Context

- **UPV Team Members:**
  - Oscar Pastor
  - Silvia Abrahão
  - Sergio España
  - Ignacio Panach
  - Inés Pederiva
- **UCL Team Members:**
  - Jean Vanderdonckt, *Université catholique de Louvain*
  - Céline Mariage
  - Costin Pribeanu
- **Cooperation with MAUSE project partners**
  - http://www.cost294.org/

MAUSE

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Goal

- Assess the usability of the user interfaces of IS produced by OlivaNova Model Execution (ONME).
- The long term goal of the project is **to prove that the UIs (as they are generated) satisfy a certain level of usability** and that this level is reached by construction.
- Compare a UI designed by several experienced designers and the UI generated by ONME for a same IS starting from the same models.
- Provide an empirical evidence of the usability of user interfaces generated by a tool.

Project Phases

1. Selection of Case Studies
2. Usability Evaluation WITHOUT users
3. Usability Evaluation WITH users
4. Comparative Analysis

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Selection of Case Studies

- **Select 3 case studies** in the portfolio of IS generated by ONME:
  - Should have varying levels of complexity:
    - A first case study could be a toy example for facilitating the experimentation, a second case study could be a moderately-complex system, a third one could be more complex while the semantics of the domain should stay affordable.
  - Should be realistic enough to warrant credibility of the testing
  - Should be available/developed for 3 different contexts of use:
    - An environment suitable for desktop applications with a programming language (e.g., Visual Basic, Visual C++, Java).
    - An environment suitable for multi-platform rendering with a markup language (e.g., HTML).
    - An environment suitable for mobile applications with any language (e.g., C# for Pocket PC).
  - Should provide access to a reasonable base of real end-users (i.e., who are really using the system in their daily work, not designers or developers).
  - Should manipulate a reasonable amount of data. The conceptual model should not only consist of a few classes and relationships.

Project Phases

1. Selection of Case Studies
2. Usability Evaluation WITHOUT users
3. Usability Evaluation WITH users
4. Comparative Analysis

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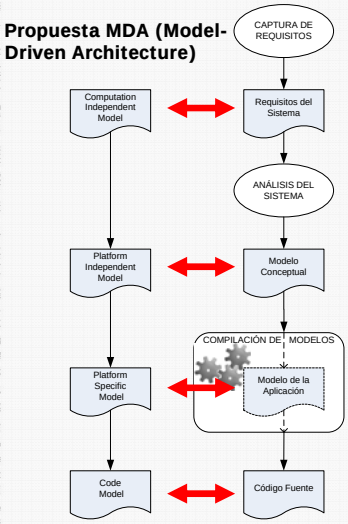
Relationships between MDA and ONME



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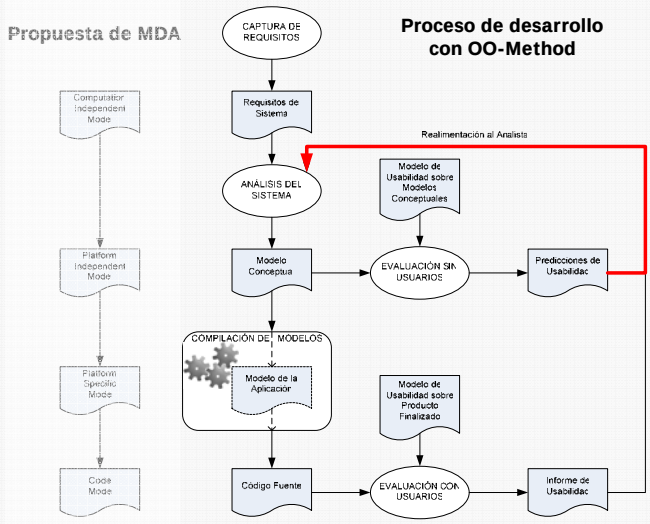
Early Usability Evaluation (without users)



