

TOWARDS A UNIVERSAL CATALOGUE OF USER INTERFACE PATTERNS FOR E-GOVERNMENT WEB SITES

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Abstract – In the last years, usability and accessibility have entered the agenda of e-Government projects as important requirements for Web sites. Since then, compilations of guidelines have been proposed as a definite panacea for problems with the User Interfaces. Guidelines are a good principle, but to be useful, they should not only provide good advices but also be organized to support fast access to the appropriate solutions. This paper presents a framework for User Interface design patterns whose main goal is to promote the efficient use of guidelines by people involved in the design of e-Government Web sites. This framework has been validated by an industrial project at SmalS-MvM which is devoted to the development of e-Government applications. Based on the lessons learned in this project, we discuss policies to promote such a framework in very large scale.

1. Introduction

E-Government Web sites should provide accessible information and service for every citizen regardless the diversity of users in terms of age, language skills, cultural diversity, literacy, and information technologies literacy [1]. Cross-consistent Web sites and uniformed User Interfaces (UI) could help to reach such a goal. Despite the efforts of world wide governments in training developers on User-Centred design methods [2] and promoting W3C's WAI guidelines for accessibility [3], the quality of the User Interface of e-Government Web sites have been progressing very slowly. Some governmental agencies, such as the UK e-Government Unit [4,5], have also invested on specialized publications to help the development of usable UK governmental Web sites. Guidelines for designing usable Web applications [2,6,7] are known to be useful, and some efforts have even been done to prepare guidelines compilation specifically to e-Government applications [5,8]. However, guidelines alone are not a definite solution for design because there is a gap between the recommendations in guidelines (e.g., "make the Web site consistent") and its applications [9]. Good insights are provided but lack of guidance reduces the utility of the advices provided

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[10], even if a usability expert belongs to the design team which does not appear that often. This paper presents an ethnographic study concerning the use of guidelines employed during the development of e-government Web sites. The results of this study argue for the organization of usability guidelines in a catalogue of User Interface (UI) design patterns. Such a catalogue offers benefits both to designers (by guiding the design of the application thanks to design patterns) and end-users (by proposing standards UIs reused by several e-Government Web sites which will ensure cross-consistency of UIs of e-Government applications). This position is supported by a large case study conducted in the industry where we followed the implantation of UI design patterns as a solution for creating a usability culture in a company.

2 Maturing the Way of Thinking e-Government UI Design

An ethnographic study was performed at SmalS-MvM (<http://www.smals-mvm.be>), a non-profit organization devoted to the design, deployment and handling of public e-Government applications in Belgium. Fifteen applications developed as part of the Belgium Social Security portal (<http://www.socialsecurity.be/>) were screened in this study. These applications are mostly targeted to firms that is to say, very often, to internal or external secretaries of firms that take in charge the fulfilment of administrative procedures for the benefit of the firm manager. For example, the Social Risk Declaration is dematerialized on this portal: it enables an employer to declare an employee's inability to accomplish his work (e.g. in case of pregnancy, accident or disease) so that the employee will receive allowance from the Social Security during the period he is off job. This study permitted to measure the maturity of the team concerning the design of usable UIs and to identify the difficulties of the development team in putting such methods in practice. It outlined as well the diversity of people that are involved in the design process of an e-Government application and the complex relationships among them. From the final user to the client institution, going through the security expert, they hold different interests, competences and constraints towards the design process, but they have to discuss and cooperate anyway towards an application that satisfies all of them. Hereafter we present some observations made during the ethnographic study, which are the most relevant for the purposes of this paper.

Taking Care of Users and of Designers. SmalS-MvM design process (see Figure 1) already follows many recommendations from HCI Software Engineering such as user testing and ergonomic guidelines compilations which are made available to designers [2,3,6,7]. Mock-ups are used from the earliest phases of the development process to gather user requirements and communicate them to the development team. The first mock-up is developed quickly from the requirements gathered from client institution(s) and users. It consists in Web pages, allowing some interactions that simulate the behaviour of the designed application. Pages are static ones, coded in HTML; fake data is therefore displayed when it is supposed to be dynamically generated (e.g. from a database). The first purpose is a communication purpose: the mock-up is used to describe the UI in a way that allows any stakeholder of the design team (from the client to the developers' manager) to handle it, form an opinion on it, and eventually fill blanks and propose modifications according to his own viewpoint, wishes and constraints. The second purpose is to make user testing on those mock-ups; user testing done from earliest stages of the design process is better accepted and efficient, since not much development efforts have been deployed yet. The third purpose is to increase this mock-up step by step onto a validated UI; from then, the application can be actually implemented. This "pure implementation" part only represents 20% of the time spent on an e-Government application design project, which outlines the importance and critical aspect of the UI design. However,

