User Experience Heuristics for Geoportals

Daniela Quiñones, Andrés Barraza, and Luis Rojas

Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile

ABSTRACT

User experience (UX) evaluation is an important task to perform when developing any kind of websites. It is necessary to assess whether the websites meet the needs of the users and whether it fits properly in the physical, social, and organizational context in which it will be used. In this regard, it is important to evaluate whether a Geoportal – a specific type of website – is intuitive, easy to use, and allows users to complete their objectives. The heuristic evaluation is an inspection method where experts use a set of heuristics to detect potential usability/UX problems. Since geoportals has specific features, generic heuristics may not be efficient to detect usability/UX domain-specific problems. Geoportals have their own features that differentiate them from other products, so it is necessary to use a set of specific and appropriate heuristics for these types of websites. Moreover, we think that heuristics can help detecting problems related to UX, and not limited to usability aspects. This article presents a set of 10 heuristics to evaluate the UX of geoportals. The heuristics were developed using the methodology proposed by Quiñones et al. (2018). We performed a preliminary validation with UX experts in order to refine and improve the proposed set of UX heuristics for geoportals.

Keywords: User experience, Geoportals, Heuristic evaluation, User experience heuristics

INTRODUCTION

A web portal is defined as a "website that acts as a connection to a collection of information or resources including sources, services, news, tutorials, tools and an organized collection of other references from different websites" (Maguire & Longley, 2005). Specifically, the expression "geospatial resources" is used for geospatial information and services, where this "geoportal" is a type of portal, where it deals with resources with these characteristics. Based on the review that we performed, we can define a geoportal as a website that is considered an entry point to geographic content on the web or, more simply, a website where geographic content can be discovered. Several features can define this type of portals. According to the "Spatial Data Infrastructure of Uruguay" (2018), geoportals have the following characteristics: User interface; Metadata; Data access; Documentation; Contact; and Help.

According to the ISO 9241-11 standard (2018), the User Experience (UX) is defined as "the perceptions and responses of the person resulting from the use and/or anticipated use of a product, system or service". The UX evaluation is an important task to perform when developing any kind of websites.

It is necessary to assess whether the websites meet the needs of the users and whether it fits properly in the physical, social, and organizational context in which it will be used. In this regard, it is important to evaluate whether a geoportal is intuitive, easy to use, and allows users to complete their objectives. UX should be explicitly considered, since the information, the content, the, presentation and the structure of the website should generate a user-friendly experience, motivating people to use the several functionalities and tools provided by the geoportal.

Heuristic evaluation is an inspection method where expert evaluators detect potential usability/UX problems, based on heuristics (Nielsen, 1994). Nielsen's heuristics allow evaluators to inspect a website in a general way, without focusing on specific domain features. However, the above makes it difficult to detect usability/UX domain-specific problems. Geoportals have their own features that differentiate them from other products, so it is necessary to use a set of specific and appropriate heuristics for these types of websites. Moreover, we think that heuristics can help detecting problems related to UX, and not limited to usability aspects (Quiñones & Rusu, 2019; Quiñones, Rusu, & Rusu, 2018).

This article presents a set of 10 heuristics to evaluate the UX of geoportals. The heuristics were developed using the methodology proposed by Quiñones et al. (2018). The methodology proposes eight stages to develop and validate a new set of heuristics and can be applied iteratively, repeating the stages that are necessary to refine the proposed set. We performed a preliminary validation with UX experts to refine and improve the proposed set of UX heuristics for geoportals.

The article is structured as follows: firstly, we show geoportal features; then we explain the heuristics development process; later we present the set of UX heuristics for geoportals; next we explain the preliminary validation; and finally, we present the conclusions and future works.

GEOPORTALS

As presented above, a geoportal is a website that is considered an entry point to geographic content on the web or, more simply, a website where geographic content can be discovered. According to the "Spatial Data Infrastructure of Uruguay" (2018), geoportals have the following characteristics: User interface; Metadata; Data access; Documentation; Contact; and Help. After analyzing the geoportal features, we proposed the new set of heuristics that evaluate the following characteristics:

1. Reference Map: allows the user to locate the area of interest in context. It should be represented by a bounding box that distinguishes it from the main focus of the map.
2. Available layers: organized by categories which represent geographic information based on matters of interest. This allows grouping and searching by theme.
3. Tools: it includes navigation and scrolling tools on the map.