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Evaluation Without Users

- Selection of the **Usability Evaluation Method (UEM):**
  - Heuristic Evaluation and Action Analysis
- Identification of a **base of usability guidelines:**
  - General usability guidelines for Graphical User Interfaces (GUIs)
  - Specific usability guidelines for the context of use, that is the user, platform, and environment (i.e., specific guidelines for HTML, Pocket PC, accessibility guidelines)
- Constitution of a **common repository of guidelines**
  - Usability guidelines should be structured according to quality models (ISO/IEC 9126, ISO/IEC 9241, etc..)
- Selection of the evaluators (usability engineers, human factors expert, etc.)
  - UPV: Inés, Ignacio, Sergio, Silvia, Oscar
  - UCL: Céline, Jean, Costin
- Definition / selection of templates to document the usability evaluation results (Usability Evaluation Reports)

Evaluation Without Users

- Analysis and discussion of the results. Expected analysis contents will be:
  - Classification of usability problems by criteria, linguistic level, severity, etc.
  - Amount of usability problems per case study, in average
  - Amount of usability problems per computing platform
  - Analysis of convergence and divergence of results provided by different evaluators
  - Analysis of the severity of the usability problems
  - Results of the negotiation between the evaluators
  - Analysis of design recommendations to solve the usability problems
  - Possible link to tweaking activities classification: what are the operations needed to fix the problem? Is it an operation on a model, on several models, or is it a manual tweaking?

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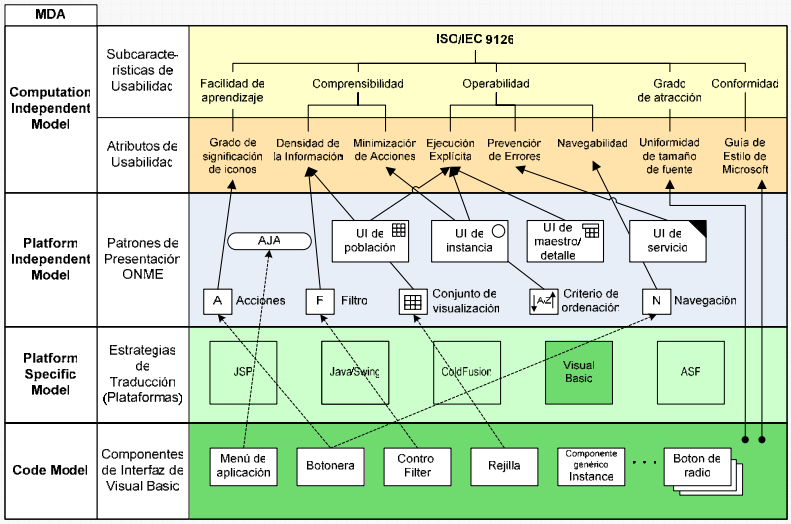
Usability Model for Early Usability Evaluation



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Usability Model for Early Usability Evaluation

