it is important to provide the analyst with computer-based tools for editing task models and for analyzing them. To this end, this course provides attendees with a pragmatic toolset, including techniques, guidelines and the HAMSTERS task modeling tool that can be directly applied in practice. The tool will be distributed to attendees together with several examples going from toy examples to industrial projects.

Objectives

On completion of this tutorial, attendees will:

- Know the benefits of using task modeling techniques to design, structure and assess user interfaces,
- Be able to describe users' activities in a systematic and structured way,
- Have experience in analyzing an interactive systems focusing on the tasks users have to perform with it,
- Know how to use the HAMSTERS tool suite for editing, analyzing and simulating task models.
- Know how user errors can be represented in a task description and how to assess interaction

costs (e.g. number of actions) for the users to recover from these errors.

Description and content

This course is composed of two parts:

Part 1: the basic principles for design and assessment of interactive systems using task models

- What task models are good for (recording the output of task analysis, performance evaluation of users, tasks complexity assessment[9] ...)
- Basic principles of task models (hierarchical view on human activities, abstraction and refinement, temporal ordering, objects, information and knowledge ... [7])

Part 2: the advanced techniques and case studies

- Automation design (identification of users' activities that could be good candidates for task migration towards automation, authority sharing, impact of automation degradation on tasks performance) [12],[14]
- Benefits of using task models in various stage of the interactive system development (structuring user documentation, designing and assessing a training program [13], assessing the complexity of the users' work)
- Taking into account human errors at design time using task models (identification of types, location and likelihood of human errors [11])
- Dealing with large scale application using structuring mechanisms in task models [5] and [8].

In addition, this course will provide attendees with:

- A state of the art on task modelling techniques
- A set of case studies (and their related task models) from various domains

Presentation

Lecture with slides, demonstrations and practical exercises. The course is approximately 60% tutorial and 40% activities with the HAMSTERS graphical editor and simulator.

Agenda

This course is intended to be taught in two consecutive parts, one focusing on basic principles and notations, the other focusing on interactive hands-on exercises, case studies and HAMSTERS tool practice.

Audience and Prerequisite

This course is open to researchers, practitioners, educators and students of all experience levels. No specific skills or knowledge are required beyond a background in User Centered Design.

Resources

Each attendee of the course will receive a USB key containing HAMSTERS graphical editor and simulator, a set of examples, the course notes (including slides and a 30 page textual documentation) and a video demonstrating the use of the HAMSTERS tool.

Course background

This course has been taught for the first time at an international conference at CHI 2015 [10]. The course has also been taught at the Brazilian conference in HCI (IHC 2015) [5]. At University level, this course is taught in different place such as the Master on HCI in Toulouse (in French).

Instructors' background

The instructors have applied task modeling techniques to several industrial projects such as the design of

collaborative environments to manage collision risks between satellite and space objects (more information can be found at:

<http://www.irit.fr/recherches/ICS/projectsummary/projects.html>).

Philippe Palanque is Professor in Computer Science at University of Toulouse 3. He has been teaching HCI and task engineering classes for 20 years and is head of the Interactive Critical Systems group at the Institut de Recherche en Informatique de Toulouse (IRIT) in France. Since the late 80s he has been working on the development and application of formal description techniques for interactive system. He has worked on research projects to improve interactive Ground Segment Systems at the Centre National d'Études Spatiales (CNES) for more than 10 years and is also involved in the development of software architectures and user interface modeling for interactive cockpits in large civil aircraft (funded by Airbus). He is also involved in the research network HALA! (Higher Automation Levels in Aviation) funded by SESAR program which targets at building the future European air traffic management system. The main driver of Philippe's research over the last 20 years has been to address in an even way Usability, Safety and Dependability in order to build trustable safety critical interactive systems. As for conferences he is a member of the program committee of conferences in these domains such as SAFECOMP 2013 (32nd conference on Computer Safety, Reliability and Security), DSN 2014 (44th conference on Dependable Systems and Networks), EICS 2014 (21st annual conference on Engineering Interactive Computing Systems) and was co-chair of CHI 2014 (32nd conference on Human

Factors in Computing Systems) and research papers co-chair of INTERACT 2015.

Célia Martinie is Assistant Professor in Computer Science at University of Toulouse 3. She has been working on task modeling techniques for the design and development of interactive systems since the beginning of her PhD in 2009. Prior to that, she worked in the mobile industry (Motorola) during 8 years, and has contributed to the design and development of user interfaces for mobile devices. She is the principal investigator of the projects related to the design and development of the HAMSTERS notation and tools. She applied the task modeling approaches to a variety of systems including satellite ground segments, interactive cockpits of large civil aircrafts and air traffic control workstations.

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