

APPLYING TRANSFORMATION TEMPLATES TO DIVERSIFY USER INTERFACES GENERATED BY MODEL-DRIVEN ENGINEERING

NATHALIE AQUINO¹, LUCA CERNUZZI¹, OSCAR PASTOR²

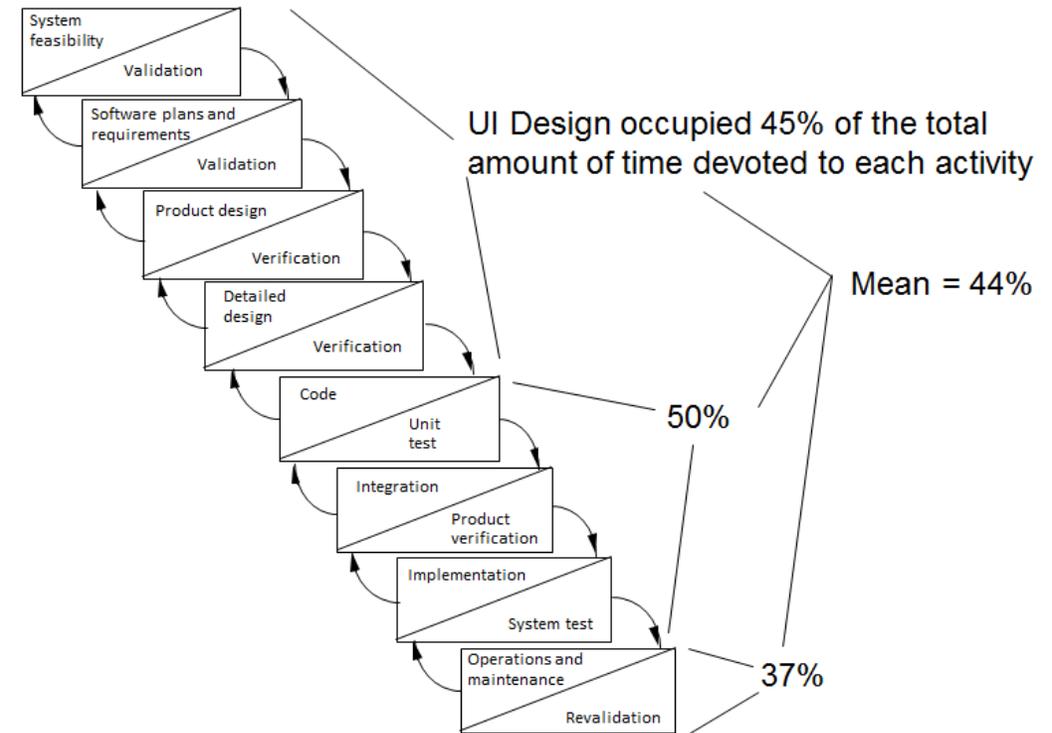
¹Departamento de Electrónica e Informática, Universidad Católica "Nuestra Señora de la Asunción", Paraguay
nathalie.aquino@uc.edu.py, lcernuzz@uc.edu.py

²Centro de Investigación en Métodos de Producción de Software, Universitat Politècnica de València, España
opastor@pros.upv.es

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MOTIVATION DIFFICULTIES RELATED TO USER INTERFACE DEVELOPMENT

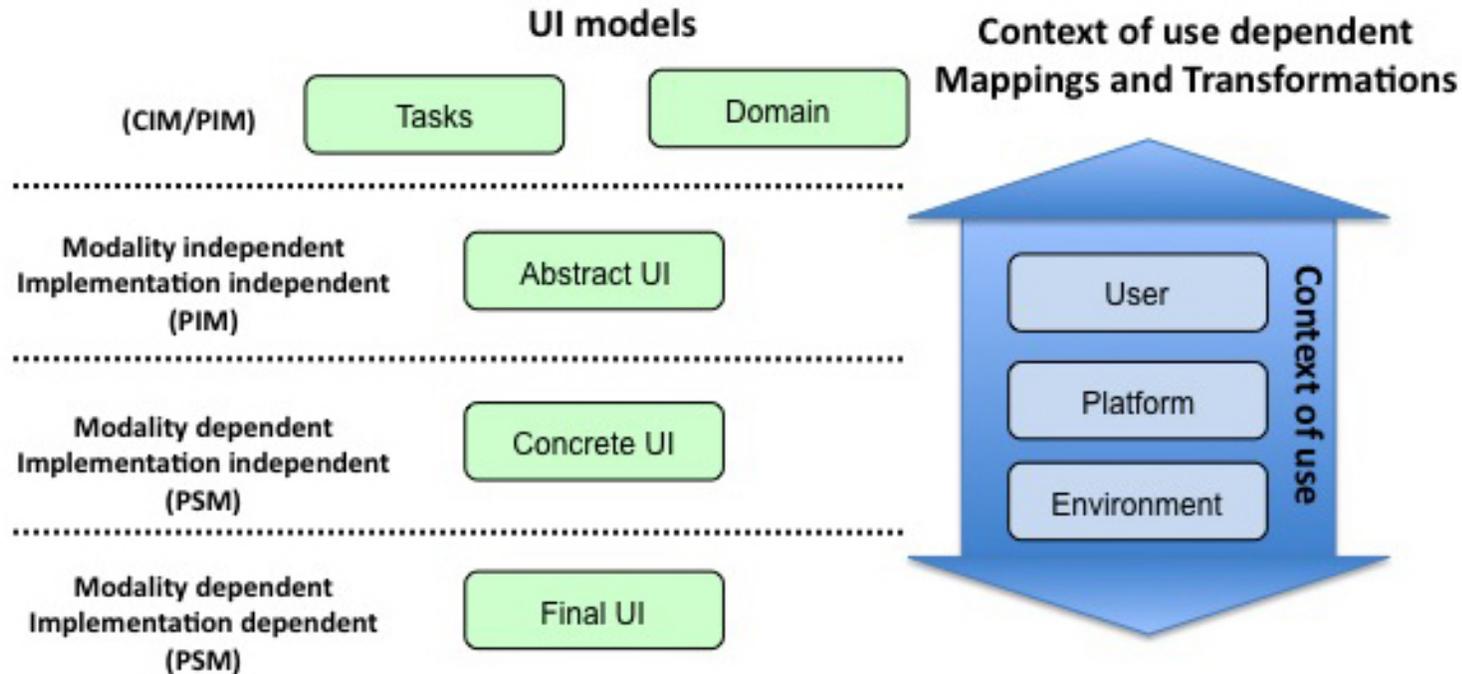
- The development of graphical user interfaces is challenging in terms of skills, time, resources



