Web design patterns for E-Government websites

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ABSTRACT
In this paper we describe a set of *web design patterns for E-Government websites* that emerged from the usability studies on the websites of the government of São Paulo state, conducted by the University of São Paulo (USP), Brazil. These studies coupled with studies on E-Commerce websites showed a clear trace of similarities in the importance of information being presented to the user in an appealing matter. The difference lies in the motivation behind this importance; economy in E-Commerce and democracy in E-Governance. The fact that the E-Government websites must be accessible to *all* citizens is fundamental if democracy through the Internet is to succeed. Special attention is needed to avoid the pitfalls of segregation. Thus, E-Government websites must seek a structure that pleases all types of computer users. The work in this paper is an effort in laying a common ground for them to achieve this through web design patterns.

Author Keywords
Best practices, design pattern, fieldwork and ethnography, website, E-Government, web design, conference publications.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
The Brazilian government is actively trying to increase the value of their corresponding websites. At the same time they try to grow the number of services available online they are committing common website mistakes as well as using different practices, both results confusing the user and pushing him further away from using the services. The need for establishing working and patterned practices is ever increasing. That is the goal of this paper and its accompanying web design patterns.

Background
Brazil is a large country which is a mixture of several different cultures; each state in Brazil feels like another country. They have their own food recipes, traditions, clothes, and sometimes, even religions. This should be taken into considerations since culture does have an affect on what the people come to expect out of governmental services. Aside from that the economical structure is heavily divided between those who have very little and those who have very much. A problem that arises from this is the lack of education among a large percentage of the population. This, in turn, manifests in the absence of participation in governmental issues as well as lacking knowledge of their own rights. The goal of E-Government is to be able to supply all needed information to the entire country, including places that currently lack the infrastructure to hold classical knowledge bases such as libraries. Websites also provide a bidirectional communication which is fundamental in a democratic country.

The solution might seem easy; when the entire government structure is accessible online the information would be equally accessible to anyone. Wrong. Only a minority has access to a computer, with Internet access, and an even smaller number has access to this around the clock. This segregates the people and puts the power in the hands of people that already have power; those with money. Moving further away from democracy, than moving too it.

A way to solve the problem of accessibility to the Internet can be solved through physical stations, like libraries, where ordinary citizens can access the Internet and the E-Government websites. This project is called E-Poupa Tempo and is currently being tested in São Paulo state by the University of São Paulo (USP), Brazil.

Yet another problem arises, which is the main focus of the work by USP, is that even if the information is physically available the common man is not used to using computers, at all. Some test subjects have even been first-time computer users.

Despite all these problems with the users' physical and cognitive accessibility to the information, things are further

complicated by the fact that the government websites hold a very low standard. Even when compared to websites of the early Internet. Often one sees common errors that bring reminiscence of the early days of the Internet. The resulting websites seem to be a mixture between various factors that resembles what one might consider ignorance of the motives of why the user entered that specific website in the first place. Or it could be that the websites are so important that they have to be created rapidly, with lacking structure as a result; typically ad-hoc.

It is of the outmost priority to fix the current websites and hinder new badly created E-Government sites from emerging. There should be a book of simple guidelines that an E-Government website designer can adhere too in case of doubt, but that all web developers have at least a basic knowledge about. This type of book is in reference to the GOF book [4] in software engineering. Like all programmers should know about *software design patterns* presented by GOF, all E-Government web designers should know about the patterns presented by this work.

The idea was first conceived by Plinio Aquino Jr. under the guidance of Lucia Filgueiras. John-Philip Johansson joined later in the project and was responsible for the actual creation of the patterns.

Creation of the E-Government website patterns

The patterns presented were created with two goals in mind:

1. Directly applicable to government public websites.
2. Not bound to current technology or "fashion".

Being directly applicable to E-Government sites is an absolute requirement for these patterns to be useful and used on a daily basis by E-Government site designers. If the patterns are vaguely related or even against some defined E-Government design recommendation it will reduce their usage, thus it is important to follow the first goal.