Tabla 1. Árbol de aributos de usabilidad

1. **Facilidad de aprendizaje**
   1.1. Facilidades de Ayuda
      1.1.1. Completitud de Documentación
      1.1.2. Documentación Multiusuario
         1.1.2.1. Distinción por Capacitación
         1.1.2.2. Distinción por Rol
   1.2. Predecibilidad
      1.2.1. Grado de Significación de Iconos
      1.2.2. Título de Iconos o Enlaces
      1.2.3. Determinación de la Acción
   1.3. Realimentación Informativa
   1.4. Facilidad de Memorización
2. **Comprensibilidad**
   2.1. Legibilidad
      2.1.1. Tamaño de Fuente
      2.1.2. Contraste
      2.1.3. Disposición
   2.2. Facilidad de Lectura
      2.2.1. Agrupación Cohesiva de la Información
         2.2.1.1. Agrupación por Disposición
         2.2.1.2. Agrupación por Formato
      2.2.2. Densidad de la Información
   2.3. Familiaridad de conceptos
      2.3.1. Significación del Etiquetado
      2.3.2. Internacionalización
   2.4. Reducción de la Carga de Trabajo
      2.4.1. Brevedad
         2.4.1.1. Inicialización de Valores
            2.4.1.1.1. Compleción de Valores Iniciales
            2.4.1.1.2. Modificabilidad de Valores Iniciales
         2.4.1.2. Minimización de acciones
      2.4.2. Autodescripción
   2.3. Orientación al usuario
      2.3.1. Calidad de los Mensajes
      2.3.2. Navegabilidad
3. **Operabilidad**
   3.1. Capacidades de Instalación
      3.1.1. Facilidad de Instalación
      3.1.2. Multiplicidad de Instalación
      3.1.3. Capacidad de Actualización
      3.1.4. Transparencia de Actualización
   3.2. Validación de datos
   3.3. Capacidad de Control
      3.3.1. Aplazamiento de Edición
      3.3.2. Soporte de Cancelación
      3.3.3. Ejecución Explícita
      3.3.4. Soporte de Interrupción
      3.3.5. Soporte de Deshacimiento
      3.3.6. Soporte de Rehacimiento
   3.4. Capacidad de Adaptación
      3.4.1. Adaptabilidad
      3.4.2. Adaptatividad
   3.5. Consistencia
      3.5.1. Comportamiento Constante de Controles
      3.5.2. Permanencia de Controles
      3.5.3. Estabilidad de los Controles
      3.5.4. Consistencia de Orden
      3.5.5. Consistencia de Etiquetado
   3.6. Gestión de Errores
      3.6.1. Prevención de Errores
      3.6.2. Recuperación de Errores
   3.7. Monitorización del Estado del Sistema
4. **Grado de atracción**
   4.1. Metáfora
   4.2. Uniformidad del Color del Fondo
   4.3. Uniformidad del Color de la Fuente
   4.4. Uniformidad del Estilo de la Fuente
   4.5. Uniformidad del Tamaño de la Fuente
   4.6. Uniformidad en Disposición de Elementos
   4.7. Atracción Subjetiva
5. **Conformidad**
   5.1. Cumplimiento con ISO/IEC 9126 (partes 1 y 3)
   5.2. Cumplimiento con ISO 9241-10
   5.3. Cumplimiento con Guía de Estilo de Microsoft
   5.4. Cumplimiento con Guía de Estilo de Java

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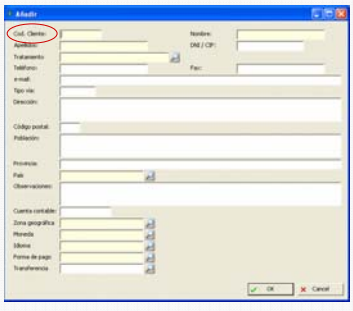
Action Analysis

- An evaluation procedure that forces you to take a close look at the sequence of actions a user has to perform to complete a task with an interface.
- It has two fundamental phases:
  - **First step:** to decide what physical and mental steps a user will perform to complete one or more tasks with the interface.
  - **Second step:** to analyze those steps, looking for problems that the analysis might reveal:
    - It takes too many steps to perform a simple task
    - It takes too long to perform the task
    - There is too much to learn about the interface.

Example



- Clic en crear cliente -> 1.5 seg
- Ver el resultado de la acción. Se abre vent. 2 -> 0.23 seg
- Leer la etiqueta “Cod_cliente” -> 0.34 seg
- Recordar el código del cliente -> 1.2 seg
- Escribir el código del cliente -> 0.84 seg (0.28 * 3)