Distribution of user interface development effort in a waterfall development life cycle [Meixner et al. 2014]

MOTIVATION

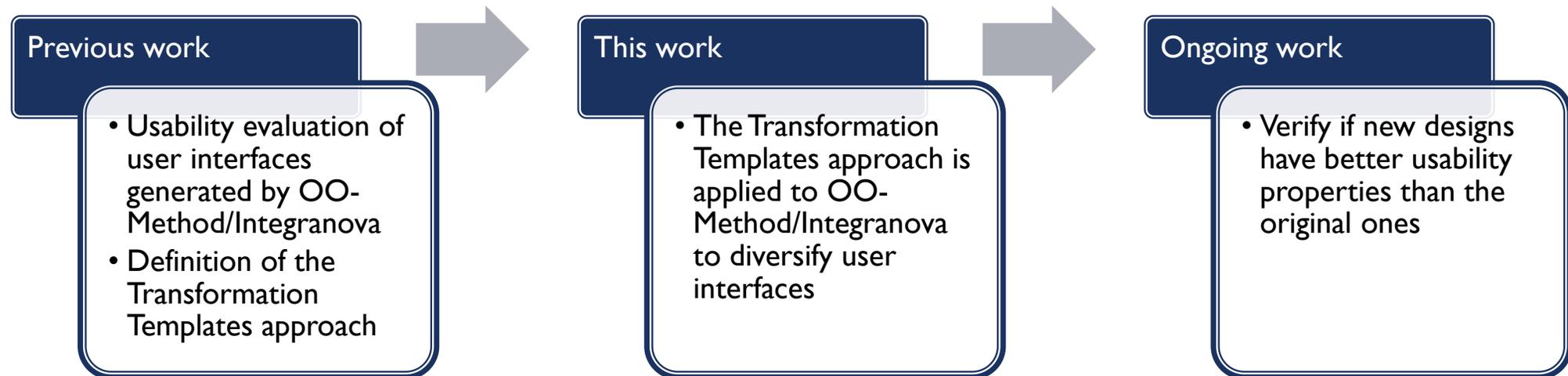
MODEL-DRIVEN ENGINEERING OF USER INTERFACES



- Open issues
 - The possibility to generate different, customised user interfaces is not provided
 - Usability problems

Cameleon Reference Framework [Calvary et al. 2001]

