

Improving e-Shops Environments by Using Usability Patterns

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Abstract: The exigencies and the particular characteristics of website development are a great challenge for designers and developers. There are many differences between typical software application development and website development. In website development, the presentation component; visual and graphical, plays an important role, which is not that important for not web applications. This component can be documented by using patterns, and particularly usability patterns. Traditionally, guidelines have been used to deal with it. These patterns should be written so that they can be used by users, designers and developers. Thus, users will be able to make proposals, user interface designers will be able to imagine and developers will be able to build the application.

Keywords: usability patterns, user interfaces

1 Introduction

The growth of Internet is evident. Nowadays, almost everybody is concerned about new economy, new business, information society, information technology, the Internet and e-commerce, e-business, and so on. Seminars, forums, conferences and debates are being constantly organized, both on public and private level, to discuss the risks and opportunities of this challenge. Currently, websites development is different to traditional software applications. The differences that makes differ these two development processes are related with contents, flexibility, adaptability and plasticity (Montero et al, 2003) requirements.

Web is changing, at the beginning, it was basically textual and interaction possibilities were quite limited. However, at this moment, Web has become mostly graphical, and although information to be shown could be the same, now we want to provide additional web services and task support.

Like in traditional software application development process, software engineering discipline can provide many solutions; modeling, specification or programming languages,

methodologies, software architectures, guidelines and patterns, are some of them. Patterns, which is the focus of this work, were not first introduced in computer sciences, they were inspired by architectural patterns introduced by (Alexander et al., 1997), an architect. His patterns gathered experience about city layouts, buildings and ornamental details. These patterns are organized into several levels and they suggest requirements for living our lives with the so called *quality without name*.

In website development we have a similar requirement, we need to provide quality, but, in our case, this quality is an usability and accessibility-centered one. In this context, usability patterns can be used to gather experience in web application development. We are aimed to provide usable environments with ornamental elements appropriate to achieve user's commodity when he is visiting our website.

This paper is organized as follows: first, we shall speak about related work on pattern topic, on its use and how they can be applied to web development. Then, the challenges for using patterns, their problems and their advantages are introduced. And finally, an e-shop study case will be presented to illustrate our ideas.

2 Related Work

Pattern concept was introduced quite late in computer science. Curiously, this term was first used in computer science for gathering experience in user interfaces development using Smalltalk programming language. Later, the book *Design Patterns* (Gamma et al., 1995) provided experience in object-oriented development. This book and workshops, international conferences and other different events have given an important dimension to this topic.

Nowadays, we face great challenges in human-computer interaction. We have new devices, new interaction mechanisms and many languages and methodologies to develop applications. But these elements are not enough, the final user must be considered. Without the user, the final developed application will not be successful, and probably our application will be neither used nor visited.

Under a user-centered design philosophy, user plays a really meaningful role. The final user decides when the application is ready. Satisfaction is an important element of usability, and it is a subjective factor that depends on the user. We need to know user's characteristics, his tasks and goals when we want to develop any software application. If we know this information, the possibilities to create a successful software tool will be greatly increased. Our main objective as designers or developers is to provide solutions to problems under a context of use, and a pattern is basically that. A pattern is a tuple of three elements: a problem, a context and a solution. Many patterns have been proposed for many different computer science fields. For example in Graphical User-Interface (GUI) development, (Tidwell, 1999), (Welie, 2003) or (Borchers, 2001) are meaningful references, and in web development (Percele et al., 1999), (Tidwell, 2002), (Welie, 2003), (Van Duyne et al., 2002), (Rossi et al., 12), or (Montero et al., 2002b) (Montero et al., 2002c) can be cited.

Tidwell's collection (Tidwell, 1999) is organized according the following criteria: Whole UI, Page Layout, Forms and Input, Tables, Direct Manipulation and Miscellaneous. These patterns are intended to be read by people who have some knowledge of UI design concepts and terminology: dialogs, selection, comboboxes, navigation bars, whitespace, branding, and so on. Nevertheless, it does not identify some widely accepted techniques such as wizards. Welie's patterns (Welie, 2003) are organized according to the different sorts of applications.

Patterns have proved to be a useful tool for software development. However, they have some problems, mostly related with their structure and presentation. Patterns are introduced using natural language, so ambiguity and flexibility appear. Specifically with usability patterns, we find another problem, the way solution is specified. Code, using an object-oriented language like C++ or Java, can be associated with the solution proposed in a design pattern. But usability patterns have no language associated, maybe an XML-based declarative language could be used, but at this moment no collection is using such a language to specify the solution.