the usability culture of the firm could be better: usability guidelines quite often are not consulted by the design team. Usability experts are expected to review the User Interfaces produced, and the rest of team does count on their expertise, without handling by themselves information such as guidelines or encouraged practices. The usability culture in the firm is verbally transmitted by usability experts during meetings but the design team is not encouraged much to handle it directly.

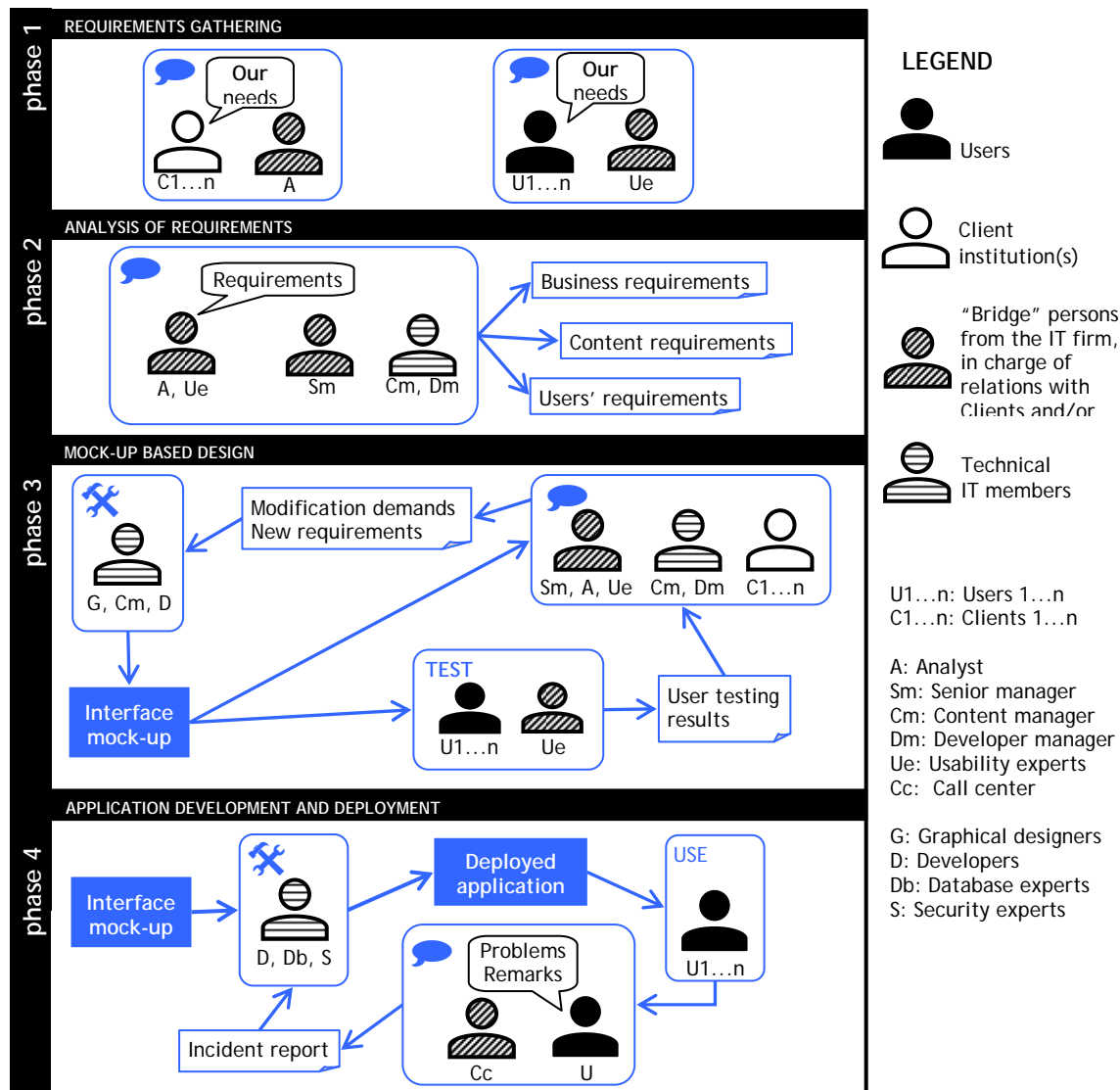


Figure 1: Typical e-Government application life cycle in SmalS-MvM

Communication and Decision Supports Are Not Satisfying. Situations of bad communication between stakeholders were inventoried along the design process. The reasons for failures (e.g. divergence of jargons, incomplete requirements) were observed from the very early stages of design. Analysts are responsible for the report of institutions' expressed needs to the rest of the design team. Bad analysis can bring cascading misunderstandings all along the design process which makes this step critical for the whole project. Currently, the analyst's report of clients' needs to the rest of the team is done verbally in meetings, with no particular formality. The design team questions the analyst to learn more, and this is how the collect of the requirements is done (the usability expert brings users' needs during the discussion). While interviewing analysts about their activity, one said: *To express clients' needs, I often let myself be tempted by coding some HTML pages, and then show them to the*

rest of the team. However, I realize that this way I already suggest design decisions that aren't yet required. This quote says quite a lot about the lack of support, at the very beginning of the design process, for analysts to express the application requirements from the clients' expressed needs. Communication problems happen in particular when it is time to take decisions with so many stakeholders involved, each one holding his proper interests. Final users' interests come from their work habits and their functional needs the application has to satisfy. As for institutions, interests come from political, branding and power topics: they are expressed as requirements upon the application (e.g. *Can the logo of my institution be displayed first in the list of stakeholders?*), or more fuzzily, in general terms (e.g. *We should seize the opportunity of the deployment of this application to rework this administrative procedure...*) The IT firm and the project manager carry interests as well, mostly concerning technical and resource topics. To take good decisions in spite of those divergent flows, a design methodology guided by a strong rationale could help the design team coping with endless clashes of interests.

