Methodology for rapid prototyping and testing of Speech Recognition user interfaces in Telefónica Móviles España

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Abstract

Telefónica Móviles España (TME) is Spain's largest mobile telecommunications operator in number of customers. TME is continuously providing new services to its customers and a main objective is to ensure their usability. One of the key services deployed during 2002 has been the Portal de Voz (Voice Portal). This service provides hierarchical navigation on pre-recorded or synthetic speech contents like news, weather forecasts, horoscope, stocks news, and also complex queries, as films shown in a specific theatre, all obtained by a complex information retrieval service that can be managed by both speech recognition and more traditional DTMF commands.

The product brief placed great emphasis on the usability of the system, and thus planned for a corporate Style Guide for dialogues and navigation procedures. This Style Guide was made available to designers and developers from the beginning of the project, and iteratively refined from early tests of the prototypes. The user tests were based on a methodology that combined usage scenarios, several types of users, and different use contexts, by means of experimental design procedures. However, the difficulty in producing realistic working prototypes in early phases suggested the need to have a software tool that could emulate limited sets of the system functions in selected contexts, to allow quick testing by using a software simulation rather than actual prototypes.

This software tool is called SIS-PRUEBA and is built on top of Microsoft Visio™, integrating proprietary software tools to manage the simulation processes, the user tests and data capture, and the generation of documents from the trials. The software tool can also simulate data services, by using a mobile terminal on-screen emulator. In short, SIS PRUEBA:
- Integrates realistic usage scenarios within a standard software design tool. Designers can easily integrate user responses and input together with more usual functional parameters.
- Makes possible the on-line query of the style guide developed prior to the project.
Simulates realistic user navigation processes by scanning through the forms represented in flowcharts. This way it allows detecting and storing critical points and errors by means of rapid tests on the flowcharts.

- Allows the quick testing of variations of important system properties: time-outs, delays, interruptibility of speech sequences, number of active grammars, error probabilities associated to speech recognitions, etc.

- Generates and manages user test cases by applying experimental design procedures to the combinations of scenarios, contexts and type of users.

This software tool has made possible a quick deployment in TME of a design methodology firmly based on customer needs, and focused from the beginning on the usability.

Key words: Software development methodology, usability, rapid prototyping

1.  Telefónica Móviles is a global telecommunications operator

Telefónica Móviles (http://www.telefonicamoviles.com) is the company of the Grupo Telefónica (http://www.telefonica.com/home_eng.html) dedicated to the mobile telephony business. In May 2003, Telefónica Móviles was the sixth world operator by capital, managing over 45.7 million customers, mainly in Spain and Latin-America, including Mexico, Brasil, Peru, Chile and Argentina.

In Spain, Telefónica Móviles closed 2002 with more than 18.4 million customers, an increase of 10%, once again making it the largest incumbent operator with the greatest national market share among large European countries (estimated at 55% at December 2002).

Telefónica Móviles España is the only Spanish operator with a positive differential between its share of outgoing traffic and its client share. The outstanding success of the Company’s marketing campaigns throughout the year can be demonstrated by the fact that churn has decreased by one percentage point throughout the year, reaching monthly rates of 1%. Another factor which explains this success is the greater weight of contract customers, which has meant that the growth of minutes of use (MOU) has increased in year-on-year terms for the first time in the Company’s history.

The greater quality of the client portfolio has also favoured an increased importance of data services and contents. These grew by 30% during the year, to reach 12% of average revenue per user.

TME is continuously providing new services to its customers and a main objective is to ensure their usability. One of the key services deployed during 2002 has been the Portal de Voz (Voice Portal). This service provides a single entry to many information retrieval services already available by SMS, but with a voice and DTMF user interface. The whole service provides hierarchical navigation on pre-recorded or synthetic speech contents like news, weather forecasts, horoscope, and stock news. It also allows complex queries, as films shown in a specific theatre, all obtained by a complex information retrieval service that can be managed by both speech recognition and more traditional DTMF commands.
2. **User-Centred service development methodology in Telefónica Móviles España**

As one of the most complex services to design and deploy, the Portal de Voz was subject to extensive work from the methodological point of view. Usability was a core attribute from the beginning of the design phase, with the following objectives (as can be found in Helander, 1998):

- Usability must be quantifiable and not an opinion.
- Usability must be in the same level as other quality attributes in software engineering, as reliability or performance.
- It is essential to reach early consensus on the usability definition and criteria in the design team.
- Usability objectives must be weighted and prioritised as a function of the global objectives of the system.
- Objectives must be clearly separated of methods and implementations.