As the government hopes that E-Government websites will solve a lot of problems, it is also hoped that these are more or less permanent solutions, until better solutions are available. Though the technology is ever evolving as well as website designs vary with "fashion", it is important to set some common ground. Patterns are meant to be ideas and not implementations, thus, a well thought of pattern is "timeless" in a sense that it can be re-implemented over and over again in different ways using different languages and tools for different technologies but still solve the same problem.

To create the E-Government website patterns it was needed to find already recurring solutions to E-Government websites, both good and bad implementations. The University of São Paulo has been contracted by the Government of the State of São Paulo to conduct several projects related to E-Government websites. One of the papers [2] written for one of the projects, an extensive research on the usability of current websites belonging to the State of São Paulo, was the main source of information in the creation of these E-Government website patterns.

PATTERN DEFINITION

Each pattern consists of several elements which are explained here. They are derived from the Pattern Language Markup Language (PLML, pronounced "pell-mell"). PLML was presented after the CHI 2003 workshop [3], to make it possible to collect and combine patterns by different authors; by supplying a standard way of structuring the patterns. This section is intended to explain the difference between the E-Government website patterns XML structure and the PLML, as well as why those differences exist. The simplified structure used by the patterns defined here is used mainly to concentrate on the pattern, thus allowing for fast iterations until the final pattern has been chiselled out.

Used PLML elements

These are definitions (elements) that have been brought from the PLML structure.

Pattern ID

During the development of these patterns this refers to the document *Interface Patterns* [2], the ID is the same as the ID used in the result tables of that document.

When the patterns have been field tested this will be a unique ID for each pattern and the current ID will probably be stored in some element for historical coherence.

Name

This is the name of the pattern. During development this might have a few alternatives, but for the release there should only be *one* name for each pattern.

The pattern name should be short and have a certain punch to it, at the same time it should be relevant to what it does. It should not be confusing when used in a sentence, so names like "Thing" and "Stuff" are strictly avoided.

Pattern names are the simplest way to communicate a lot of information quickly and that is why the name is so important. Making up a fake conversation where the name is used is a good way to test if it gives a hint of being a pattern and not just part of the sentence.

Example of a bad pattern name would be "Mouse", for example: "Have you tried using a Mouse?" The name is ambiguous and causes confusion.

Problem

Shortly explains a common problem that the user encounters while navigating the site.

Context

Shortly explains in what situations the given problem may occur.

Solution
Explain a common and proved solution for the given problem. The solution must be independent of time (trends, OS, web browser, etc.), i.e. it should not be mention any implementation details at all.

Removed elements
These are elements that are part of the PLML but were decided not to be used in the definition of the E-Government website patterns. As a side note, all elements in the PLML are optional.

Alias
These patterns haven't lived long enough to have gone through name changes (where the old names already have been used outside of the project). This might be added along time where the resemblance with existing patterns is clearer.

Illustration
We use the tag *Examples* instead. Illustrations for implementations might be added later in a separate paper; that would concentrate on the implementations of these patterns on Brazilian government websites.

Synopsis
When the patterns have been field tested and revised a short summary will be written for each, so that it is useful in a catalogue like structure, such as in the GOF book.

Diagram
Diagrams are only useful for communicating implementation details. We have decided to not dwell into implementation details in the pattern definitions. But an external source, such as another article or even a book, might be created in a later date to convey useful implementation tips. This is different from the implementation structures that the *Illustration* element based paper would be based on

Evidence
An attempt to add this element will be made when the patterns have been applied to real life E-Government websites. Although one should note that the patterns themselves actually do exists in various implementations through all kinds of websites.

Confidence
It has been decided that no patterns will be presented unless it has the full confidence of its authors.

Literature
References to other articles, websites, and books, can only be applied once the presented patterns have reached a more complete version after field testing, which should be possible shortly after this article has been accepted.

Implementation
It has been decided that no implementation details will be supplied with the pattern definitions. This could be supplied as an external source of reference, as stated in the *Diagram* element.

Related pattern
Currently an element called *See also* is used. It might be replaced or aggregated with this PLML element when reached the final stage.