The use of usability patterns introduce yet another problem, we have no tool in order to make easier the collection, compilation and later use of patterns. However, we have some prototypes with this intention. We can make reference to Damask (Lin et al, 2003), that is a tool for early-stage design and prototyping of multi-device user interfaces. Damask is not a tool to create final UIs, so designers are allowed to modify the generated user interface design. The Concurrent Task Tree Environment (Paternò, 1999) is a tool realized by the Human Computer Interaction Group - CNUCE (Pisa). With this editor we can build a task model and generate an interactor-based architectural model. MOUDIL (Gaffar et al., 2003) is an integrated pattern environment. This environment is a service for UI designers and software engineers. Besides, it is a research forum to understand how patterns are really discovered, validated, used and perceived. MOUDIL has a pattern ontology editor, a pattern navigator and a pattern viewer available to make easier working with our patterns. Finally, UPADE (Usability Patterns-Assisted Design Environment (Seffah et al., 2002)) is a project, where patterns are documented using an XML-based notation.

3 A Study Case: e-shop Web site

This workshop proposed as a particular study case e-shop patterns. Under this topic several collections of patterns can be cited:

- (Welie, 2003): SHOPPING CART, LOGIN, REGISTERING, PRODUCT COMPARISON, PRODUCT CONFIGURATOR, PRODUCT ADVISOR, PREMIUM CONTENT LOCK, NEWSLETTER, PRINTER-FRIENDLY PAGE or CASE STUDY.