4. Coordinate and reference system: it defines a relationship between the geographic resource and the real world, using existing coordinate types. These can be by means of degrees, minutes, seconds, or decimal degrees character.
5. Scale: relationship of similarity or proportion between dimensions of the geographic resource and the real object of the earth.
6. Metadata: it is the information related to each resource available on the website.
7. Access to data: possibility of accessing what is known as "geo-services".
8. Documentation: documentation presented to the user for the purpose of informing which standard is used and technical details of the portal.
9. Contact: section dedicated to representing the organization responsible for the administration of the geoportal, in order to establish contact between users and the administrator or managers.
10. Help: specific document dedicated to users to understand how to use the geoportal efficiently.

DEVELOPING THE USER EXPERIENCE HEURISTICS FOR GEOPORTALS

To create the set of UX heuristics for geoportals we used the methodology proposed by Quiñones et al. (Quiñones & Rusu, 2019; Quiñones et al., 2018). The methodology presents 8 steps: exploratory stage, experimental stage, descriptive stage, correlational stage, selection stage, specification stage, validation stage, and refinement stage. Table 1 describes the stages and activities performed to create the new set of heuristics.

To develop the UX heuristics for geoportals, the set of specific heuristics for geo-websites proposed by Komarkova et al. (2007) was used as a basis since it considers characteristics of geoportals, in addition to including generic heuristics in its proposal. To specify the heuristics, we used the template proposed in the methodology (Quiñones & Rusu, 2019; Quiñones et al., 2018) including 10 elements: ID, name, definition, explanation, priority, application feature related (geoportal), usability attributes, UX factors, examples, and existing related heuristics. We proposed a set of 10 heuristics. As a result of the preliminary validation, we refined and improved the heuristics specification.

USER EXPERIENCE HEURISTICS FOR GEOPORTALS

We proposed a set of 10 heuristics to evaluate the UX on geoportals. Table 2 shows the set of heuristics including their ID, name, and definition.

As an example, Figure 1 shows compliance and noncompliance of the heuristic GH10: "List of available services". The figure represents the section corresponding to the maps available through the GEOOS Geoportal (https://geoos.org/); however, the difference between the available maps is not shown (something to improve).

Table 1. Methodology stages applied, and activities performed to develop the UX heuristics for Geoportals.

Stages	Activities performed
Step 1: Exploratory stage	– Literature review of main concepts, such as: user experience, geoportals, geoportal features, and existing set of heuristics.
Step 2: Experimental stage	– Not performed due to available time.
Step 3: Descriptive stage	– Selection of the set of heuristics to use as basis to develop the new set: Komarkova et al. heuristics (Komarkova, Visek, & Novak, 2007). – Selection of usability and UX attributes to evaluate with the new heuristics: 5 usability attributes proposed by Nielsen (learnability, efficiency, memorability, errors, and satisfaction) (Nielsen, 2012); and 5 UX factors proposed by Morville (useful, usable, findable, credible, and valuable) (Morville, 2004). – Selection of specific features of geoportals (Adapted from (Infraestructura de Datos Espaciales de Uruguay, 2018)): Reference Map, Available layers, Tools, Coordinate and reference system, Scale, Access to data, Documentation, Contact, and Help.
Step 4: Correlational stage	– Association of usability attributes and UX factors to the specific features of geoportals identified.
Step 5: Selection stage	– Selection of the heuristics to maintain, adapt, eliminate, and create using the Komarkova et al. heuristics (Komarkova et al., 2007). We adapted 9 heuristics; deleted 0 heuristics; and created 1 new heuristic.
Step 6: Specification stage	– Specification of 10 UX heuristics for geoportals using the template provided in the methodology.
Step 7: Validation stage	– Preliminary validation of heuristics through experts' judgement.
Step 8: Refinement stage	– Detection and documentation of improvements to be made.

PRELIMINARY VALIDATION

The set of heuristics was preliminary validated through expert's judgment. The expert judgement involved two experts, all of them have participated in more than 10 heuristic evaluations and have experience in topics related to Human Computer-Interaction, Usability, UX, and use of geoportals. The validation consisted of a review by the experts of the 10 heuristics where they evaluated the wording, clarity, and usefulness. In addition, the experts provided comments regarding the heuristic proposal and what changes should be made to evaluate specific characteristics of geoportals. Based on the feedback received, the heuristics proposal was refined. All heuristics were improved in terms of wording and clarity. After this preliminary validation, we are currently conducting a validation of the proposal through a heuristic evaluation of the "GEOOS" geoportal (https://geoos.org/) with two groups of expert evaluators: a control group that evaluate the geoportal using the heuristics of

Table 2. User Experience Heuristics for Geoportals.