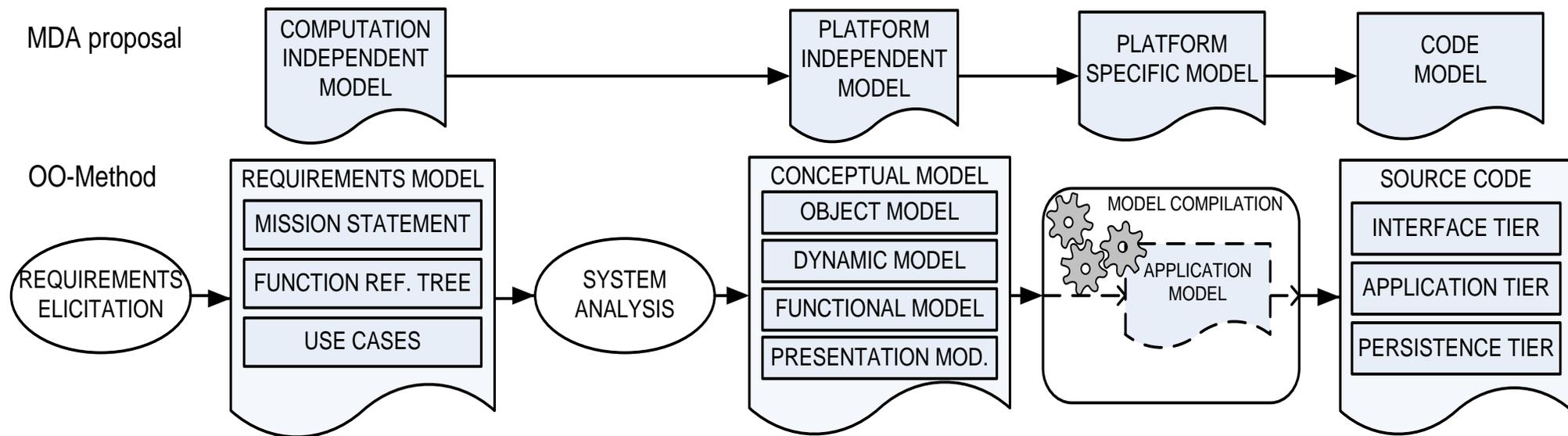
CONTEXT AND SCOPE



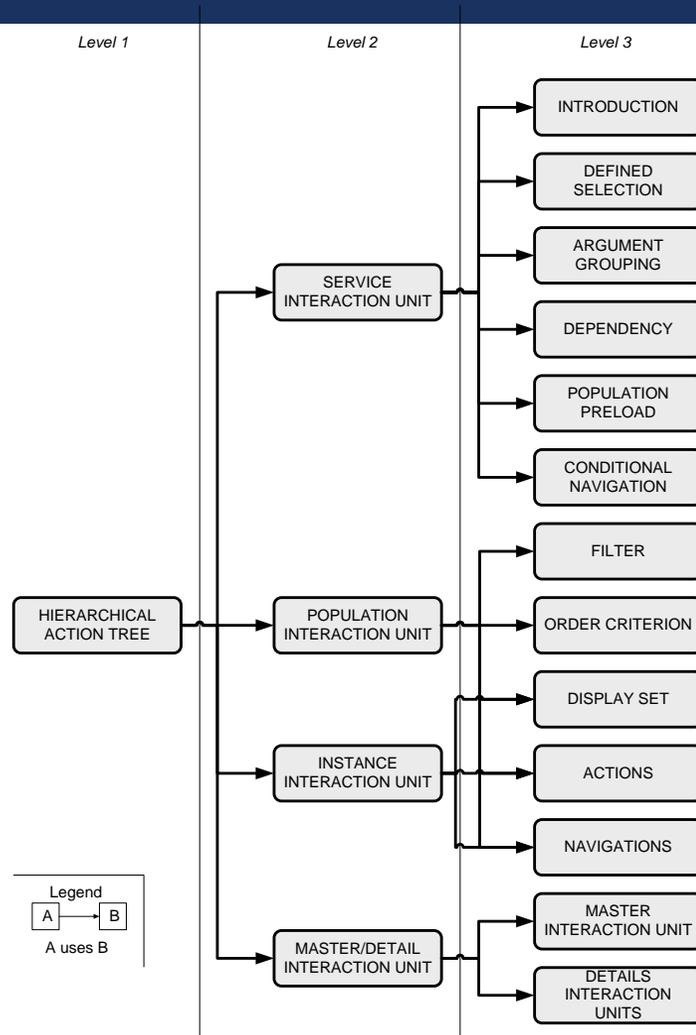
AGENDA

- Previous work
 - OO-Method/Integranova and its Presentation Model
 - Usability evaluation of user interfaces generated by OO-Method/Integranova
 - Transformation Templates
- This work: Applying the Transformation Templates approach to OO-Method/Integranova
 - Parameter Types for OO-Method/Integranova
 - Alternative designs for Population and Service Interaction Units
- Discussion and future work

OO-METHOD / INTEGRANOVA



PRESENTATION MODEL



Between presentation dates By Total Expenses By status **Filter**

Order Criteria **Order criterion** Elements per page

	ID Expenses Report	Presentation Date	Cause	Advances in Currency	Balance in Currency	Payment Comments	Payment Date	Status	Total Expenses	Authorization Date
<input type="checkbox"/>	22	Oct 12, 2008	Car rental	50.0	30.0			Approved	80.0	Dec 15, 2008
<input type="checkbox"/>	26	Oct 20, 2008	Purchase of DCs	0.0	30.0 paid			Paid	30.0	Oct 30, 2008
<input type="checkbox"/>	10	Nov 2, 2008	Car rental	0.0	150.0			Closed	150.0	Nov 17, 2008
<input type="checkbox"/>	32	Nov 3, 2008	Lunch	0.0	50.0			Approved	50.0	Dec 22, 2008
<input type="checkbox"/>	11	Nov 10, 2008	Hotel during client's visit	30.0	150.0			Closed	180.0	Nov 25, 2008
<input type="checkbox"/>	31	Nov 16, 2008	Trip to Siena	0.0	560.0			Open	560.0	
<input type="checkbox"/>	6	Nov 17, 2008	Purchase of toner	20.0	20.0			Open	40.0	
<input type="checkbox"/>	14	Nov 17, 2008	Lunch	0.0	50.0			Approved	50.0	Nov 19, 2008
<input type="checkbox"/>	21	Nov 17, 2008	Lunch with SAB	50.0	200.0			Approved	250.0	Nov 21, 2008

25 elements

Actions New Expense Report Edit Expense Report Close an Expense Report Delete an Expense Report

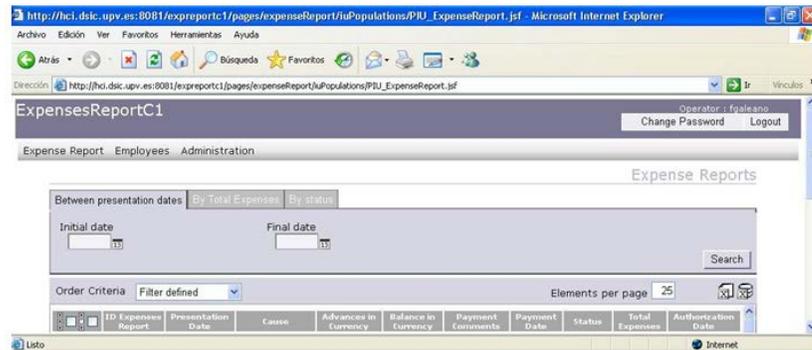
Navigations Expense Lines Employee Expense Currency Payment Type Project

