A Set Of Heuristics for User Experience Evaluation in E-commerce Websites

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***Abstract*—Electronic Commerce (e-commerce) websites need to provide customers with a positive User Experience (UX) to be successful and competitive. In this paper, it is presented a set of 64 heuristics as a tool to evaluate the grade of UX achievement of these kinds of sites. The set is based on three studies which provide functional requirements and guidelines in regard to the quality of e-commerce web sites. The main contribution of this work is the standardization of these recommendations by formulating them in interrogative sentences to facilitate the evaluation of e-commerce sites. Each heuristic is accompanied by examples and suggestions that facilitate their evaluation by a provided scoring system.**

Keywords-Heuristic evaluation; E-commerce; User Experience.

I. INTRODUCTION

Business-To-Consumer (B2C) websites are complex interactive systems whose primary goal is to draw a visitor into completing an online purchase. It is well know that User eXperience (UX) is one of the most critical factors for Electronic Commerce (e-commerce) success and as such, it has become a competitive requirement. The standard ISO DIS 9241-210:2008 [7] gives one of the most popular definitions, it says that UX is: "A person's perceptions and responses that result from the use and/or anticipated use of a product, system or service". Morville [14] has contributed in the field of UX providing seven well-known facets, these are: useful, usable, findable, valuable, desirable, accessible and credible.

However, it seems that UX is not as implemented in e-commerce sites as it should be. According to Baymard Institute [1], the average shopping cart abandonment rate from 18 different studies is 67%. Therefore, enhancing the UX is required in B2C sites as this in turn contributes to an increase in the number of orders. The first step to improve the UX in existing and new e-commerce websites is their evaluation.

One of the most used evaluation inspection methods is the Heuristic Evaluation (HE). It can be applied during the development process of interactive systems or used on real operational systems. The HE is an effective method to review interfaces by taking the recommendations based on User Centered Design rules and contrasting them with the website. These recommendations come in different guises, such as design principles, heuristics, guidelines, best practices or user interface design patterns and standards [10] that are supposed to serve interface designers and evaluators. Despite this, only heuristics are usually orientated as an evaluation more than a design tool. This is because they are often written in interrogative sentences instead of being written in declarative sentences. An study presented by Masip et al. [11] reveal that evaluators prefer interrogative sentences because they are more intuitive.

Another difficulty of HE is that it is necessary to adapt the heuristic set to the specific features of each interactive system. Thus, evaluators have to combine different recommendations sources in order to review the specific application domain. This involves a long reviewing process as guideline collections inevitably induce conflict between various resources. Guidelines conflicts are caused by the different characteristics of each set of recommendations. For instance, level of detail, format, scope, language, classification of the principles, updating, level of validity and quality and development phase for use [16]. In addition, each set uses different scoring systems to score the recommendations, so it is necessary to adjust it in the resultant set.

The process of combining different heuristic sets usually finishes up with a long list of duplicated recommendations, similar statements using different terms and potentially conflicting guidelines. A clean-up and selection process is then required to provide a reliable, consistent and easy to use heuristic set [9]. Furthermore, the majority of the recommendation sets are written in declarative sentences. The evaluators can keep to this way of writing, as it eases the adaptation process of the heuristic set, but then the implementation of the evaluation process will be a far more complicated task.

For e-commerce websites the adaptation of the heuristic set is especially challenging. It is possible to use universal usability principles, such as Nielsen's [15], but they do not cover all the aspects involved in B2C sites. Additional heuristics appear to be needed to support e-commerce specific components and functionalities, such as shopping cart, customer service, checkout and registration process, category and product pages. Moreover, there are some factors that are especially important for the customer, such as trustworthiness, safety and privacy.

Some specific e-commerce user interface recommendations are available; for example, the Bauer's guidelines for Product Pages [2] or the Guidelines of E-

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Commerce Checkout Design presented by Holst [6]. As of the two previous examples, most of the sets of recommendations found for e-commerce websites are partial, presenting principles only for some aspects of B2C websites, such as shopping cart, product pages, checkout process, etc. In addition, any recommendations written in interrogative sentences have been found in this field.

