Designing and Assessing Interactive Systems Using Task Models (2017)

Philippe Palanque, Célia Martinie, Marco Winckler

Designing and Assessing Interactive Systems Using Task Models

Philippe Palanque[*], Célia Martinie[*], Marco Winckler[*,§]

[*] IRIT – Université Paul Sabatier Toulouse 3, Toulouse, France
[§] Université Nice Sophia Antipolis (Polytech)

{palanque, martinie, winckler}@irit.fr

Abstract - This two-part course takes a practical approach to introduce the principles, methods and tools in task modelling. Part 1: A non-technical introduction demonstrates that task models support 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 (through analysis and simulation) that a task model is correct? How to identify complexity of user tasks …

Keywords. User Interaction Design, Task description and modelling

1 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 practionners 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.

2 Contribution and benefit

This course intends to provide newcomers with 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 the HAMSTERS task modeling tool that can be directly applied in practice.

3 Objectives

On completion of this tutorial, attendees will:

- Know the benefits of using task modeling techniques to design, structure and assess UIs,
- 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.

4 Description and content

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:

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 [1] [6] [5]1 …)
- Basic principles of task models (hierarchical view on human activities, abstraction and refinement, temporal ordering, objects, information and knowledge … [8])

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) [9], [4]
- Benefits of using task models in various stage of the interactive system development (structuring user documentation, designing and assessing a training program [7], 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 [2])
- Dealing with large-scale application using structuring mechanisms in task models [10] and [3].

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

5 Presentation

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

6 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.

7 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.

Marco Winckler is full professor in Computer Sciences at Université Nice Sophia Antipolis (Polytech), Sophia Antipolis, France. He investigates models, methods, techniques and tools to support the development of reliable, usable and effective interactive systems. He obtained a PhD degree in Informatics (2004) from Université of Toulouse 1 Capitole (Toulouse, France), a Master's degree in Computer Science (1999) from the Universidade Federal do Rio Grande do Sul (Porto Alegre, Brazil) and a Post-doc degree from the Université catholique de Louvain (Louvain-la-Neuve, Belgium). His research combines topics of Engineering Interactive Systems, Human-Computer Interaction and Web Engineering. He also serves as chair for the IFIP working group 13.2 on Methodologies for User-Centered Systems Design and secretary of the IFIP TC 13 on Human-Computer Interaction.

8 References

1. Anett, J. Hierarchical Task Analysis. In Diaper Dan, Stanton Neville (Eds), The Handbook of Task Analysis for Human-Computer Interaction (pp. 67-82). Lawence Erlbaum Associates, 2004.
2. Fahssi R., Martinie C., Palanque P. Enhanced Task Modelling for Systematic Identification and Explicit Representation of Human Errors. IFIP INTERACT (4) 2015: LNCS, Springer Verlag 192-212.
3. Forbrig P., Martinie C., Palanque P., Winckler M., Fahssi R. Rapid Task-Models Development Using Sub-models, Sub-routines and Generic Components. IFIP HCSE 2014: 144-163.
4. Bernhaupt R., Cronel M., Manciet F., Martinie C., Palanque, P. Transparent Automation for Assessing and Designing better Interactions between Operators and Partly-Autonomous Interactive Systems. ATACCS 2015, ACM DL.
5. Fayollas C., Martinie C., Palanque P., Deleris Y., Fabre J-C., Navarre D. An Approach for Assessing the Impact of Dependability on Usability: Application to Interactive Cockpits. IEEE European Dependable Computing Conference, 2014: 198-209.
6. Greenberg, S. Working through Task-Centered System Design. In Diaper, D. and Stanton, N. (Eds) The Handbook of Task Analysis for Human-Computer Interaction. Lawrence Erlbaum Associates. 2002.
7. Martinie C, Palanque P., Navarre, D., Winckler, M., Poupart R. Model-based training: an approach supporting operability of critical interactive systems. ACM SIGCHI EICS 2011: 53-62.
8. Martinie C., Palanque P., Ragosta M., Fahssi R. Extending procedural task models by systematic explicit integration of objects, knowledge and information. Europ. Conf. on Cognitive Ergonomics, 2013: 23-34, ACM DL.
9. Martinie C., Palanque P., Barboni E., Ragosta M. Task-model based assessment of automation levels: Application to space ground segments. IEEE SMC, 2011: 3267-3273.
10. Martinie, C., Palanque, P., Winckler, M. Designing and Assessing Interactive Systems Using Task Models. Book of Tutorials of the 14th Brazilian Symposium on Human Factors in Computing Systems, 29-58, Springer.