3 Designing e-Government with User Interface Patterns

The browsing of e-Government applications already deployed by SmalS-MvM revealed that a large set of User Interfaces fragments keep appearing, at different levels of granularity (from sequences of pages to smaller UI fragments such as forms). At a higher level of abstraction in terms of design process, it was observed that clients' needs actually recurred as well in this domain: around five families of applications appear corresponding to clients' requirements (e.g. declaration form in several steps, management of cases). The idea came out then to setup a methodology that would allow the reinvestment of knowledge from a project to another, archiving good practices and even solutions to deploy when facing a common design problem. Furthermore, this reinvestment would encourage cross-consistency of UIs throughout e-Government applications: they are kind of uniformed so, as a user, I learn once and for all how to use them.

The identification of suitable UI patterns first consisted in finding in the literature common UI patterns and Web design recommendations, good design practices. In parallel, we browsed fifteen applications developed by SmalS-MvM. Recurrent patterns were listed as well as good and bad examples of instantiations of those UI patterns. This listing showed that many patterns are already uniformed on a large proportion of e-Government applications, even if it is in an informal way. For example, the **LOGGING PAGE** UI pattern appears in 100% of the applications we investigated, only under two different forms (one for the identification of social workers and another one for the identification of firm representatives): this UI element is actually already uniformed. As for the **SEARCH** UI pattern, it appears in 80% of the applications, under one only shape: even if the criteria of search vary along the cases, the principle is always the same. When UI patterns appear under several shapes, what is important is to outcome the justification of each instantiation. The analyst has to identify the solution that best fits his current situation. The identification of the relevant pattern (and then, the relevant solution) is to be guided by examples and must/should/shouldn't/mustn't cases of use.