For all the reasons above, it is proposed to pull all the e-commerce principles from the literature together and standardize them into interrogative sentences to be ready for evaluators to use. A scoring system is also suggested to ease the reviews and overall scoring of B2C sites. The resultant heuristic set will prevent the problems that arise from the combination of the recommendations taken from different sources. The aim of this paper is to begin with the recommendations standardization by providing ”a first set of heuristics“ to evaluate the UX in e-commerce websites.

This paper is structured as follows: first, in the methodology section, the procedure to obtain the heuristic set and the scoring system are explained. Then, in section 3, the resultant set and its detailed organization and presentation are shown. Finally, in the conclusion section, the main conclusions and the future work are shortly described.

II. METHODOLOGY

The heuristic set introduced is based on the analysis of three studies, these studies present guidelines or functional requirements for e-commerce websites. The selected studies are Liang and Lai [8], Lightner [9] and Cao et al. [3]. They were selected due to their similarity as their criterion is used to test on-line bookstores. These studies do not cover all the aspects of User Experience but as stated, this paper's aim is just to begin the standardization.

The first thing to do to obtain the proposed heuristic set was to deduce and recollect all the recommendations given by the three studies. Then, each recommendation was rewritten formulating an interrogative sentence and providing examples or advice to facilitate their scoring. In table I, an applied example is shown in order to clarify the process followed to obtain the heuristics. In the first column there are cited the three studies. In the second column there are quoted the author's definitions of their own recommendations. In the next column there are the guidelines about security extracted from the studies. Finally, in the last column, the resultant heuristics which are inspired by the three authors' recommendations are presented.

TABLE I. PROCESS FOLLOWED TO OBTAIN THE HEURISTICS

Author	**Authors' definition of their own recommendations**	**Recommendations about security from the studies**	**Resultant Heuristics**
T. P. Liang, and H. J. Lai [8]	“Functional requirements derived from the customer's perspective”	“I trust the web site will not misuse my personal information”	*Does the website show security logos?* It should show them especially in the checkout process to build trust. The logos may be related to the shipment (FedEx, UPS, etc.), payment options (Visa, PayPal, etc..) or security, like SSL.
		“The web site is secure”	
		“The web site is realiable”	*Does the website inform of the level of security when paying by credit card?* It should demonstrate that it is a safe website to buy from.
		“I fell protected/safe when I use the site”	
N. J. Lightner [9]	“Functional requirements that represent facets of customer service in a B2C site”	“Provide secure payment”	*If personal information is required by the website, does it have the Privacy Policy available?* It should include all possible uses of their personal information. The footer is the standard location to link this information. It has to be easily understandable by the customers.
		“Inform customer of paymen security (Safe Shopping Guarantee)”	
		“Inform customer of privacy policy (For instance: Link during checkout or help, Privacy icon link, etc.)”	*Does the website has safety certificates granted by external companies?* It is important to get them and let customers know about them. These are companies like VeriSign or ControlScan. It must use the secure SSL technology as well.
M. Cao, Q. Zhang, and J. Seydel [3]	“A set of factors that capture the quality of an e-commerce website”	*“Claiming security of transactions:* Since the seller and the buyer do not actually see each other in the virtual market, Internet security is a major concern. Therefore, adopting proper security mechanisms, such as secured electronic transactions, and making announcements may help.”	

Following that, the heuristics were organized based on the stages of customer's buying behavior described by Engel et al. [5]. Consequently, as it is explained in the next section, the heuristics are organized in the following six parts: Need Recognition and Problem Awareness, Information Search, Purchase decision making, Transaction, Post-sales Services and it has been added a section to gather factors that affect UX during the whole purchase process. This organization intends to facilitate the evaluators' understanding of customer behavior to enhance the HE results. If during the reviewing of the interface the evaluators follow the stages of the purchase decision process they will understand the customer's needs and point of view.