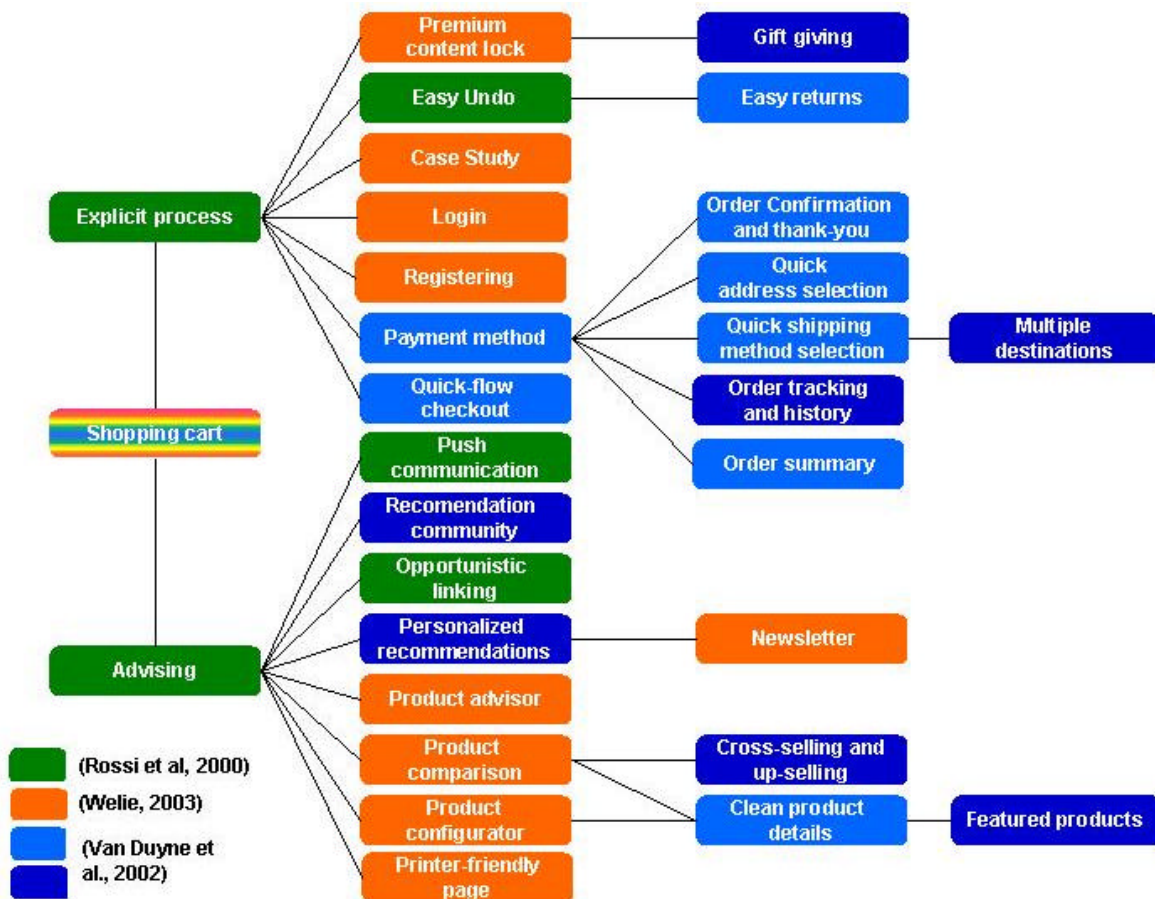


Figure 1: Relationships between e-commerce patterns

- (Rossi et al., 2000): where we can find several patterns like: OPPORTUNISTIC LINKING, ADVISING, EXPLICIT PROCESS, EASY UNDO or PUSH COMMUNICATION.
- (Van Duyne et al., 2002). We find two groups of patterns:
 - **Basic E-commerce:** QUICK-FLOW CHECKOUT, CLEAN PRODUCT DETAILS, SHOPPING CART, QUICK ADDRESS SELECTION, QUICK SHIPPING METHOD SELECTION, PAYMENT METHOD, ORDER SUMMARY, ORDER CONFIRMATION AND THANK-YOU, EASY RETURNS.
 - **Advanced E-commerce:** FEATURED PRODUCTS, CROSS-SELLING AND UP-SELLING, PERSONALIZED RECOMMENDATIONS, RECOMMENDATION COMMUNITY,

MULTIPLE DESTINATIONS, GIFT GIVING and ORDER TRACKING AND HISTORY.

Before these patterns are gathered and presented, in Figure 1 we can see the relationships between these patterns, that we have found. A hierarchical structure is presented to organize them, where more general patterns are located first in the structure. From these patterns, and following the relationships identified, the solution is enriched. Inside a concrete collection there are more relationships, but this ones are not displayed in Figure 1 for the sake of legibility. These relationships can be found in the associated references.

All patterns were introduced using natural language. The authors did not use any programming language, declarative or procedural.

Examples of using these patterns are provided when each pattern is introduced.

In these proposals there are many curiosities, for example, all the pattern collection authors' are writing e-commerce patterns but only a pattern: SHOPPING CART pattern, is appearing in all collections. Then, all proposed patterns are different and complementary. It is shown in the Figure 1. In an activity like e-commerce, users need to have the easy things, he needs an EXPLICIT PROCESS, and this is achieved following an STEP BY STEP process (Tidwell, 1998a) or WIZARD one (Welie, 2000). This process consist of several steps, REGISTERING / LOGIN, SHOPPING CART, QUICK-FLOW CHECKOUT and a PAYMENT METHOD. In these activities an EASY UNDO should be provided. EASY UNDO and EASY RETURNS are very similar patterns, we are considering that EASY UNDO is more general that EASY RETURNS in Figure 1. We think that this last pattern only refers to the navigational situation, but the former involves edition or acceptance tasks that user want to avoid.

Other task that we have to provide when we are designing or developing an e-shop web site should be ADVISING. This task is a typical one for a salesman, they provide information about several products, and then clients have to choose. PRODUCT ADVISOR, PRODUCT COMPARISON, PRODUCT CONFIGURATOR or PERSONALIZED RECOMMENDATIONS are related with advising tasks.

Then we can ask if these collections or pattern languages are complete and fully functional. We have three collections and between theirs patterns we can establish relationships.

Other question could be: How should we use this pattern collection? We should follow these steps:

1. Read the resumed list of patterns.
2. Scan down the list, and find the pattern, which best describes the overall scope of the project or the problem that you want to solve.
3. Read the starting pattern. Tick all of the low order patterns and ignore all the high order patterns.
4. Turn to each pattern and now tick only relevant low order patterns.
5. Keep going like this, until you have ticked all the patterns you want for your project.
6. Adjust the sequence by adding your own material where you haven't found a corresponding pattern.
7. Change any patterns where you have a personal version, which is more relevant.

Obviously, our problem is to develop an e-shop web site. This web should have usability characteristics; natural mapping, consistency, accessibility, feedback, explicit user control, error management, guidance, adaptability or minimize cognitive load. Many of these patterns are related with these features of usability. We can see relationships between usability properties and e-shop patterns in the following table.