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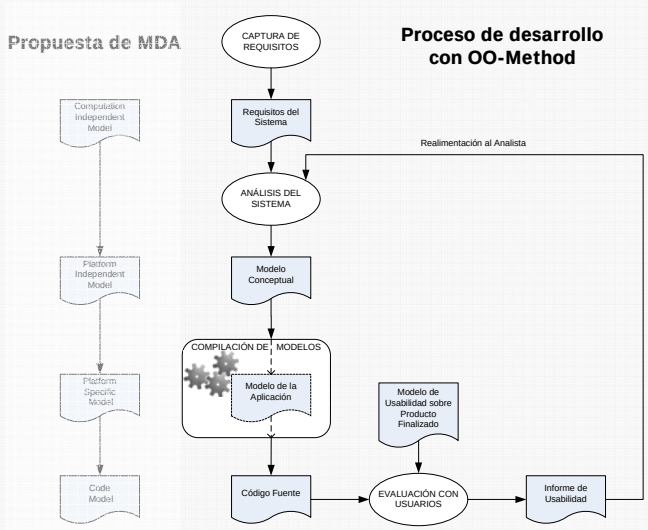
Project Phases

1. Selection of Case Studies
2. Usability Evaluation WITHOUT users
3. Usability Evaluation WITH users
4. Comparative Analysis

Usability Evaluation with Users



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Evaluation With Users (Steps)

- **Selection of the UEM** (i.e., cognitive walkthrough)
- Selection and classification of end users who will test the UIs:
  - Should belong to different groups, Should be male and female, Should include both novice and expert users
- **Specification of the tasks** to be tested by the end users (using the CTT notation)
- **Execution of the tasks** by selected users in the different contexts of use
  - Calibrating the experience
  - Briefing: collect demographic data from the user and explain the procedure
  - Video-taping the actions of the end users
  - Logging activities
  - De-briefing: collect feedback from the end through evaluation surveys

Evaluation With Users (Steps)

- Analysis and discussion of the results:
  - Classification of usability problems by criteria, linguistic level, severity, etc.
  - Amount of usability problems per case study, in average
  - Amount of usability problems per computing platform
  - Analysis of convergence and divergence of results depending on the type of user (e.g., novice vs. expert)
  - Analysis of the severity of the usability problems observed
  - Analysis of the correspondence between observed problems and problems identified in the questionnaire, thinking-aloud technique
  - Analysis of design recommendations to solve the usability problems
  - Possible link to tweaking activities classification: what are the operations needed to fix the problem? Is it an operation on a model, on several models, or is it a manual tweaking?

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Evaluation With Users

Experiment Design Pre-test Operation Analysis of the Results

- Experiment Goal

Analizar	Una aplicación generada automáticamente
Con el propósito de	Evaluar
Con respecto a	Su nivel de usabilidad
Desde el punto de vista de	Usuarios
En el contexto de	CARE Tech y la tecnología OlivaNova

Aplicación: AGUAS DEL BULLENT
Día previsto: 20 de diciembre

Workshop Teniendo Puentes IPO-IS, Madrid, Diciembre 2005

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Evaluation With Users

Aplicación: AGUAS DEL BULLENT
Día previsto: 20 de diciembre
Variables dependientes: ver tabla

PdV	Cat	Subcategoría	Métrica
Variables objetivas	Efectividad	Ratio de compleción	**Unassisted Completion Rate**
			Assisted Completion Rate
		Errores	**Mean Errors**
			Range of Errors
			Standard Deviation of Errors
		Asistencias	**Percentage of Assisted Tests**
			Mean Assists
			Standard Deviation of Assists
			Mean Assists in Assisted Tests
			Range of Assists in Assisted Tests
			Standard Deviation of Assists in Assisted Tests
	Eficiencia	Tiempo de la tarea	**Mean Time-On-Task**
			Mean Unassisted Time-On-Task
			Mean Assisted Time-On-Task
			Range of Task Times
			Standard Deviation of Time Tasks
		Medida central	**Completion Rate / Mean Time-On-Task**
Variables subjetivas	Satisfacción	Eficiencia percibida	**SUMI Efficiency Subscale**
		Afecto	**SUMI Affect Subscale**
		Utilidad percibida	**SUMI Helpfulness Subscale**
		Control percibido	**SUMI Control Subscale**
		Facilidad de aprendizaje percibida	**SUMI Learnability Subscale**

