Education and Heritage in the era of Big Data in Astronomy
Proceedings IAU Symposium No. 367, 2020
R. M. Ros, B. Garcia, S. R. Gullberg, J. Moldon & P. Rojo, eds.
doi:10.1017/S1743921321000272

A User Centred Inclusive Web Framework for Astronomy

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Abstract. This contribution presents the ongoing work to develop the Sensing the Dynamic Universe (SDU) webpage elements, based on the sonoUno framework, a user centered software for sonification of astronomical data. The SDU provides an inclusive experience that transcends the approach of assuming and limiting design based on the Web Content Accessibility Guidelines (WCAG) and ISO recommendations.

Keywords. digital accessibility, user center design, virtual assistants.

1. Introduction

Digital access to information is a human right, and effective and individualised support measures are needed to allow People with Disabilities (PwD) to fully enjoy this right. However, despite many initiatives, we are far from achieving that goal. Focusing on Astronomy, the Sensing the Dynamic Universe (SDU) team proposes an approach to web access for inclusion targeting the comorbid aspect of 5 groups of diverse functionalities, namely: a) mastoid problems/hearing impaired, b) skin disorders, c) orthopedically impairment, d) Neurodiversity, and e) B/VI (Blind/Visually Impaired), using as a framework the sonoUno interface (Garcia 2017) which permits people with other sensory styles to explore scientific data and make science by sonorization. To support these target audiences, SDU reduces complexity in navigation, offers selection and saving of user preferences, and generates strategies to dynamically identify and utilize at will desired web elements, which may communicate dynamically with each other. Users can decide freely what path to take for task performance, error prevention and error recovery. It also attempts to embed the framework of a virtual assistant: Stephanie (Gupta 2017).

2. Methodology

SDU uses JavaScript local storage method, which does not communicate with servers, does not use cookies and gives the option to add an expiry date. While this method has rarely been used for accessibility purposes so far, it permits to create web interfaces that adapt to the user, goes beyond the subjectivity of the WCAG (https://www.w3.org/TR/WCAG20/), ISO *Guidance on software accessibility* (https://www.iso.org/standard/39080.html), etc., aiming for high granularity, usability,

efficiency, effectiveness, performance and user satisfaction. The webpage aims to embody the mindset of "how to create an interface in which the user may work at their own maximum without submitting them to transactions that may further exclusion?". The SDU team began by identifying, and experimenting with, structural factors that support PwD. The list will grow and change over time, as it is multi-axial and it includes:

(*a*) Choices. There is a lack of intuitive options to alter choices in digital systems, rendering the individual excluded or dependent. Many PwD become inured to the frustrations of inaccessibility or break down. Choices may be grouped as:
- Dynamic choices: In digital interfaces dynamically let the user focus their attention as desired, and let them activate options and freely switch I/O options.
- Choices that cause or diminish attention demands: SDU tries to preserve structure and consistency, for example employing contrast options, saving user choices and reducing language, without overloading the user. The combination of words and actions does not jeopardise the user action-word processing and movement, considering the relation between the verbs and the actions to be performed.
- Choices to meet the needs of cognitive processing: The user is not overloaded with information which is not needed or distracting.
- Choices about information needs: what does the user want to learn multisensorially about a subject. SDU provides a sensorial display and expansion of specific examples, and provides a direct link to the sonoUno to display visually and auditorily and explore data using their own settings.
- Navigation choices. The options to reduce the learning curve are linearised according to user preferences and allow the user to select how to start the interaction and change I/O modalities without exhaustion. SDU employs the alt-text functionality of html to provide a comprehensive description of the content and options, attempting to assist users in the process of identification.

(*b*) Interruptions. As interruptions undermine the user's ability to engage in decision making and integrative thinking, they are minimised. SDU offers saving preferences and optional alerts, allows changes of text size or font, and avoids crowded I/O management.

(*c*) Body physical transactions. The location of displayed information seeks to minimise the number of physical transactions the user has to carry out to access a functionality, to deliberate or to experience a display.

The website will soon be available at https://www.cfa.harvard.edu/sdu.

3. Final remarks

While some people with disabilities/impairments express that traditional barrier removal is enough, the multifactorial and multidimensional nature of disabilities imply that traditional barrier removal may make interactions more difficult for some users or impose a very high learning curve not related to their academic abilities. Given that the features required for more inclusive access were easy, one has to ask why it is hard to find a wider engagement on allowing PwD to bring their diverse functionalities on board.

This work has been performed partially under the Project REINFORCE (GA 872859) with the support of the EC Research Innovation Action under the H2020 Programme SwafS-2019-1.

References

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