Usability Property	e-shop Patterns
Natural Mapping	SHOPPING CART, EXPLICIT PROCESS,
Consistency	EASY UNDO, EASY RETURN, PRINTER-FRIENDLY PAGE, PRODUCT ADVISOR,
Accessibility	WAI guidelines, Section 508, PERSONALIZED RECOMMENDATIONS, NEWSLETTER, PRINTER-FRIENDLY PAGE,
Feedback	PREMIUM CONTENT LOCK, GIFT GIVING, OPPORTUNISTIC LINKING,
Explicit user control	EASY UNDO, EASY RETURN, MULTIPLE DESTINATIONS, ORDER TRACKING AND HISTORY, ORDER SUMMARY, ORDER CONFIRMATION AND THANK-YOU, PUSH COMMUNICATION,
Error Management	CASE STUDY, EXPLICIT PROCESS, ADVISING,
Guidance	CASE STUDY, PAYMENT METHOD, QUICK ADDRESS SELECTION, QUICK SHIPPING SELECTION, PRODUCT ADVISOR, PRODUCT COMPARISON, PRODUCT CONFIGURATOR, ADVISING, EXPLICIT PROCESS,
Adaptability	LOGIN, REGISTERING, PERSONALIZED RECOMMENDATIONS, PRINTER-FRIENDLY PAGE,
Minimize cognitive load	SHOPPING CART, EXPLICIT PROCESS, ADVISING

Reference	Name	Problem	Solution
(Welie, 2003)	Shopping cart	Users want to buy a product	Introduce a shopping cart where users can put their products in before they actually purchase them.
	Login	The users need to identify themselves so that stored data about/of them can be used in the process they are in	When needed, ask the users to login using a combination of an email-address and a password
	Registering	The users repeatedly need to (re)enter a large amount of personal data	Offer users to possibility to store their personal information for later use
	Product comparison	The users need to compare similar products	Show a matrix of products and features
	Product configurator	Users want to configure the product they may intend to buy	Allow users to configure a product using a direct and visual version of the configured product
	Product advisor	Users want advice on selecting the best product for them among a set of products	Advise users on product based on constraints, preferences and needs users have
	Premium content lock	Users need to know which content is for free and which is not	Show previews of premium content and mark it visually
	Newsletter	Users want to be regularly informed or updated.	Send users a newsletter regularly
	Printer-friendly page	User may need to print content of the page they are viewing	Place a link to a print-ready version of the page the users are viewing.
	Case study	Users need to know how a certain real-life problem was solved in order to decide whether the problem-solvers could do the same for them	Describe a case by describing the problem, the solution and the value of that solution
(Rossi et al, 2000)	Opportunistic linking	Keep the user interested in the site. Seduce him to navigate in the site even when he has already found what he was looking for	Improve the linking topology by suggesting new products to explore from a given one
	Advising	Help the user find a product in the store. Assist him according to his wishes	Build specific functionality for advising about products
	Explicit process	Help the user understand the buying process when it is not atomic	Give the user a perceivable feedback about the process by keeping him up to date about which steps he has already accomplished
	Easy Undo	Provide safe undoing capabilities in a complex process	Provide the user with Undo facilities avoiding him to use navigation facilities for this purpose
	Push Communication	Simplify the searching process for customer-selected areas or products	Combine the usual Web pull model with a push-based communication

