A summary of the article: Methodology for heuristic evaluation of the accessibility of statistical charts for people with low vision and color vision deficiency

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ABSTRACT

This contribution is a summary of the paper: R. Alcaraz Martínez, M. Ribera, T. Granollers (2021). Methodology for heuristic evaluation of the accessibility of statistical charts for people with low vision and color vision deficiency. Universal access in the society. doi:10.1007/s10209-021-00816-0. information The research presented in this paper aims to create a set of heuristics to evaluate the accessibility of statistical charts focusing on the needs of people with low vision (LV) and color vision deficiency (CVD). To do so, a set of heuristics was developed based on the methodology by Quiñones et al. [6]. Once created a first version set of heuristics (17 indicators) was applied on two evaluations. After the evaluations, the list has been amplified to 18 indicators and received other improvements: the scoring was simplified, and the authors created further documentation for evaluators. This research is a first step in the direction to create accessible charts for people with low vision, a user profile normally forgotten in digital accessibility research.

CCS CONCEPTS

• Human-centered computing • Accessibility • Accessibility design and evaluation methods

KEYWORDS

Charts, Data visualization, Accessibility, Heuristic evaluation, Low vision, Color blindness

1 Introduction and background

Statistical charts have an important role in conveying, clarifying and simplifying information, thus making information more accessible to everybody [1] because they improve the

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understanding of big volumes of data very efficiently and reduce the cognitive load associated with reading and digesting textual and tabular information. Low vision (LV) is defined as the condition under which a person's vision could not be corrected completely with correcting lenses. LV difficulties may be classified under five different categories: visual acuity; light sensitivity; contrast sensitivity; field of vision; and color vision deficiency (CVD).

A previous literature research [2] unveiled an important lack of publications and guidelines focused on the accessibility of statistical charts for people with LV and CVD. This identified gap adds to the existing marginality of a user group representing the 97% of people with visual disabilities [3], in the field of accessibility research.

2 Methodology and results obtained

The research presented in this paper is based on the Heuristic Evaluation (HE) method, one of the most efficient usability evaluation techniques without users [4]. Although there is no a clear agreement on the best suitable process or methodology to develop heuristics within the literature [5], this research adopts the proposal by Quiñones et al. [6] of a formal and systematic methodology as the framework of reference and complements it with the metrics proposed by Jiménez et al. [7] to validate the efficiency of the proposed indicators compared to an existing heuristic list control. This methodology has eight stages. Each one is summarized below, and the results obtained are detailed: 1) exploratory stage: the focus of this stage is to do a literature review with the goal to collect information in order to develop the heuristic list thorough a review of WCAG 2.1 and concomitant documents and tried to gather all criteria related to the subject of this work. As a second step the authors carried out a literature review about charts accessibility for LV users [2]; 2) experimental stage: the objective of this stage is to analyze data obtained from previous experiments to retrieve additional

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information not identified during the first stage. However, the authors did not find any previous research with a focus on charts accessibility for users with LV; 3) descriptive stage: in this stage the focus was on selecting and prioritizing the most important questions within the collected information during stage 1 and 2; 4) correlational stage is used to map features and functionalities of the heuristic evaluation domain with attributes from the usability and user experience (UX) fields, as well as with additional pre-existing heuristics, in an attempt to reconcile domain features and functionalities with UX and attributes related. The features and functionalities were matched with other heuristics sets [8-12] and with WCAG 2.1 [13]. Many indicators, specific to charts and their elements did not find a counterpart in any other guidelines; 5) the objective of the selection stage is to review the list of indicators created up to this point and decide whether to keep, adapt or delete; 6) in the specification stage the heuristics were formally defined. As a result, a total of 17 heuristics were obtained: title, legend, axes, caption, abbreviations, print version, short text alternative, long description, safe colors, contrast, legibility, image quality, resize, focus visible and personalization. It was also established a 7-point Likert scale to score the heuristics and weighted depending on their impact or severity into 3 levels: low impact (1), average impact (2), high impact (3).

Average salary information for Spanish Workers, 2010-2017







Figure 1: Accessible chart that meets the heuristics: Tiresias font family, font size between 16-20px, brief and descriptive title and axes titles, legend, safe colors and the use of different patterns for better differentiation, a contrast ratio of 6.9:1 and 6.4:1 for marks, information about the data source, short alternative text, a complementary caption with a brief comment, compatible with keyboard navigation, focus visible and tooltips with data associated, customizable (SVG format), and an equivalent data table. Chart developed with Highcharts Library. Available at: http://rubenalcaraz.es/graficos/ejemplos/example.html.

7) validation stage: in this stage the set of heuristics were validated through a heuristic evaluation [14]. At this point, the methodology was complemented by the calculation of four quality metrics [8]: ratio of unique problems; ratio of problem dispersion; ratio of severity; and ratio of specificity. The results show that the proposed heuristics identify more unique problems, problems are better distributed, more severe and specific than in the control set (a WCAG relevant success criteria selection), and therefore the new set of heuristics is much more suitable for evaluating the accessibility of charts; 8) refining stage: in this stage the Likert scale was reduced to 5 points; a new heuristic was added (With no disturbing elements), and the descriptions of all of the heuristics were improved to better understanding by evaluators.

3 Conclusions and future work

The research presented shows a proposal of 18 heuristic indicators for a quantitative evaluation of the accessibility of statistical charts on the Web. As a future work, the research team is working on the incorporation of users, to further validate the set of heuristics. Another future line of work, incorporated in another recent work [15] would be to complement the score obtained by calculating the severity (frequency, impact, and persistence) of the problems.

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