New elements
These elements are not part of the PLML but were decided as useful or important to complete the E-Government website patterns.

Category
This categorizes what problem area the described pattern solves. The pattern is one of the following categories:

- Navigational: helps the user navigate the site somehow, often indicating where they are and where they can go.
- Structural: the way the site is organized internally, how data is related to one and other.
- Informational: the way data is explained to the user, a bridge between the internal language used (such as "lawyer talk") and what the user knows (i.e. "lay man terms").
- Visual: the way information is presented to the user.

Example
This is actually a sub element of the *Evidence* element, that is not currently used. *Example* shows at least one graphical example of an implemented solution, as seen in an E-Government website. Preferably being a screenshot, optionally marking the relevant part of the shot, with the URL where it was taken from and also the date from when it was taken.

See also
If the pattern can be used more effectively with other patterns or somehow relates to them, they should be listed here.

Extra – "Change management elements"
These are extra elements that are defined by PLML to indicate authorship and change management, and are used when possible.

Credits
Credits go to Plinio Aquino Jr. and Lucia Filgueiras in all patterns.

Creation date
This element is used in all patterns.

Last modified
This element is used on any updated patterns.

Revision number
This element is used on any updated patterns.

THE PATTERNS
Following are the created patterns, in short.

Name: Brain

Category
Structural

Problem
With a lot of information, finding the right thing can be very demanding. The user is lost on how to go to where he wants to.

Context
The user wants to find information about something, or only knows roughly what he wants.

Solution
Making tree structures is something that falls very naturally for humans. By structuring all the information into a tree-structure (a graph type) the information becomes more logically structured. Each node can refer to other nodes if needed (turning into an acyclic graph). Each node is a topic, but should contain more information for the user; explaining the topic.

Name: Contact

Category
Navigational

Problem
The user is in need of human assistance.

Context
The user has exhausted all the information on the site and requires further assistance.

Solution
Allow the user to communicate both ways with a human, either by phone or some other interactive method.

Name: Date

Category
Informational

Problem
The user is confused to when a change is going to be made in the area of interest.

Context
The area of interest is subject to changes affected by time.

Solution
Explicitly show the connection between time and the area of interest. For example showing creation dates, expected change dates, etc.

Name: Guardian

Category
Navigational

Problem
The user has lost himself on the web page, either by entering a search term that didn't produce any hits or by problems with the site such as broken links.

Context
Both the user and the developer might cause errors that in turn cause the user to get lost.

Solution
Always be ready to pick up stray users and help them find their way back or propose ways forward.

Name: Keeper

Category
Informational

Problem
The user enters incorrect data and is notified about the error only in the end, frustrating the user and minimizing the chances for the user to correctly supply the needed data.

Context
Data needs to be entered by the user, and one wish to keep the data correct at all times.

Solution
Check each entered data before it's accepted, and notify the user of any error as soon as possible.

Name: Keyword

Category
Informational

Problem
The user is having trouble understanding a word or some situation, that’s part of a sentence or bigger situation.

Context
When writing informational text or prerequisites (like Oracle pattern) the user might need some “reminder” of what a certain word or phrase means.

Solution
Intelligently select words and situations that are commonly misunderstood or not understood at all and provide help and/or more information about them for quick access.

Name: Map

Category
Navigational

Problem
The user doesn't quite know where he is on the site, or how he got there. He also doesn't know how to "go back".

Context
While shopping for books the user found a book by searching, but he doesn't know how to go back to a broader category in the same area.

Solution
By making a reference to the current location the user can both see where he is and go back if he wishes. A simple way is to list all the places he would normally go through to get to his current location in a simple to overview kind of way.

Name: Memorizer

Category
Navigational

Problem
The user has found something but wants to return to it later.

Context
With a lot of data there should be ways for a specific user to choose what he thinks is important and return to that exact location any time she wishes.

Solution
The website should allow the user to memorize where he is. It isn't always practical to let the user memorize her exact position, for example right in the middle of a Wizard process.

Name: Notifier

Category
Visual

Problem
The user is about to make a transition on the site, but isn't sure whether it is "safe" or not.