(Van Duyne et al. Quick-flow checkout, 2002)	An e-commerce shopping experience will not be enjoyable, or worse, a purchase might not be completed, if the checkout process is cumbersome, confusing, or error prone	Follow a simple four step approach so that customers can complete their orders: <ol style="list-style-type: none"> 1. In a secure area of the site, allow customers to check out without storing their information, or let them create or use a customer identifier so that they do not need to reenter information. Set expectations by giving an overview of the process and providing answers to common questions. 2. Gather shipping and handling information and shipping methods so that you can tabulate the total cost of the order, including taxes, at the next step. 3. Show the total cost of the order along with the order summary so that customers can verify that the information is correct. 4. Confirm that funds for the order are currently available, and give the customer a final opportunity to confirm the order. When the order is complete, provide a printable receipt and invite the customer to return
Clean product details	When shopping, customers want to see product details to help inform their buying decisions. They must also trust a seller before deciding to make a purchase. Many sites do not provide enough in-depth information about their products, or they project an untrustworthy image	Provide in-depth information in a grid layout. Keep important items that every customer will needed above the fold, such as general navigation, product thumbnails, need-based descriptions, prices, an options pick list or a link to a configuration page, product ratings and delivery time frame, the Add to Cart action button, and links to more detailed information, even if the information is farther down on the page. Put secondary items, such as a full product description reviews, <u>related products</u> , and a <u>product comparator if possible</u> , below the fold
Shopping cart	Customers want to collect and purchase several items in one transaction. Online shopping carts can provide much more than their offline namesakes, such as making it easy to change the quantity of an item in the cart. However making shopping carts simple and useful requires restraint	Give customers easy access to the shopping cart from every page of your site
Quick address selection	Entering addresses need not be cumbersome, especially if customers are ordering from a site for a second time	At the top of the page, provide a link to the area where a new address can be entered
Quick shipping method selection	Customers resent hidden shipping and handling charges, and they want to pick the best shipping option for their situation	Provide a pick list or radio buttons for selecting shipping options. Give a high level description of the delivery time frames and the associated costs. Calculate the shipping costs on the basis of size and weight of the products being shipped. Provide links to more in-depth information about shipping issues, including international requirements and insurance

Payment method	When it comes to paying for an order, people demand security and simplicity	Dispel any concerns that customers might have about security by addressing them up front with a link to your security or privacy policy. A pick list or radio buttons help customers select the billing options. Create a new credit card form that is quick and easy to read: with labels right-aligned and input fields, left aligned along the same vertical grid line, using a minimum of fields, minimal instructions, and a Use this card action button. If storing multiple billing addresses, above the new address form include a list of all previously stored addresses with a Use this address action button next to each one
Order summary	When finalizing orders, customers want to see everything related to what they're ordering; the specific products, all the charges, and the billing methods, as well as where, how, and approximately when packages will be delivered. If any one of these elements is missing from an order summary, customers might abandon their purchases	First, let the customer know that the order still has not been placed, and provide high-visibility action buttons for completing the order. Second, show the items being purchased and all the information that the customer entered: address, payment method, and shipping selections. Provide action buttons to edit these items in case they are incorrect. Third, calculate and present the total costs, including shipping and taxes.
Order confirmation and Thank-you	After they complete their orders, if customers do not get confirmation or a receipt indicating that the order has gone through, they will be unsure of their order status and have to work to find confirmation evidence	Provide a thank-you on a printable page that displays the order number, the order date, and all the order information, including items purchased, quantities, prices, shipping prices, tax, total and shipping and billing information. Give customers an action button to continue shopping and cross-sell them on other products they might be interested in purchasing
Easy returns	When items that are accidentally ordered, damaged during delivery, or just not wanted can be returned quickly and easily, customers are more likely to order. But making returns easy is not simple	Put the return policy on all product and checkout pages, including a link to a return process. If customers throw away a return label, give them the ability to print another one, and use the label to track returns as they arrive
Featured products	Customers find value when sites identify specific products as recommended or featured. Otherwise product lists can appear bland and tedious	To give people a better sense of what's on your site, build category pages that highlight special featured products and editorialize in the product recommendations. Provide different kinds of recommendations, choosing different categories, such as top sellers, editor's choice, and so on. Let visitors explore by highlighting as many areas of interest as possible
Cross-selling and up-selling	When choosing a product in stores, people appreciate hearing about related products that are complementary to or better than the products they have chosen. Doing the same thing online requires prudence and planning	In a subtle and careful way, cross-sell and up-sell related products by indicating the benefit they provide to your customers. Customers will be seduced and will not need to go far to make a purchase if you make it quick and easy to add a related product to a shopping cart without leaving the context of the current page. Make a visual distinction between these promotions and the order content on the page. Sell the related products again later in the checkout process, in case customers missed them the first time