Finally, a scoring system has been established as a convenient tool to assist the evaluators in conclusion making by providing quantitative results of the HE. Each

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heuristic was assigned either a "yes" or "no" answers or a 1 to 5 Likert scale. To obtain a global score for the evaluated websites the affirmative answers get 5 points and the negative answers get 1. For the other system, the evaluator can grade the level of accomplishment between 1 to 5. The scale is represented as: 1 strongly disagree, 2 disagree, 3 neither agree nor disagree, 4 agree and 5 strongly agree. The first scoring system is assigned to the questions that either have or do not have specific features or functionalities. The Likert Scale system is attached to the heuristics that require a ranged score as they depend on expert opinion. Eventually, it is possible to combine scores together to obtain a total score out of 233 points. This eases the comparison between different websites, and is useful to estimate the level of UX that a website has according to the heuristic set.

III. RESULTS

In this section, a set of 64 heuristics ready to be rated by experts is presented. The set is the result of the compilation and standardization of the recommendations from the three selected studies.

A. Heuristics organisation

As it is pointed out at the Methodology section, the heuristics are gathered in 6 groups according to the stages of the Buying Decision Process described by Engel et al. [5].

1) Need Recognition and Problem Awareness (Table II): *It is* the first step of the process. Without the recognition of the need a purchase cannot take place. In this stage, customers use search and navigation tools to find a product or service which covers their needs. The website has to stimulate the desire to purchase to enhance that needs.

2) Information Search (Table III): This is the next step customers may take after they have recognized their problems and needs in order to find out what they feel is the best solution. The customers search for information sources related to the products which can cover their needs.

3) Purchase Decision Making (Table IV): At this stage, consumers evaluate different products on the basis of varying product attributes to find the product which offers more benefits. After that process, the customers make a choice.

4) Transaction (Table V): The checkout is the last step in the Buying Decision Process. It has to be clear and trustworthy to drive the customers to finish a purchase.

5) Post-Sales Behaviour (Table VI): At this stage, companies should carefully create positive post-purchase communication to engage the customers. Also, the system has to facilitate tools to modify or follow customer's orders.

6) Factors That Affect The UX During The Whole Purchase Process (Table VII): There are many factors that affect whole purchase process and contribute in providing a satisfactory UX. One of the most important is trustworthiness because the customers have to believe that the website is reliable to finish a purchase.

B. Heuristics presentation

The heuristics are presented in the following six tables. It is shown according to the column order: the heuristics formulated as a questions to contrast with the website, a short explanation or examples to assist the rating decision making, the sources where the recommendation come from and the most appropriate rating system. It is recommended to add an additional column where experts can write their observations and reasons for scoring the heuristics in a manner of their choosing.

TABLE II. NEED RECOGNITION AND PROBLEM AWARENESS

Heuristics	Description	Source(s)	Importance of factors
Search and navigation tools			
Is the navigation obvious enough throughout the related sections?	Customer should be able to move easily through the different sections. For instance, between the shopping cart, the detailed description of the products and the shipping information.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the website use a clear user-logical hierarchy of categories to classify products and to find them?	The categories should be easy to identify and differentiate by the customer.	T. P. Liang and H. J. Lai [8]; N. J. Lightner [9]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Do Category Pages include appropriate filters or facets by features?	They have to correspond customers' needs and be easy to undo. They are especially useful in shops that have a large amount of products.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)

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Heuristics	Description	Source(s)	Importance of factors
Does the website provides a search box to locate products and information?	It must be visible at the top right of the page and it must continue throughout the whole site.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the search have advanced features that allow for a limit to a great variety of criteria (features, categories, etc.)?	The advanced features have to correspond customers' needs This helps to retrieve the most relevant results.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Does the search engine provide the customer's expected results?	An analysis of customer searches must be made as a means to optimize search results.	T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Are there appropriate mechanisms, such as filters or facets to refine the search results?	After doing a simple or advanced search the results can be refined by applying these mechanisms. They have to correspond customers' needs and be easy to undo.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Do the pages and sub-pages provide orientation elements?	As a means to orientate it is necessary to use breadcrumbs, titles and subtitles.	T. P. Liang and H. J. Lai [8]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the checkout process includes a progress indicator at the top of the checkout pages?	Usually, it is a progress bar which indicates the steps that are missing to complete the purchase and the steps that have already been completed.	T. P. Liang and H. J. Lai [8]; M. Cao, Q. Zhang, and J. Seydel [3]	(Yes / No)
Does the website clearly display the "call to action buttons"?	This means that the buttons like "Add to Cart" or "Buy now" are easy to see and click. They should be located away from other buttons to avoid being clicked by mistake.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the website includes a site map?	This gives the user an overview of the site's areas in a single glance.	M. Cao, Q. Zhang, and J. Seydel [3]	(Yes / No)
Stimulating the desire to purchase			
Does the website use elements to draw customer's attention?	It can use banners, sounds and animations to focus customer attention on certain items or events.	T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Are the new products or special offers prominently advertised?	For instance, adding next to them "New!" or "On Sale."	T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Does the website shows the number of current visitors?	This is an index of the current shopping atmosphere that gives the customers a sense of store popularity.	T. P. Liang and H. J. Lai [8]	(Yes / No)