USABILITY EVALUATION OF USER INTERFACES GENERATED BY OO-METHOD/INTEGRANOVA

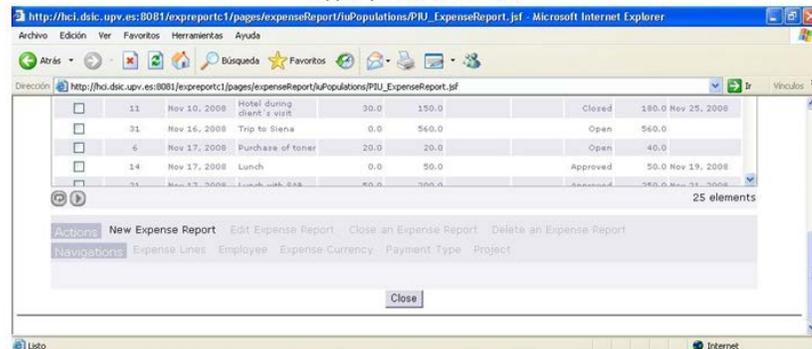
- An exploratory usability evaluation was carried out in an experimental controlled context
- Usability was examined in terms of satisfaction, effectiveness and efficiency
- Interfaces generated from Population and Service Interaction Units (PIUs and SIUs)
- Expenses Report application
- Different platforms
 - Web: JavaServer Faces running on Java
 - Desktop: C# running on .NET
- Devices with different screen sizes
 - Small (7")
 - Standard (19")
 - Large (32")
- 31 participants

USABILITY EVALUATION OF USER INTERFACES GENERATED BY OO-METHOD/INTEGRANOVA

PIU – Web – Small screen

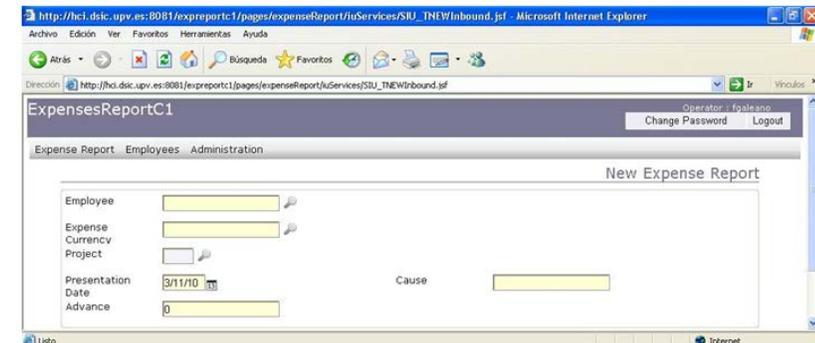


Upper part of the screen

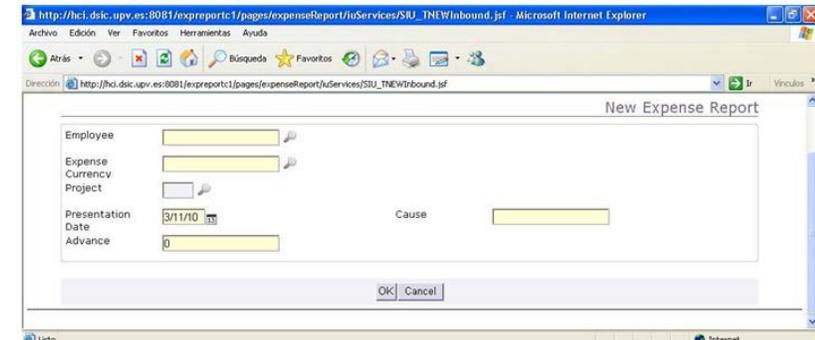


Lower part of the screen

SIU – Web – Small screen



Upper part of the screen



Lower part of the screen

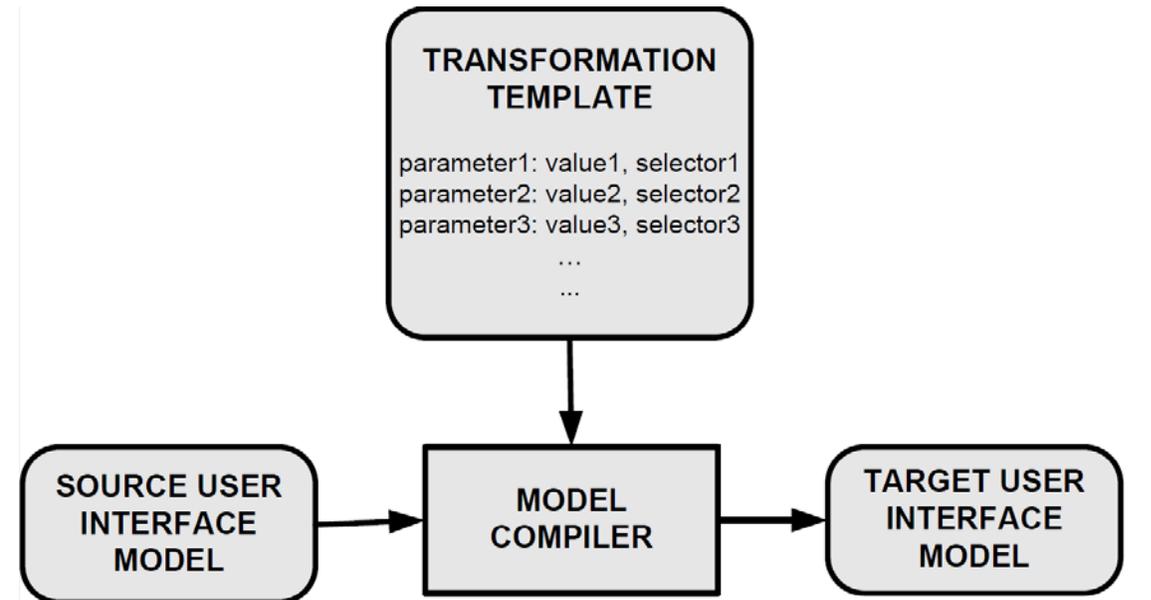
USABILITY EVALUATION OF USER INTERFACES GENERATED BY OO-METHOD/INTEGRANOVA

- Efficiency results were most affected by the use of different platforms and devices
- The web platform obtained worse results than the desktop platform
- The small screen obtained worse results than standard or large screens

