An approach for Interactive Dialogue Modelling of Multimodal Applications

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ABSTRACT
This poster presents ongoing work of an approach for the model-based design of multimodal applications that can be adapted to various multimodal setups.

Keywords
Interaction Modeling, Model-based User Interface Development, Multimodal Interaction, HCI.

INTRODUCTION
Nowadays multimodal systems that support the user by a combination of speech, gesture and graphical-driven interaction are already part of our everyday life. Examples are combinations of speech-driven and graphical interfaces like in-car assistance systems, language-learning software, or tourist information systems. The market success of recent video-games that can be controlled in a more natural and intuitive way by using hand gestures, balancing and moving the body demonstrates that even new audiences can be addressed by enabling multimodal interaction to ease the usage of interactive systems.

All these systems have one aspect in common. They rely on a static, predefined multimodal interaction setup, where the interaction devices, paradigms and the possibilities of controlling their applications are predefined. Changes to the multimodal interaction setup require re-implementing the application.

RELATED WORK
Modeling multimodal systems that support various multimodal setups is an open research issue. A recent promising work by [5] that implemented a model-based development process to generate multimodal web interfaces stated the importance of considering the CARE-properties [7], but neglected the support of modeling complementary or redundant multimodal interaction to support multimodal fusion. The CAMELEON framework [1] summarizes various model-based user interface development approaches and identifies a set of models that are generally used to design interfaces for different devices, but does not consider multimodal system design.

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Research how to design multimodal interfaces has resulted in both modality-independent and modality-dependent dialogue models. The latter ones concentrate on proposing dialog models to design a certain modality (mainly graphics like [6] or a specific multimodal setup [5]. The former ones propose a set of abstractions by interactors or generic widgets that are transformed by rules [2] or interpreted at runtime to result in concrete widgets [4].

CHALLENGES
Research on model-based development to design user interfaces for heterogeneous platforms based on common abstractions has been successfully performed since a long time. But looking at developing multimodal systems, it keeps questionable if different modalities have more in common than that they differ in order to argument for a modality independent dialogue model.

The basic challenge of our work is about to specify a modeling notation that enables modeling of multimodal applications for arbitrary multimodal setups. Different to earlier work of others, we consider all the characteristics of multimodal systems as defined by the CARE properties [7] to describe complementary, assigned, redundant, and equivalent relationships between the modalities.

INTERACTOR AND INTERACTION SETUP MODELING
To specify multimodal applications dialogs for different multimodal setups, we require two basic building blocks: (abstract) interactors to construct the user interfaces and specifications of all the multimodal setups that should be considered during the design. Further on, we need mappings to connect interactors to multimodal setups.

For our current approach we use state-charts to describe the behavior of both, the multimodal setups and the interactors. Figure 1 illustrates by the left box the behavior of a mouse, which we specify as an input interaction resource (IR:IN) consisting of a pointer and a button device. The pointer can be moved while communicating it’s X,Y coordinates and is set to stopped as soon as the user does no longer move it for at least 0,3 seconds. A button is defined to be pressed or released.

Like proposed by the CAMELON framework [1] user interfaces can be described on an abstract user interface (AUI) abstraction, which is considered a modality-independent description and a concrete, modality dependent model level (CUI).

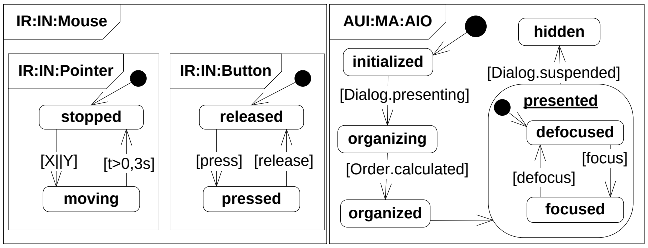

Figure 1: The behaviour of a mouse and an abstract interactor.