Personalized recommendations	Personalized recommendations can provide customers with a better sense of what's useful and what isn't. But if they require too much effort on the customer's part, or if they are based on what customers perceive as scant evidence, they will fail	Avoid using pure inference data to make product recommendations because it will not necessarily reflect real customer choices. Start by offering product and category recommendations based on previous purchases by other customers. Then add recommendations based on past purchases, ratings, and interviews completed by the customer. Integrate this data into your site on product pages, category pages, and personalized recommendation pages. Provide feedback about why a recommendation was made. Provide multiple recommendations, including those that customers have seen before, to help people gauge the quality of the recommendations. Address privacy concerns and how the personalization data will be used
Recommendation Community	Recommendations from other customers are valuable, but the process of making sure the community system is not abused is time-consuming and littered with obstacles	Provide a two-step process to write a review: (1) Have customers enter review title and text of the review, and any numerical rating. The text must follow the guidelines of the site. (2) Let customers see the recommendation as it will appear in the site, and allow them to edit it. Filter the title and text for profanity and HTML that might link to another site. Staff an editor to review customer-written recommendations and remove them if they are offensive or libellous. Once the review has been posted, provide a mechanism for other customers to rate the review, giving it a meta-rating. Finally, offer an incentive for customers to write the first review, to get people to use the community features
Multiple destinations	Customers sometimes want to ship to multiple addresses once they have chosen their items to purchase. Making this process simple requires changes throughout the checkout process	Provide a Send to multiple addresses action button at the top of the quick address selection page. If the customer clicks it, show a new page with an Add new address action button, a list of all the products in the order, and a pick list next to each product. The pick list provides all the destination options. If there are no existing addresses, as in the case of first-time customers, immediately go to a new-address page
Gift giving	When ordering gifts online, customers want to write notes to the recipients and to be assured that the price will not be disclosed. If a site does not offer these conveniences, customers will be less likely to order gifts	Give customers clear indications early in the shopping process that the site has gift-giving options, so that they can shop for that reason. On the checkout page, provide a button that takes customers to a form where they can enter notes and select gift-wrapping options. And on this form, provide a button that takes customers back to the order summary page, where they can review their whole order, including gift options. Then they're done, the order confirmation page will list the entire order, including gifts, in case customers want to the information for their records
Order tracking and history	Then customers place online orders, the details about order status and shipping become important. If this information is not easily available online, the cost of processing customer inquiries increases dramatically	Require customers to sign in to review their orders and modify them. Give them access to an order history that categorizes orders as pending, shipped or completed. Display the selected orders chronologically, listing the order number, as well as the contents of the order if the list is not too long. For pending orders, indicate each item's availability, and allow modification of everything from shipping and billing to products and options. For orders you have already shipped, allow order tracking by interfacing with the shipper's database and displaying the shipment way-station history

4 Challenges and Advantages of Available Patterns

Several problems and advantages derived from using patterns can be identified in the available literature. We are considering that usability patterns are generally presented as the ideal medium for gathering and disseminating user experiences and UI design practices.

The narrative format used to document patterns makes them similar to design guidelines (Seffah et al., 2002). However, one question arises: have the patterns been elaborated for users, graphical designers or developers?. If the final user needs to be involved in the design and development process, natural language will be needed, so that the user can identify his problems in an easier way. Furthermore, our patterns address usability and interaction issues. If we use a formal notation to specify the solution, probably we will lose generality, and the graphical design can be too limited, because, from our point of view, design patterns are oriented to internal characteristics as modularity or reuse, but usability patterns try to get external facilities related with satisfaction and ease of use. Therefore, providing a concrete solution in a particular language for each usability pattern is not clearly a good idea.

In addition, which language is the best one?, there are many platforms, many devices and many languages and, the modeling languages such as UML have limited capabilities when describing user interfaces.

The final success of a pattern collection depends on different aspects, for instance, Alexander's patterns have a good structure, and relationships between patterns is rigorous (Montero et al., 2002a), so when a architectural problem is identified we know which patterns can provide a solution. In other collections, for example GoF's patterns (Gamma et al., 1995), we have a more reduced number of patterns, and the problems are programming ones, more objective than usability or interaction problems. It is well-known that usability itself is already a subjective quality.

Providing usability pattern-oriented tools is difficult, we have not a clear language or notation, patterns are disseminated and the relationships between them are not clearly defined. Perhaps, at this moment, the pattern collections introduced can be used as a checklist where designers can verify

prototypes or applications, as a heuristic usability evaluation method.

5 Conclusions

Designing interactive systems is difficult and designers need effective tools that are usable themselves. Guidelines have since long been used to capture design knowledge and to help designers in designing user interfaces. Patterns can be more powerful than guidelines as a tool for designers, however, there are a lot of suggestions, drawbacks and possibilities that need further work. In this paper we have done an overview on usability patterns, the tools that support them, the problems that appear when applying those patterns and the challenges we will have to face in a near future to include usability patterns in daily software development.

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