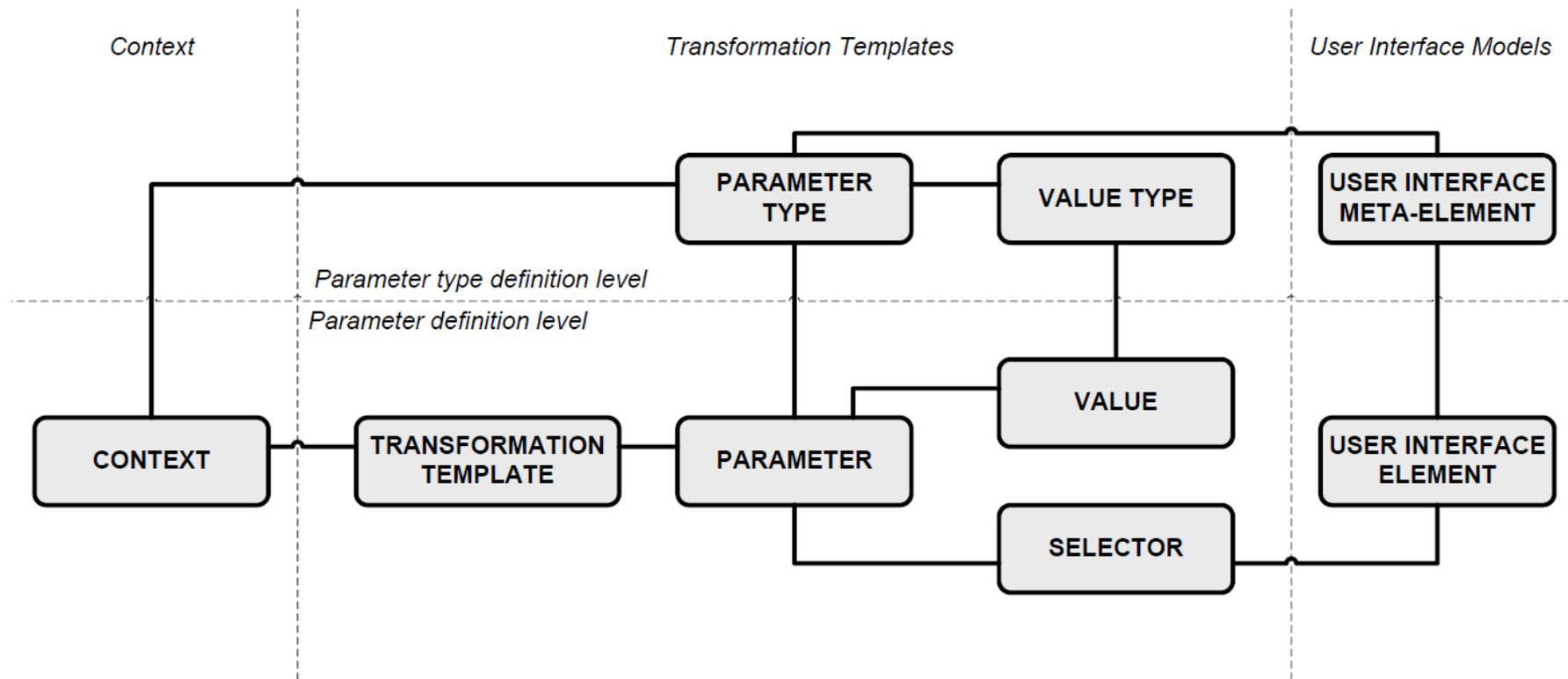
- The OO-Method/Integranova approach should incorporate enhancements in order to generate multi-device/platform user interfaces with improved usability

TRANSFORMATION TEMPLATES

- Transformation Templates
 - Specify the structure, layout, and style of a user interface
 - Are composed of parameters with associated values that parameterize user interface model transformations
 - Are inputs for transformation tools



TRANSFORMATION TEMPLATES



NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: Filter Widget

Name	Description	Affects To	Possible Values	Contexts of Use
Filter Widget	Allows to select the widget to be used to present filters of a PIU	Filter	Tabs Combo Accordion	Desktop Web