Based on well-known usability standards, like ISO 9241, ISO 13407, and in the Unified Process (UP) and Unified Modelling Language (UML) software engineering approaches, the usability group in Telefónica I+D proposed a development driven by use cases. It is based in components and is iterative.

Use cases represent the basic requisites to be accomplished by the system. The development process requires an increasing refinement of the requisites. The success criteria are met when the specifications in the use cases are met, and these are basis for the tests. A thorough description of the Unified Process can be found in Jacobson and Rumbaugh (2000).

The development methodology also defines the following essential concepts:

- **User**: the user is always a person, the woman or man who interacts with an application or service. But he or she is never in a single category, nor has the same interests or objectives or preferences in different moments. Therefore, the definition for the different types of users must include the cognitive and motor requirements and previous experience or training for the use of the system under consideration.

- **Functionality**: it is the component implemented or to be implemented in a service or system that allows the user to achieve an objective. For instance in our example, accessing a theatre list in a retrieval system by means of a mobile telephone.

- **Context of use**: this is formed by all the variables and situations that form the environment in which the user is when using the system. This concept includes other users, equipment, physical and social environment. In our service, the Portal de Voz, different contexts that have to be considered are silent versus noisy environments, or handsfree vs. traditional use of the terminal when accessing the service.

- **The use case (or usage scenario)** is a representation of all conditions and actions that the user has to carry out in order to perform an interaction, which is always conducted by relevant objectives for him or her. For instance, for the Portal de Voz, and for the service
"Musical Agenda", a use case was consulting pop-rock music events and within them, to be able to know the place of celebration of a concert, and the date and time.

- Test case represents a concrete situation with which you validate system and user requisites as specified in a use case. A test case is itself a process, including several components: work scenario, test procedure, and evaluation of the test.

With all these concepts two aggregates are built: use case model, representing all user types and all possible use cases, and tests model, which selects a representative set of the use case model together with their associated test cases, all by means of an experimental design.

3. **SIS-PRUEBA: A software tool to manage the user-centred methodology and for rapid prototyping of services**

![Figure 1: Screenshot of the main module of SIS-PRUEBA](image)

SIS-PRUEBA is a software tool developed by Telefónica I+D for Telefónica Móviles, which allows to:

- Maintain all components of the methodology in a single database. Each project can create and maintain all definitions as stated previously, i.e., functionality, user types, use contexts, etc.
- Create test models by combining the different concepts and using basic experimental designs.
- Create and maintain usability criteria, questions for user tests and all associated tools as required in actual usability tests.
- Manage user tests in both "paper and pencil" and "remote testing" (either web or e-mail) formats. This module allows the automatic capture of the generated data.
- Manage grammars, DTMF syntax and expressions, including stored voice recordings and also synthetic speech files, for speech recognition services.
- Provide support for modelling of voice services, by the use of a modelling tool, Microsoft Visio™, and allowing on-line consultation of the corporate voice services style guide and also allowing to emulate and quickly prototype any data or voice services over the produced diagrams.

Figure 2: Screenshot of the service emulation and rapid prototyping module of SIS-PRUEBA (on top of Microsoft Visio™)

4. Benefits obtained with SIS-PRUEBA and the User-Centred development methodology in Telefónica Móviles

SIS-PRUEBA and the methodology on which it is based has allowed to:

- Standardise all properties of the basic components of voice-operated services in Telefónica Móviles, by proposing a practical set of tools that have been applied in all development stages.
- Implement an iterative methodology that works from the very beginning of the project with real use scenarios, in addition to functional parameters, at the same time allowing tests of early prototypes.

- Improve the efficiency of the whole development process and the final quality of the product as delivered to the market.

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