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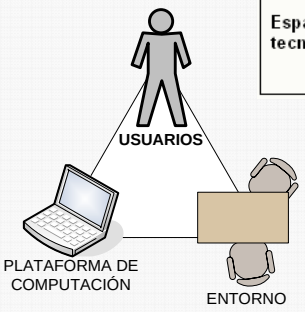
Evaluation With Users

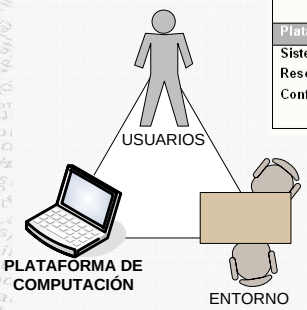
- Context of Use

usuarios (N=6)		Espacio del negocio	
		Noveles	Expertos
Espacio de la tecnología	Noveles	-	user1 user2
	Expertos	user3 user4	user5 user6



Evaluation With Users

Plataforma hardware	
Tipo de Ordenador	Ordenador portátil Fujistu Siemens AMILO Pro
CPU	1.700 MHz
RAM	512 MB
Disco Duro	80 GB (60% libre)
Tamaño de Pantalla	Pantalla Samsung 17' CRT
Teclado	Teclado PS2 mecánico estándar, 102 teclas
Ratón	Logitech™ RX300 ratón óptico, con rueda de scroll, no wireless.
Plataforma software	
Sistema operativo	Microsoft Windows XP Home Edition version 2002 SP2
Resolución	1024 x 768 pixels
Configurac. color	32 bits



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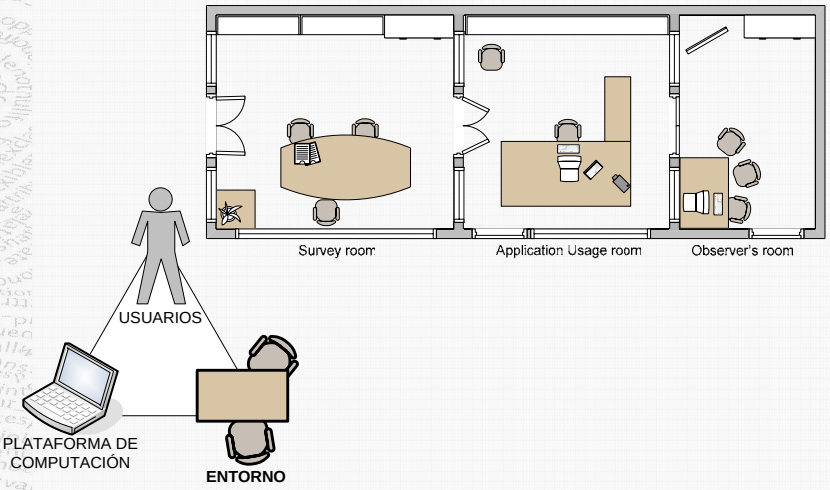
Evaluation With Users



Evaluation With Users

- Experimental Tasks:
  1. Demographic survey
  2. User Testing: use of the application by users and the observation of the evaluators
  3. Post-task survey
  4. Interview/focus group

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Project Phases

1. Selection of Case Studies
2. Usability Evaluation WITHOUT users
3. Usability Evaluation WITH users
4. Comparative Analysis

Comparative Analysis

- Identify **similarities and differences of problems** identified in the evaluation with or without users
  - There is some correlation between results obtained without and with users? If this is the case, a predictive model could be built.
- Compare predictive time obtained by **action analysis** and observed time provided by **user testing**
- Global classification of problems using different taxonomies (CUP, etc.)
- Discussion of the **level of problems**: goal, pragmatic, semantic, syntactic, lexical, alphabetic, physical.
- Determination of the **origin of the problem**: model level, pattern level, transformation level or platform level
- Determine a **plan for design recommendations**, modifications, and improvements in the transformation or code generation.

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