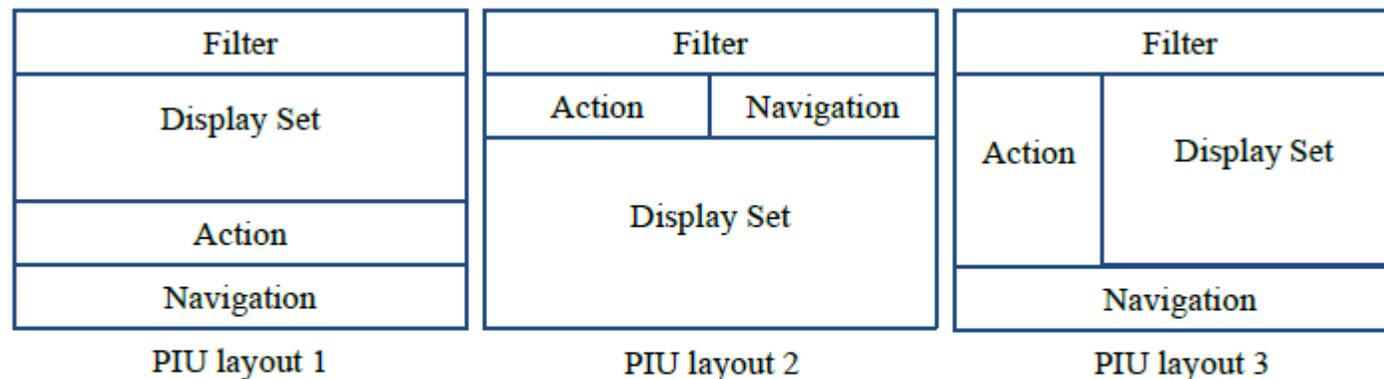
Parameter Type: Filter Widget - importance level, development cost and usability guidelines for the web platform

Value	Importance Level	Development Cost	Usability Guidelines
Tabs	high	low	The number of filters is not too big, less than 8
Combo	low	low	The number of filters is high
Accordion	high	low	The number of panels should be small, less than 8

NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: PIU Layout

Name	Description	Affects To	Possible Values
PIU Layout	Provides options for positioning elementary patterns of a PIU	PIU	PIU layout 1 PIU layout 2 PIU layout 3



Graphical representation of the possible values of PIU Layout

NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: Display Set Layout

Name	Description	Affects To	Possible Values
Display Set Layout	Allows to specify if a display set is going to be displayed with a table or with a set of independent fields	Display Set	Table Reduced table Independent fields

Last name	Name	From
Damon	Matt	EEUU
Pitt	Brad	EEUU
Vaughn	Vince	Australia
Depp	Johnny	UK
Aniston	Jennifer	EEUU
Jolie	Angelina	UK

Subscriber code: 12149

Undertaken diameter: 0
Distributor diameter: 0
Invoiced: Yes
Creating date: 28/05/2005

Subscriber code: 12149

Undertaken diameter: 0
Distributor diameter: 0
Invoiced: NO
Creating date: 11/11/2000

NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: SIU Layout

Name	Description	Affects To	Possible Values
SIU Layout	Allows to specify if a SIU is going to be displayed in 1 or 2 columns, or following the standard algorithm	SIU	Standard algorithm 1 column 2 columns

NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: Label Alignment

Name	Description	Affects	To Possible Values
Label Alignment	Allows the alignment of a label with regard to an input field to be specified	Filter SIU	Left Up Inside

NEW ALTERNATIVE DESIGN FOR PIU - #1

- PIU layout = PIU layout 2
- Filter widget = accordion
- Display set layout = independent fields
- Label alignment = inside

Filter	
Action	Navigation
Display Set	

Between presentation dates

Actions Navigations

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)
- id: 11
date: Nov 10, 2018
cause: Hotel during client's visit
[more...](#)
- id: 31
date: Nov 16, 2018
cause: Trip to Siena
[more...](#)

Between presentation dates

By total expenses

By status

Actions Navigations

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)
- id: 11
date: Nov 10, 2018
cause: Hotel during client's visit
[more...](#)

Between presentation dates

Initial date

Final date

Actions Navigations

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)
- id: 11
date: Nov 10, 2018
cause: Hotel during client's visit
[more...](#)

Between presentation dates

Actions Navigations

New expense report

Edit expense report

Close an expense report

Delete an expense report

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)

NEW ALTERNATIVE DESIGN FOR PIU - #1

Between presentation dates

Actions Navigations

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)
- id: 11
date: Nov 10, 2018
cause: Hotel during client's visit
[more...](#)
- id: 31
date: Nov 16, 2018
cause: Trip to Siena
[more...](#)

Between presentation dates

Initial date

Final date

Actions Navigations

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)
- id: 11
date: Nov 10, 2018
cause: Hotel during client's visit
[more...](#)

Between presentation dates

By total expenses

By status

Actions Navigations

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)
- id: 11
date: Nov 10, 2018
cause: Hotel during client's visit
[more...](#)

