

EMODE

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Model-based approach cuts cost of complex user interfaces

The EMODE project showed that it is possible to simplify user interaction for complex business systems at low cost. Use of a model-based approach to design the user interface enables automation of development and so improves productivity, maintenance and evolution by a factor of three to four. This ensures gains in terms of efficiency, effectiveness, satisfaction and cost. Moreover, models used for design can be reused to manage interactions, ensuring coherence between user requirements, designers' developments and final operation.

State-of-the-art adaptive multimodal interfaces providing the user with new means of interaction such as voice or gesture and dynamically adapting to user needs have not yet reached the professional systems market. Current user interfaces (UIs) are designed and set up once and for all without any provision for adaptation at runtime. As a result, UIs remain the weak point of many complex systems, the problem of human-computer interaction not being considered as a central issue in their design and development.



Smartphone / touch screen

While user interfaces for domestic equipment or large public applications have been made much easier to use in recent years, complex business system interfaces still rely on classical window, icon, menu, pointing device (WIMP) interaction. This often leads to non-natural interaction or to long sequences of interactions to access some functionalities. In the worst cases, operators suffer a cognitive overload in critical situations: too much

information, too many actions to perform or non-access to additional information without losing the context.

Industrial systems providers argue that introducing state-of-the-art modalities and adaptability functionalities is too costly in terms of benefits, usability and reusability or global return on investment. For example, a grammar for a voice-recognition and command system requires some 10 Mbyte of text. Such an investment is huge for a single system and even worse if it cannot be adapted or reused subsequently.

TWO MAJOR INNOVATIONS

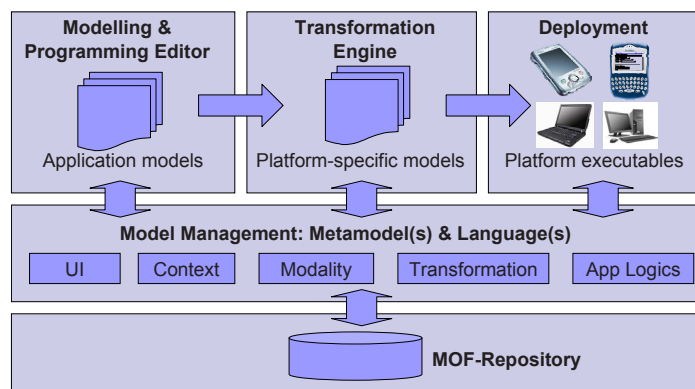
EMODE set out to make the next generation of human-machine interfaces (HMIs) for professional systems much easier to use. In particular, the aim was to tailor UIs of complex systems to specific customers' needs. To achieve this, EMODE introduced two main innovations:

1. A *model-driven approach* for adaptive multimodal interactive systems that is particularly cost effective.

The return on investment is linked to the introduction of new modalities and reusability of models thanks to:

- Increased productivity through time saving in design and development phases;
- Easier adaptation to new systems thanks to a new interaction architecture;
- Easier adaptation to new customer-specific needs; and
- Better maintainability thanks to model manipulation, automatic generation and readability.

2. A new *interaction paradigm* made possible by the use of design models during the runtime phase. This provides coherence between user requirements expressed during the design phase, and the interactive systems – both classical HMIs and new interactive modalities. At the end of the design process, the interaction – use of modalities to achieve the user's task – is the real front-end of the user needs and totally matches these requirements. EMODE's interaction architecture and model-based approach lead to a natural multimodal interaction with no user frustrations.



Example of EMODE Conceptual Design Environment

The EMODE approach applies models as a means of abstraction that can be augmented step-by-step in an iterative process with platform-specific information using model transformation. This makes possible a semi-automatic transfer into an executable software system.

As a result, EMODE's methodology simplifies the design of adaptive multimodal interfaces. New software architectures clearly separate system design from user interface design. Modelling techniques are used to design generic user interfaces that can then be tailored to specific application domains, users and contexts of use. Last but not least, model-transformation techniques make the design and implementation process as auto-

matic as possible and thus considerably lower the cost of user-interface production.

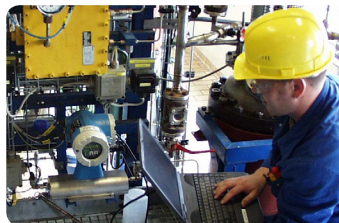
PROVEN IN FOUR DIFFERENT DOMAINS

The runtime environment for adaptive multimodal applications developed in EMODE was validated in a series of demonstrators covering four domains with different kinds of users:

1. Daimler developed an interface offering vocal commands for an advanced in-car navigation system. A particular advantage was the ability to access 'hidden' commands quickly – a single vocal command could replace up to six mouse clicks. It was also possible to develop the whole interface in only two or three weeks;
2. Philips showed the benefit of the EMODE approach in a home entertainment system application, enabling domestic multimedia server systems to be controlled by a mobile phone;
3. THALES proved the efficiency in the complex and constrained domain of maritime surveillance. The purpose of the system was to identify ships in a predefined zone as well as detecting and processing events such as accidents or pollution. The interface

was designed to use natural language and dialogues for multimodal interaction; and

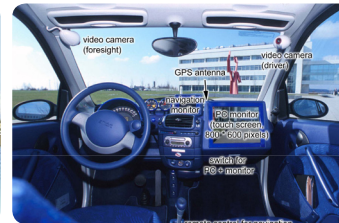
4. BASF demonstrated the design and runtime approaches in the context of mobile plant maintenance.



EMODE Demonstrators' Domains

From an interface developer's point of view, the evaluation of the EMODE approach has impressively demonstrated its benefits for model-based HMI development.

After an adequate initial training phase supported by extensive documentation, applications supporting text as well as voice modalities can be implemented in less time than with traditional methods and tools. Following



the model-based design approach, EMODE demonstrated performances three to four times better than usual for productivity, maintenance and evolution with an automation of the development. In case of porting, only specific code has to be redeveloped.

EMODE not only proved that such kind of devices and modalities are cost effective but the models used for design can be reused to manage the interaction, ensuring coherence between user requirements, designers development and final interaction.