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

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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
MULTIPLE SOURCES OF HETEROGENEITY

Computing platforms, interaction modalities, input/output capabilities

Programming/markup languages and widget toolkits

Users
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]
Previous work

- Usability evaluation of user interfaces generated by OO-Method/Integranova
- Definition of the Transformation Templates approach

This work

- The Transformation Templates approach is applied to OO-Method/Integranova to diversify user interfaces

Ongoing work

- Verify if new designs have better usability properties than the original ones
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

MDA proposal

OO-Method

REQUIREMENTS ELICITATION

COMPUTATION INDEPENDENT MODEL

PLATFORM INDEPENDENT MODEL

PLATFORM SPECIFIC MODEL

CODE MODEL

REQUIREMENTS MODEL

MISSION STATEMENT

FUNCTION REF. TREE

USE CASES

SYSTEM ANALYSIS

FUNCTIONAL MODEL

PRESENTATION MOD.

CONCEPTUAL MODEL

OBJECT MODEL

DYNAMIC MODEL

APPLICATION MODEL

MODEL COMPILATION

SOURCE CODE

INTERFACE TIER

APPLICATION TIER

PERSISTENCE TIER
PRESENTATION MODEL

Hierarchical Action Tree

- Introduction
- Defined Selection
- Argument Grouping
- Dependency
- Population Preload
- Conditional Navigation
- Filter
- Order Criterion
- Display Set
- Actions
- Navigations
- Master Interaction Unit
- Master/Detail Interaction Unit
- Details Interaction Unit

Legend:
A uses B
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
- SIU – Web – Small screen
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

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Affects To Possible Values</th>
<th>Contexts of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows to select the widget</td>
<td>Filter Widget to be used to present filters</td>
<td>Tabs</td>
<td>Desktop</td>
</tr>
<tr>
<td>of a PIU</td>
<td>Filter</td>
<td>Combo</td>
<td>Web</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accordion</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Value</th>
<th>Importance Level</th>
<th>Development Cost</th>
<th>Usability Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tabs</td>
<td>high</td>
<td>low</td>
<td>The number of filters is not too big, less than 8</td>
</tr>
<tr>
<td>Combo</td>
<td>low</td>
<td>low</td>
<td>The number of filters is high</td>
</tr>
<tr>
<td>Accordion</td>
<td>high</td>
<td>low</td>
<td>The number of panels should be small, less than 8</td>
</tr>
</tbody>
</table>
**NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA**

Parameter Type: PIU Layout

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Affects To Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIU Layout</td>
<td>Provides options for positioning elementary patterns of a PIU</td>
<td>PIU: PIU layout 1, PIU layout 2, PIU layout 3</td>
</tr>
</tbody>
</table>

Graphical representation of the possible values of PIU Layout: 

- **PIU layout 1**: Filter, Display Set, Action, Navigation
- **PIU layout 2**: Filter, Display Set, Action, Navigation
- **PIU layout 3**: Filter, Display Set, Action, Navigation
### Parameter Type: Display Set Layout

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Affects To</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Set Layout</td>
<td>Allows to specify if a display set is going to be displayed with a table or with a set of independent fields</td>
<td>Table</td>
<td>Display Set Reduced table</td>
</tr>
</tbody>
</table>
<pre><code>                                                                             | or with a set of independent fields                                          | Independent fields |
</code></pre>
**NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA**

Parameter Type: SIU Layout

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Affects To Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allows to specify if a SIU is going SIU Layout to be displayed in 1 or 2 columns, or following the standard algorithm</td>
<td>Standard algorithm 1 column 2 columns</td>
</tr>
</tbody>
</table>

**CIBSE 2018, BOGOTÁ, COLOMBIA**
NEW PARAMETER TYPES FOR OO-METHOD/INTEGRANOVA

Parameter Type: Label Alignment

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Affects To Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allows the alignment of a label</td>
<td>Filter</td>
<td>Left</td>
</tr>
<tr>
<td>Label Alignment with regard to an input</td>
<td>SIU</td>
<td>Up</td>
</tr>
<tr>
<td>field to be specified</td>
<td></td>
<td>Inside</td>
</tr>
</tbody>
</table>
NEW ALTERNATIVE DESIGN FOR PIU - #1

- PIU layout = PIU layout 2
- Filter widget = accordion
- Display set layout = independent fields
- Label alignment = inside
NEW ALTERNATIVE DESIGN FOR PIU - #1
NEW ALTERNATIVE DESIGN FOR PIU - #2

- PIU layout = PIU layout 3
- Filter widget = tab
- Display set layout = reduced table
- Label alignment = left
# NEW ALTERNATIVE DESIGN FOR PIU - #2

## Between presentation dates

<table>
<thead>
<tr>
<th>Initial date</th>
<th>Final date</th>
<th>Search</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Actions

<table>
<thead>
<tr>
<th>Id</th>
<th>Presentation date</th>
<th>Cause</th>
<th>Advances in currency</th>
<th>more...</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>Oct 12, 2018</td>
<td>Car rent</td>
<td>50.0</td>
<td>more...</td>
</tr>
<tr>
<td>26</td>
<td>Oct 20, 2018</td>
<td>Purchase of DCs</td>
<td>0.0</td>
<td>more...</td>
</tr>
<tr>
<td>10</td>
<td>Nov 3, 2018</td>
<td>Lunch</td>
<td>0.0</td>
<td>more...</td>
</tr>
<tr>
<td>11</td>
<td>Nov 10, 2018</td>
<td>Hotel during client's visit</td>
<td>30.0</td>
<td>more...</td>
</tr>
<tr>
<td>31</td>
<td>Nov 16, 2018</td>
<td>Trip to Siena</td>
<td>0.0</td>
<td>more...</td>
</tr>
</tbody>
</table>

## Navigations

- Expenses items
- Employee
- Expenses currency
- Payment type
- Project

## Upper part of the screen

- Expense Report
- Employees: Administration
- Expenses Report

## Lower part of the screen

- New Expense Report
- Edit Expense Report
- View Expense Report
- Delete an Expense Report
- View an Expense Report

- Save an Expense Report
- View selected Expense Report
NEW ALTERNATIVE DESIGN FOR SIU - #1

- SIU layout = 1 column
- Label alignment = inside
NEW ALTERNATIVE DESIGN FOR SIU - #1
NEW ALTERNATIVE DESIGN FOR SIU - #2

- SIU layout = 2 columns
- Label alignment = up
NEW ALTERNATIVE DESIGN FOR SIU - #1

[Diagram of Expense Report Form with fields for Employee, Advance, Cause, Project, Presentation Date, and buttons for Ok and Cancel.]
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

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