Between presentation dates

Actions Navigations

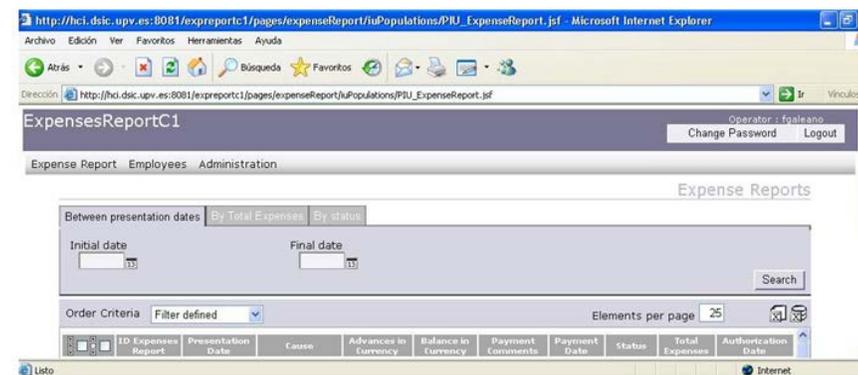
New expense report

Edit expense report

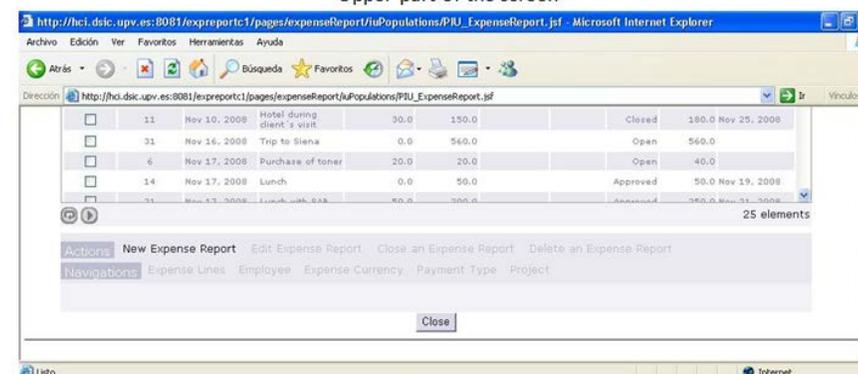
Close an expense report

Delete an expense report

- id: 22
date: Oct 12, 2018
cause: Car rental
[more...](#)
- id: 26
date: Oct 20, 2018
cause: Purchase of DCs
[more...](#)
- id: 10
date: Nov 3, 2018
cause: Lunch
[more...](#)



Upper part of the screen



Lower part of the screen

NEW ALTERNATIVE DESIGN FOR PIU - #2

- PIU layout = PIU layout 3
- Filter widget = tab
- Display set layout = reduced table
- Label alignment = left

Filter	
Action	Display Set
Navigation	

The screenshot displays a web application interface for managing expenses. At the top, there are three filter tabs: "Between presentation dates", "By total expenses", and "By status". Below these are input fields for "Initial date" and "Final date", each with a calendar icon, and a "Search" button with a magnifying glass icon. The main content area is titled "Actions" and contains a table of expense records. To the left of the table are four action buttons: "New", "Edit", "Close", and "Delete". The table has columns for "Id", "Presentation date", "Cause", "Advances in currency", and "more...". The "more..." column contains a "more..." link and a vertical scrollbar. At the bottom, there is a "Navigations" section with five buttons: "Expenses lines", "Employee", "Expenses currency", "Payment type", and "Project".

Id	Presentation date	Cause	Advances in currency	more	
<input type="checkbox"/>	22	Oct 12, 2018	Car rent	50.0	more...
<input type="checkbox"/>	26	Oct 20, 2018	Purchase of DCs	0.0	more...
<input type="checkbox"/>	10	Nov 3, 2018	Luch	0.0	more...
<input type="checkbox"/>	11	Nov 10, 2018	Hotel during clint's visit	30.0	more...
<input type="checkbox"/>	31	Nov 16, 2018	Trip to Siena	0.0	more...

NEW ALTERNATIVE DESIGN FOR PIU - #2

Between presentation dates | By total expenses | By status

Initial date Final date Search

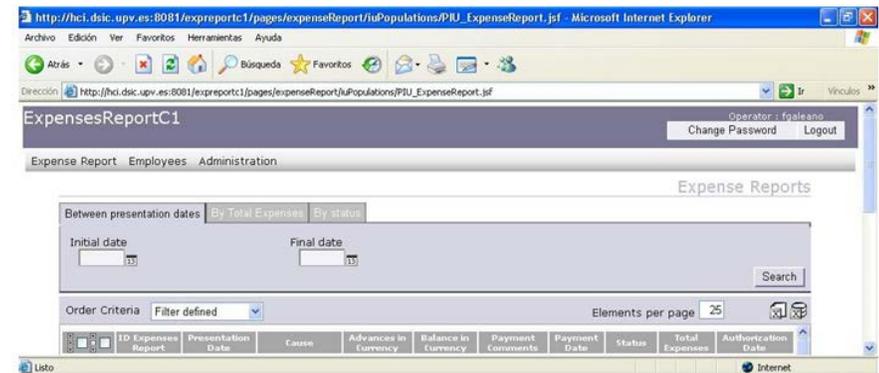
Actions

- New
- Edit
- Close
- Delete

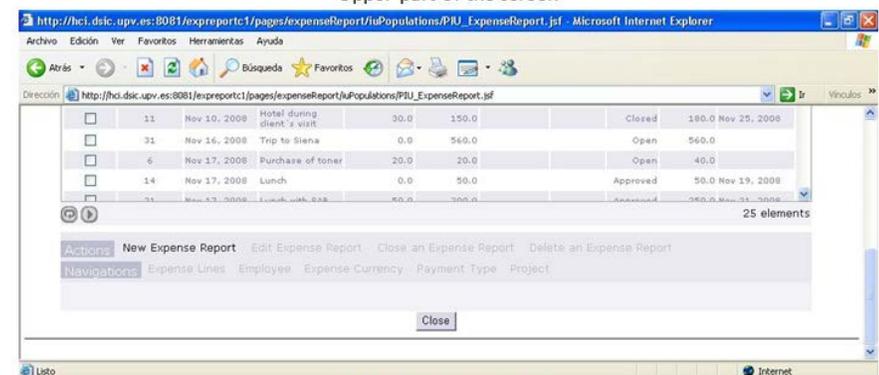
	Id	Presentation date	Cause	Advances in currency	more
<input type="checkbox"/>	22	Oct 12, 2018	Car rent	50.0	more...
<input type="checkbox"/>	26	Oct 20, 2018	Purchase of DCs	0.0	more...
<input type="checkbox"/>	10	Nov 3, 2018	Luch	0.0	more...
<input type="checkbox"/>	11	Nov 10, 2018	Hotel during clint's visit	30.0	more...
<input type="checkbox"/>	31	Nov 16, 2018	Trip to Siena	0.0	more...