Context
The user is in transition between different states on a website.

Solution
Visually try to illustrate what is going to happen, for example using different links for different type of actions. It is out of utter importance to be consistent throughout the whole website.

Name: Oracle

Category
Informational

Problem
The user has almost finished entering all data into a Wizard, at the last step she is asked for something that she doesn't have at the moment. Thus she cannot complete the process and all her time was lost.

Context
Used normally together with Wizard.

Solution
Prepare the user to what is about to happen, what the user might expect. This can also be time related.

Name: Painter

Category
Informational

Problem
The user doesn't quite know what the text is referring too, and explaining it in words would be to strain full on the reader (and writer).

Context
When describing some main or side topic to the user, it is useful to use alternative methods of explanation.

Solution
Illustrate what is meant somehow. Following the old proverb "a picture is worth a thousand words".

Name: Priority

Category
Visual or structural

Problem
The user often needs to look deep to find a commonly accessed feature. The user is wasting time and potentially not even finding what he is looking for.

Context
There are several paths to take from now but some of them are usually more used than others.

Solution
Try to organize such things in order of most used/accessed first.

Name: Reference

Category
Structural

Problem
The user wants to know more about his current subject.

Context
The user has found something he's interested in but needs more information, both electronically and tangible.

Solution
Give the user access to topics that further explain the current subject but that isn't necessarily the next natural step in a process, it is purely used for the satisfaction of interest of the user.

Name: Reflection

Category
Visual

Problem
The user has gone from one government agency to another, but doesn't see the connection between the agencies.

Context
There are several government agencies that belong into the same "family" and this should be expressed to the user in a non-intrusive way.

Solution
The simplest way to show connection between two or more related items is to use visually connect them.

Name: Reformater

Category
Visual

Problem
The user is currently viewing a web page but wants to view it in another format.

Context
The web page is currently presented on a monitor but can be printed, thus reformatted to A4.

Solution
Allow the user to switch format of the web page.

Name: Replicator

Category
Navigational

Problem
Some web pages are more suited then others for different browser tasks. But the user isn't aware of them and possible (even useful) actions are lost.

Context
The user isn't customer to his tools, such as the web browser. Don't forget to make that the web browser version works in the same way.

Solution
Replicate the browser functionality into the website. Help show the user what she can do.

Name: Teacher

Category
Informational

Problem
The user returns to the site to find that it has changed, what he/she used to know has disappeared and the user now feels confused as to what to do.

Context
The site has been updated in some way that old functions have been replaced with new.

Solution
Show the user how to use the new functionality, teach them to become more effective instead of having an "old version" of the site.

Name: Wizard

Category
Navigational

Problem
The user has to fill in information or somehow make several choices to obtain a certain goal.

Context
In the case of applying for some official document the user might need to enter certain data about her through several choices.

Solution
Divide the required data into groups and help the user make decisions in a linear and logical order. Each group is called a "Step".

CONCLUSION
This work bases itself upon the proven usefulness of design patterns, both in architecture and software design. Patterns allow for a way of communicating ideas that is extremely useful for everyone involved. The presented patterns are the fruit of the collaboration between students and teachers from two universities in two widely different countries, each adding its view so that the essence of each pattern could be extracted from the different research results created by USP. The eighteen created patterns all follow the desired guidelines set by the state of São Paulo, the results from the extensive usability tests conducted by USP and the professional view of the authors of what intuitive websites consists of.

The work was never intended to provide implementation details in the same way as GOF, but to provide a more "timeless" definition of expected results that will, in theory,

still be valid many years from now; even after leaving the Internet connected desktop computer as it is today. The short descriptions of each pattern try to capture the essence of what it is, and let the implementer decide how it is best implemented on the current project with the current platform.

To prove the validity of the patterns the authors wish to inform the current web designers of E-Government websites about *the E-Government web site patterns* to receive further input and evaluate newly created web sites where the creators can refer to the presented patterns when confronting different issues.

Even with these patterns at hand the authors have not forgot, and would like to point out, the golden rule that *there is no silver bullet*.

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