Description of UI Patterns. The description of our User Interface patterns features the classical attributes met in patterns description to work out the design problem and its recommended solution: **DESCRIPTION** of the pattern; **EXAMPLES** of instantiations of this pattern in existing applications already developed by the company; **CASES OF USE** and cases where the pattern is not recommended; **RATIONALE**, may it be empirical or academic; **WIREFRAME** of the

solution proposed by the pattern. This last attribute, less classical, can have different shapes along the nature of UI Pattern concerned.

- *Screen Flow level* patterns display wireframes under the form of navigational schema. StateWebCharts [11] navigation modelling formalism was elicited to describe those wireframes, as it is both non ambiguous and intuitive to read and modify. This intuitiveness has been informally checked during meetings.
- *Page level* and *Basic Components level* patterns hold wireframes under the form of a very schematic UI representation, a skeleton draft of the layout of the UI element concerned, may it be a page or a smaller element (e.g. form or header).

Figure 2 shows a Screen Flow Level UI pattern about how to sequence pages in a long questionnaire. For lack of space, bad and good examples screen captures are not displayed here. For the same reason, the pattern is flattened whereas it is usually displayed as a set of tabs, with a tab for each attribute (DESCRIPTION, EXAMPLES, etc.). To know more, and in particular, to see examples of patterns at other levels of granularity, please refer to our EIS 2007 paper [12].

MULTI-STEP WIZARD

DESCRIPTION The goal of the procedure is reached through the accomplishment of a sequence of activities. This sequence of activities is guided by the sequence of screens but also by the navigation proposed which is limited to “next step” and previous step” eventually “cancel all”).

EXAMPLES Good Declaration of a foreign employee to the Social Security

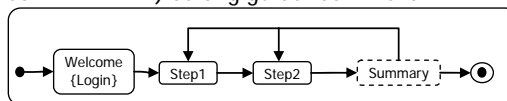
CASES OF USE Must be used when the user is a novice
Shouldn't be used when the user is very likely to interrupt his task before the achievement of the procedure

LAYOUT 1) Distinguish procedure steps (ex. Step 2) and auxiliary pages (ex. OVERVIEW page)
 2) See WIZARD STEP pattern for the layout of each step
 3) Give the procedure a clear title, whose formulation is user-centred and contains a verb corresponding to the goal of the procedure.

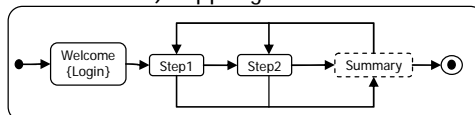
RATIONALE 1) http://www.designofsites.com/about_the_book/patternh1.pdf
 2) http://harbinger.sims.berkeley.edu/ui_designpatterns/webpatterns2/webpatterns/pattern.php?id=7

WIREFRAME Several implementations are possible, just around the way provided for the edition of the overview page. See MULTI-STEP WIZARD sub patterns to identify which one fits to your situation.

SUB PATTERN 1) Strong guidance wizard



SUB PATTERN 2) Supple guidance wizard



SUB PATTERN 3) Editable summary

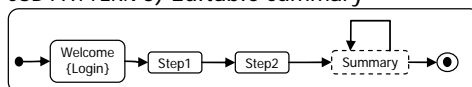


Figure 2: UI pattern at the Screen Flow level: “Multi-Step Wizard”.

4 First Uses, Feedbacks and Evaluation

One of the major issues for the use of UI patterns in the practice is the proper organization of patterns in accessible catalogues providing fast access to the appropriate solutions [14]. When presenting analysts a pyramidal structure for organizing UI patterns (along UI pattern granularity, i.e. Screen Flow level, Page level and Basic Component level), some of them told us about their will to have some other access to the information: *On top of that guiding procedure of browsing the UI patterns [from top to bottom], I'd like to be able to directly find recommendations on list boxes for example. Couldn't we have some search engine inside the catalogue?* Direct access to patterns has therefore to be provided, in addition to paths following granularity. Furthermore, some “transversal access” to patterns should be provided, with patterns referring to other patterns. Work on this topic can be found in the literature; for more information, a detailed review of patterns organization and possible application to UI Analysis e-Government Patterns is available [12]. Hereafter main approaches for linking patterns together are listed, all of them aiming to give as much semantic as possible to provide an efficient navigation.