TABLE III. INFORMATION SEARCH

Heuristics	Description	Source(s)	Importance of factors
Is the information about the products accurate, informative and convincing?	It must include specifications and features with a non-technical and persuasive vocabulary.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the website provides value-added information and services?	For instance, lists of best sellers, compiled trends, link news related to the products and services, etc.	T. P. Liang and H. J. Lai [8]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the website content regularly updated?	Out of date content leads to customers distrusting the website.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the content based on the users' needs?	The content should be based on the customers needs instead of being based around the product description.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Are there multimedia resources to explain the products?	The site can use videos, images, audio and animations. These can involve long download times, thus it is necessary to strike a balance and optimize their use.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is there any indicator about the product availability as soon as possible in the purchasing process?	If a product isn't available, it has to inform the customer when the product(s) will be available again.	N. J. Lightner [9]	(Yes / No)

c. Information Search Heuristics

TABLE IV. PURCHASE DECISION MAKING

Heuristics	Description	Source(s)	Importance of factors
	Alternative Evaluation		
Is there enough information that relates to products or services?	It must provide all necessary information required to help the customer to make a decision. This include detailed descriptions of the features. For example, in the case of a book this would be the title, author, publisher, format, description and images. It should specify the price, availability of the product, the shipping conditions and customer reviews.	N. J. Lightner [9]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Are there product-related ratings and reviews?	It is not wise to build an own rating and review system because it will be seen as less trustworthy. In such a system, it is better to let negative reviews stand unless they are obscene or violate the law.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Is there a mechanism for the customer to indicate the usefulness of other customers reviews?	It can use a question, such as "Have you found this useful?" and as an answer "Yes" or "No". This displays how many people have found each review useful, and how many have not.	N. J. Lightner [9]	(1 2 3 4 5)
Are customers allowed to comment in other customers reviews?	The website should facilitate interaction between customers as they remain loyal to the site.	N. J. Lightner [9]	(Yes / No)
Does the website include product reviews published by the media?	It should add links to these reviews and the logos of the media to increase the trustworthiness of the website.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Are there tools to ease the comparison between different products?	For instance, it can assist the customer by providing a summary of the most important features - according to customers' needs - and costs of each product within a category. Alternatively, it can provide a tool to add products to a comparative table.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Are the order charges, such as taxes and shipping costs specified as soon as possible in the purchasing process?	If this information is hidden it causes distrust and shopping cart abandonment.	N. J. Lightner [9]	(1 2 3 4 5)
Is there information about the delivery dates?	Customers would like to know when the order is going to be delivered.	N. J. Lightner [9]	(Yes / No)
Does the website provide recommended products?	This can assist in finding products which might interest the customer, because they are similar to the products he purchased before or to products in which they expressed an interest. The related products can be inserted at the bottom of the product page, shopping cart or both.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Does the website provides products related to the selected product?	It should show accessories for the product which customer may want to purchase. This section can include between 2 and 6 related products and it is normally located at the product page or the shopping cart.	N. J. Lightner [9]	(1 2 3 4 5)
	Choice		
Does the website has a shopping cart which is accessible from all the pages?	It must contain everything selected by the customer and the content should be accessible at anytime.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(Yes / No)
Does the website incorporates a Wishlist?	It is a useful tool to manage products. For many users adding products to a wishlist is less committed than to a shopping cart.	N. J. Lightner [9]	(Yes / No)
Are there Intelligent Agents that can assist the customer?	Their primary role is as a shopping assistant, helping customers to solve problems. They can also be used to promote products.	T. P. Liang and H. J. Lai [8]	(Yes / No)