The right box of figure 1 illustrates an abstract interactor (AIO) on the former level that gets organized for navigation between interactors if the dialog that contains the AIO should be presented. During the AIO is presented it is initially defocused and can be focused by the user (e.g. during interface navigation).

Figure 2 shows a complementary mapping of two input modalities (the pointer and button of the mouse) with the AIO above. Multimodal complementary requires information of two or more modalities to be merged together to catch the actual meaning. A drag-and-drop mechanism is an example for complementary fusion since it requires a pointer to be stopped on an AIO "e" (that is focused) and the mouse button to pressed - in a short temporal window (e.g. 0,3s). If the button is pressed the interface is in the "dragging" state and waits for the button to be released. Only if the button is released while an AIO "c" is focused, the complementary fusion (C) considers this as: "e dropped on c". An exit condition "E" signals that the

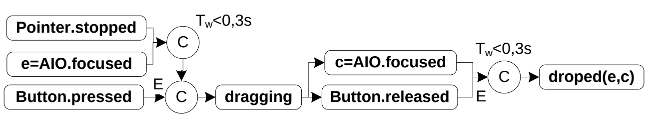

Figure 2: A complementary mapping example that implements a drag-and-drop mechanism.

mapping gets reset to its initial state in case C does not hold (e.g. the button is pressed or released without an AIO in focus.

EXPECTED RESULTS

By a detailed behaviour specification of a broad set of modalities including gesture, speech and graphical modalities we expect to identify their differences and similarities on a very fine grained level. This will allow us to implement a dialog modelling editor that supports designing multimodal applications for different setups. We hope to find a condensed graphical modelling notation that is easier understandable for interaction designers (such as e.g. used in the MoLIC designer [3]) but since we intend to directly execute the dialogs the state-machine definitions will ease the dialog interpretation.

EVALUATION IN E-LEARNING

Multimodal approaches to learning have been proven to be extremely effective since information introduced aurally, visually and kinesthetically can significantly increase the possibility of understand and remembering information.

The evaluation focuses on implementing a multimodal e-learning application that can be adapted to different multimodal learning setups to evaluate the development effort (to implement the application for the initial and subsequent multimodal setups) when following our approach.

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REFERENCES

1. Gaelle Calvary, Joelle Coutaz, David Thevenin, Quentin Limbourg, Laurent Bouillon, and Jean Vanderdonckt. A unifying reference framework for multi-target user interfaces. *Interacting with Computers*, 15(3):289–308, 2003.
2. Quentin Limbourg, Jean Vanderdonckt, Benjamin Michotte, Laurent Bouillon, and Victor Lopez-Jaquero. USIXML: A language supporting multi-path development of user interfaces. In Remi Bastide, Philippe A. Palanque, and Joerg Roth, editors, *EHCI/DS-VIS*, volume 3425 of *Lecture Notes in Computer Science*, pages 200–220. Springer, 2004.
3. Ugo Braga Sangiorgi and Simone D.J. Barbosa. Molic designer: towards computational support to hci design with molic. In *EICS '09: Proceedings of the 1st ACM SIGCHI symposium on Engineering interactive computing systems*, pages 303–308, New York, NY, USA, 2009. ACM.
4. Robbie Schaefer. *Model-based Developent of Multimodal and Multi-Device User Interfaces in Context-Aware Environments*. PhD thesis, C-LAB Publication, Band 25, Shaker Verlag, Aachen, 2007.
5. Adrian Stanciulescu. *A Methodology for Developing Multimodal User Interfaces of Information Systems*. PhD thesis, Universite Catholique de Louvain, 2008.
6. Hallvard Traetteberg. Dialog modelling with interactors and uml statecharts - a hybrid approach. In *DSV-IS*, pages 346–361, 2003.
7. Frederic Vernier and Laurence Nigay. A framework for the combination and characterization of output modalities. *Lecture Notes in Computer Science*, 1946:35ff, 2001.

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