ID	Name	Definition
GH1	Environment and user interface	The geoportal should provide all the necessary basic navigation elements and information in an understandable way.
GH2	Support in different browsers	The geoportal should successfully function in every browser for which it was designed, without inconsistencies between browsers.
GH3	Error preventions	The geoportal should eliminate failure-prone conditions or warn users before taking any important action through an alert that demonstrates the risk.
GH4	Error handling	The geoportal should provide users with information about the errors that occur and the possibility of fixing them.
GH5	Flexibility, design, and aesthetics	All visual elements sections of the geoportal should use a part appropriate to the viewport. All control elements should be clear and well distributed. The content should make sense and consistency. In addition, the geoportal should allow to adapt its interface according to the user's personal needs (such as colors and languages).
GH6	Ease of use	The geoportal should be intuitive and functional to successfully complete the needs or objectives of the user.
GH7	User privacy	If the geoportal requires personal information from users, it should inform the reason for its use and ensure that all private information will be protected for the user's security.
GH8	Manuals and documentation	The geoportal should have documentation and user manuals regarding the use, rules and legalities related to the application or website itself.
GH9	User control and freedom	The geoportal should allow the user to navigate freely and offer the possibility of doing and undoing actions.
GH10	List of available services	The geoportal providers should have a considerable number of maps for the user, in order to acquire different types of information; in addition to consider the availability of the sources from which the information presented is obtained.

Komarkova et al. (2007); and an experimental group that evaluate the same geoportal but using the new heuristics proposal. The analysis of results will be performed according to what is stated in the methodology (Quiñones & Rusu, 2019; Quiñones et al., 2018).

CONCLUSION

Geoportals are not only useful for offering users access to a series of geographic resources, but they also allow enriching information on natural resources and thereby improve decision-making for scientists, academics and professionals working in areas such as meteorology, fishery, government,
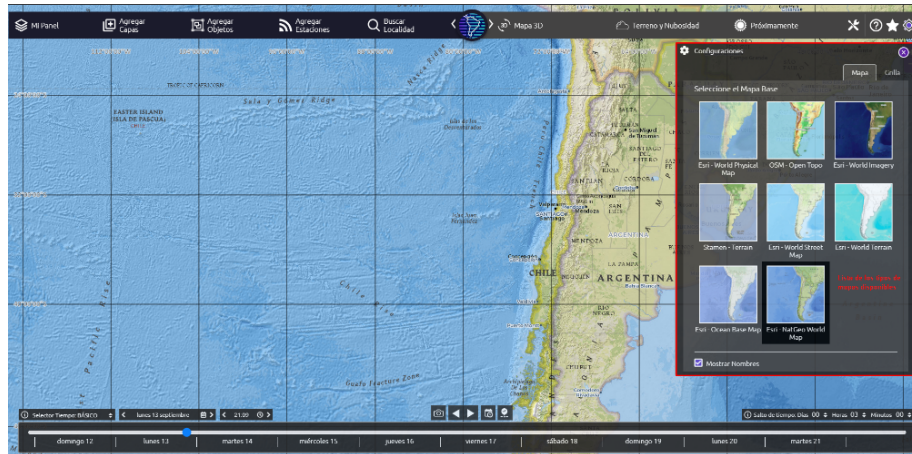
Figure 1: List of maps available in the GEOOS portal (https://geoos.org/).

among others. In this sense, having an intuitive, easy-to-use web portal that delivers reliable information is essential. For this reason, we proposed 10 heuristics that allow to detect potential usability/UX problems and thereby improve the user experience on geoportals. We performed a preliminary validation, and several improvements were made.

As future work we expect to perform new iterations and formally apply the validation and refinement stage of the methodology. We intent to validate the set of heuristics performing heuristic evaluations (in progress), user tests, and experts' judgment (survey). We also pretend to refine the heuristics in order to improve its utility and effectiveness to detect specific usability/UX problems related to geoportal features.

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