d. Purchase Decision Making Heuristics

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TABLE V. TRANSACTION

Heuristics	Description	Source(s)	Importance of factors
Is there enough information to assist in the purchase process?	It could be useful for novice users to have section with a brief explanation. It also can be achieved by adding contextual help during the purchase process this can be achieved by introducing examples in the form fields.	N. J. Lightner [9]	(1 2 3 4 5)
Is the checkout process divided into logical steps?	An example of common logical steps would be "Shipping address and payment", “Shipping and gift options" (which include options like gift wrapping or adding a message), "Payment", "Order Summary" and "Order Confirmation".	N. J. Lightner [9]	(1 2 3 4 5)
If registration is required, is the process short and simple and does it demand only essential information?	If the customers consider that the information required by a field is not mandatory the chance of them falsifying data to speed themselves through the process increases. For this reason, it is useful to keep the process as short as possible and in the case of required information briefly explain why it is required.	T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Are there enough alternatives for the delivery of the order?	The customer should be able to choose the company they prefer, such as USPS, FedEx, UPS, DHS, etc. and consequently manage the speed of the delivery.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Does the website allow for enough payment options?	To avoid losing orders it should offer as many options as possible, such as Visa, MasterCard, bank account, electronic checks, PayPal or promotional codes. It is wise to display the logos of the payment options to make them more visible and trustworthy.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Are the different costs and discounts applied in the order and detailed before it is approved?	There has to be an order summary which specify the prices for each item, number of items, discounts applied, taxes and the total cost.	N. J. Lightner[9]	(1 2 3 4 5)
Is the button to confirm the purchase clearly visible?	It is usually labeled as "Buy" and it should be large, highlighted by color and linked to the order confirmation page.	N. J. Lightner [9]	(1 2 3 4 5)
Does the website provide different means for completing the order?	The site can facilitate the completion of the purchase by fax, phone, etc. Many online orders are not completed because of perceived safety.	N. J. Lightner [9]	(Yes / No)
Does the website show security logos?	It should show them specially in the checkout process to build trust. The logos may be related to the shipment (FedEx, UPS, etc.), payment options (Visa, PayPal, etc..) or security, like SSL.	T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Does the website inform of the level of security when paying by credit card?	It should demonstrate that it is a safe website to buy from.	N. J. Lightner [9]	(Yes / No)

e. Transaction Heuristics

TABLE I. TABLE VI. POST-SALES BEHAVIOUR

Heuristics	Description	Source(s)	Importance of factors
Does the system send a confirmation email after the customer’s order?	The email should summarize the order and thank the customer. This generates a positive opinion from customer service.	N. J. Lightner [9]	(Yes / No)
Is it possible to track the status of an order from the customer account?	This section should allow the customer to consult a previous order and to track current orders.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(Yes / No)
Can the customers manage their order(s) from the customer account?	The user should be able to modify or cancel orders. If returns are possible it should allow the tracking of its status.	N. J. Lightner [9]	(1 2 3 4 5)
Does the website allow the customer to return an item?	This boosts loyalty and potential purchases.	T. P. Liang and H. J. Lai [8]	(Yes / No)

f. Post-Sales Services Heuristics

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TABLE VII. FACTORS THAT AFFECT THE USER EXPERIENCE DURING THE WHOLE PURCHASE PROCESS