Navigations

- Expenses lines
- Employee
- Expenses currency
- Payment type
- Project



Upper part of the screen



Lower part of the screen

NEW ALTERNATIVE DESIGN FOR SIU - #1

- SIU layout = 1 column
- Label alignment = inside

New Expenses Report

Employee 

Expenses Currency 

Project 

Presentation Date 

Advance \$

Cause

NEW ALTERNATIVE DESIGN FOR SIU - #1

New Expenses Report

Employee

Expenses Currency

Project

Presentation Date

Advance \$

Cause

Upper part of the screen

The screenshot shows the top portion of a web browser window displaying the 'New Expense Report' form. The browser's address bar shows the URL: `http://hci.dsic.upv.es:8081/expreportc1/pages/expenseReport/luServices/SIU_TNEWInbound.jsf`. The page title is 'ExpensesReportC1'. The user is logged in as 'Operator: fspaleano' with options for 'Change Password' and 'Logout'. The form includes fields for 'Employee', 'Expense Currency', 'Project', 'Presentation Date' (set to 3/11/10), 'Cause', and 'Advance' (set to 0). A 'Listo' button is visible at the bottom left of the form area.

Lower part of the screen

This screenshot shows the bottom portion of the same web browser window. It focuses on the 'Cause' input field and the 'OK' and 'Cancel' buttons located at the bottom of the form. The 'Listo' button is also visible at the bottom left of the browser window.

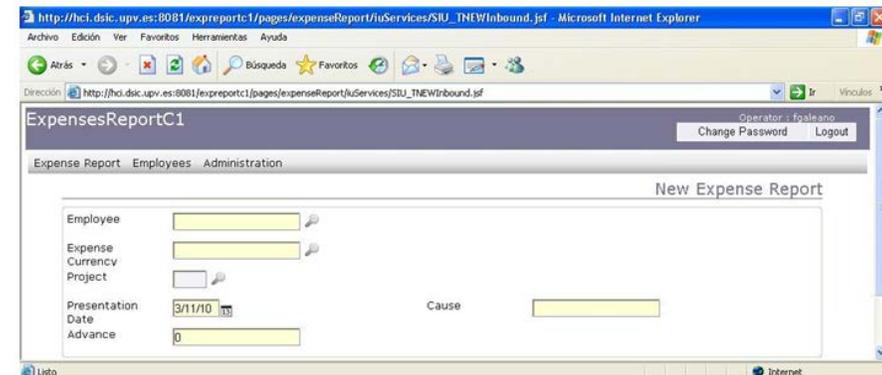
NEW ALTERNATIVE DESIGN FOR SIU - #2

- SIU layout = 2 columns
- Label alignment = up

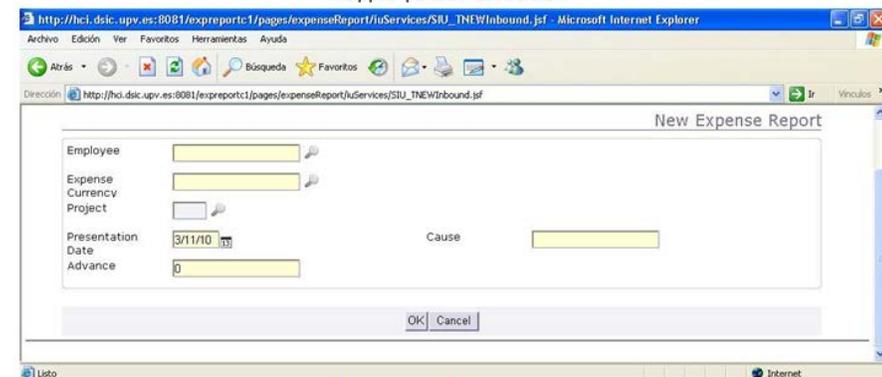
The image shows a dialog box titled "New Expenses Report" with two tabs: "Employee" and "Administration". The "Employee" tab is active. The form is organized into two columns. The left column contains four input fields, each with a label above it: "Employee", "Expenses Currency", "Project", and "Presentation Date". Each label is left-aligned and positioned above its corresponding input field. To the right of each input field is a circular icon containing a plus sign. The right column contains two input fields: "Advance" and "Cause". The "Advance" label is left-aligned above its input field, which is followed by a dollar sign (\$) symbol. The "Cause" label is left-aligned above a larger text area. At the bottom of the dialog box, there are two buttons: "Ok" (green) and "Cancel" (red).

NEW ALTERNATIVE DESIGN FOR SIU - #1

New Expenses Report		Employee	Administration
Employee	<input type="text"/>	Advance	<input type="text"/> \$
Expenses Currency	<input type="text"/>	Cause	<input type="text"/>
Project	<input type="text"/>		
Presentation Date	<input type="text"/>		
		<input type="button" value="OK"/>	<input type="button" value="Cancel"/>



Upper part of the screen



Lower part of the screen

DISCUSSION

- Benefits of Transformation Templates for OO-Method/Integranova
 - The transformation logic becomes explicit and customisable
 - It becomes possible to target specific contexts of use
 - It becomes possible to generate different types of user interfaces
 - Some new designs could have better usability properties than original designs
 - Usability guidelines are provided for each possible value of a parameter type and each context of use

NEXT STEP

- Perform an empirical evaluation in order to verify if new designs improve usability with regard to original designs



THANK YOU VERY MUCH FOR YOUR ATTENTION

NATHALIE AQUINO

nathalie.aquino@uc.edu.py

LUCA CERNUZZI

lcernuzz@uc.edu.py

OSCAR PASTOR

opastor@pros.upv.es