- References between patterns including similar interface elements
e.g.: patterns including forms;
- Grouping close patterns that are patterns which appear in close contexts
e.g.: patterns which are likely to appear in declaration procedures;
- Relations just as in object theory: association, aggregation, composition etc. [15]
e.g.: MULTI-STEP WIZARD pattern is composed of the following patterns:
CHECKLIST PAGE, WIZARD STEP, OVERVIEW and ACKNOWLEDGEMENT OF RECEIPT;
- Networks of patterns with ontological relations [16]: Semantic Web theory could help linking patterns with more in-depth sense given to the relations, thanks to meta-data about the patterns
e.g.: patterns which were proposed by usability experts.

User-Centred Integration of the Catalogue of Patterns. Integrating such a tool for analysts will obviously modify their way of working; however, we have to get inspired by their current design activities to make the integration as smooth and useful as possible. That's the reason why the catalogue of UI Analysis Patterns is made in cooperation with volunteers belonging to SmalS-MvM (mostly analysts, developers, usability experts and content managers) and who are therefore daily involved in e-Government design projects. They are not Design Pattern experts, but they are interested in this initiative and, as final users of such a methodology (if not directly users of the patterns), they bring relevant comments and evaluation of the patterns in terms of their contents as well as the way to use them. To complement analysts' active participation to the construction of the catalogue, an ethnographical observation was conducted to know more about their actual way of working, with some questions in mind: what kind of support is used? Who are analyst's spokespersons? When does he intervene? What artefact is supposed to be produced as an output of analysis stage? In parallel, a study has been led around software engineering for functional Web sites, in order to learn about what kind of advises an analyst receives to guide his work, about their theoretical background on their own job.

Evolution of e-Government UI Patterns. Behind an e-Government application, administrative procedures are standing. The definition of those procedures is frequently evolving, as well as the regulations governing institutions. For example, in February 2005, the

French government made it compulsory for e-Government designers to make their Web applications accessible to disabled people. UI patterns do have to satisfy those requirements, eventually getting adapted to new regulations of this type. An updating process is in place, with modifications being proposed by any user of the UI patterns, and a committee studying the proposition and its coherence with the rest of the catalogue before updating the catalogue.

Post-Deployment Planned Evaluation. A formal evaluation of the patterns will take place at the end of the year, with the analysis of data collected during the use of the catalogue, questionnaires and interviews of some eighteen persons who will have been using the catalogue for six months. These investigations will be axed around user's profile and status in the project; most used sections of the catalogue and subjective satisfaction. As a complement, user testing on the catalogue is envisaged. Some work has been found in the literature about methods of evaluation of pattern languages in general (i.e. not only UI patterns). Dearden [17] evaluated how their pattern language actually supported participatory design from Alexander's [18] criteria: *empowering users*, *generative design* and *life-enhancing outcomes*. A comparative evaluation of libraries of patterns supporting design was led as well by Cowley [19]. Users had to redesign an e-Commerce Web site using patterns; afterwards, they filled in a satisfaction questionnaire about the efficiency, usability and usefulness of patterns contents, format and structure.

5 Conclusion

At the light of this study we suggest that a catalogue of UI patterns could be a technical solution to improve the usability and it can be extended towards a universal solution to standardize e-government Web sites. This can be made possible with the commitment with the following issues:

- Adoption of UI analysis patterns rather than guidelines since they provide more guidance to implement standard solutions;
- The catalogue should focus on category of applications rather than a universal solution to all kind of e-Government Web sites; so that it can assure the best solution according to the user tasks;
- Training of IT actors for the correct use of the catalogue; which should include User-Centred design process, the practice of the user interface prototyping and participatory design;
- Official agreement on the set of pattern used in the catalogue; national agencies/bodies could develop their own catalogue according to their needs and provide consultancy and training;
- Commitment from IT teams and third party agencies developing applications to e-government initiatives;
- Development of appropriate quality models and evaluation techniques that could certify the quality of applications developed under the catalogue guidance.

Our results suggest that the inconvenient of standard e-Government Web sites can be easily overrated by advantages in terms of better reuse of proven solutions for UI design, pragmatic guidance to implement a usability culture into organizations, and support to the development of similar user interfaces which will greatly reduce the learning curve of end users.

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