Heuristics	Description	Source(s)	Importance of factors
Is the response time of the website reasonable?	Customers do not tolerate long waiting times. If the time to download a page is not reasonable for them they may leave the site.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the waiting time for the search results reasonable?	This depends on the size of the database. If the waiting time is going to be long, it would be wise to include small illustrations and animations to keep the customers waiting.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the interface's style consistent?	It reduces the cognitive load and facilitates the ease of orientation.	T. P. Liang and H. J. Lai [8]	(1 2 3 4 5)
Does the website presents an innovative and attractive image?	This helps to differentiate it from the competition and it is highly appreciated by customers. For this reason, they spend a longer amount of time on the site.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the website exciting?	It can include resources, such as interactive materials, downloadable applications, games, personalized information, etc. This benefits the playfulness and entertainment on the site and consequently the customer's satisfaction.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the website personalize any type of contact with the customer?	For example, when the system send an email it can include the customer's name.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does the website offer the possibility for the customer to become a VIP?	This exclusivity increases the satisfaction and loyalty of the customers who spend more money.	T. P. Liang and H. J. Lai [8]	(Yes / No)
Trust building			
If personal information is required by the website, does it have the Privacy Policy available?	It should include all possible uses of their personal information. The footer is the standard location to link this information. It has to be easily understandable by the customers.	N. J. Lightner [9]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Does it have the shipping, return or exchange Policy and other shop rules available?	This information can be included in the FAQs or in a specific section of the store. These resources have to be easily understandable by the customers.	N. J. Lightner [9]	(1 2 3 4 5)
Does the website has safety certificates granted by external companies?	It is important to get them and let customers know about them. These are companies like VeriSign or ControlScan. It must use the secure SSL technology as well.	N. J. Lightner [9]; T. P. Liang and H. J. Lai [8]	(Yes / No)
Is contact information visible during the purchase process?	The telephone number should be shown at least to answer any questions about orders.	T. P. Liang and H. J. Lai [8]	(Yes / No)
Does the website provide different means for customers to contact the company?	For example forms, email and phone as these improve customer confidence.	N. J. Lightner [9]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the best way to contact the company clarified for each type of concern?	It should specify the best means of contact for each type of question. For example, if it's a technical question, a matter of sales or about returning an item.	N. J. Lightner [9]	(1 2 3 4 5)
Does the website gives the address of the company?	It can be shown in the information about the company, in the FAQs and in the checkout process to give credibility to the page.	N. J. Lightner [9]	(Yes / No)
Does the website has a FAQ section that covers common customer questions?	It has to cover the most common questions detected by the customer service. For example, it can answer questions concerning the return policy. The information included has to be easily understandable and useful.	N. J. Lightner [9]	(1 2 3 4 5)
Does the company responds to comments and concerns expressed by the customers?	Either through private means like email or public, like a product review.	N. J. Lightner [9]; M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)
Is the appearance of the website safe and reliable?	Security is independent from the graphic design but the perception of security is very important for the customer. For instance, the introduction of elements, such as the image of a padlock affects positively this perception.	M. Cao, Q. Zhang, and J. Seydel [3]	(1 2 3 4 5)

g. Heuristics that affect the UX during the whole purchase process

IV. Conclusion and future work

As we pointed out in the methodology section, the heuristics presented above are derived from functional requirements expressed by customers and from factors that capture the quality of e-commerce websites. Therefore, they do not equally cover every UX's facet mentioned in the introduction. The only aspect that any of the three studies have considered is the accessibility. None the less, it is quite common to check it separately with online tools that automatically analyze it and provide quantitative results [4]. Anyway, as a future work, it is planned to integrate accessibility requirements in the proposed model to improve the consistency of the evaluation.

The presented heuristic set is an assisting tool for evaluators based on proved standards to review the aspects of a website that can affect UX. It is an open list that is going to be extended in a broader study by adding more recommendations to create a greater and more exhaustive set of heuristics. The set will be updated and adapted by modifications, updates and additions because of the continuous evolution of e-commerce sites. The follow up study's goal is to cover as many B2C websites and UX's aspects as possible. In this way, the set can serve a wide range of e-commerce sites that may require only small adjustments depending on the website features. Thus, the set might require some revision to discard the sections and heuristics which do not apply.

Moreover, it is necessary to add that the current set of heuristics has some more limitations apart from the ones mentioned. The heuristics understandability has been checked by two experts, but the set has not yet been used to review any e-commerce websites. Consequently, it is not possible to prove empirically its efficiency.

Finally, as future work, it has been planned to follow this research introducing the presented heuristics into the Open-HEREDEUX repository [12][13]. This will enable to start an experimental test with two objectives: enhance the database of Open-HEREDEUX heuristics (introducing a specific set for e-commerce systems) and validate the set of guidelines presented in this paper. The second goal will consist in evaluating different e-commerce sites (between 5 and 10) in order to obtain and analyze the results. This also will serve to refine the e-commerce set of heuristics.

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