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**FROM ABSTRACT DATA MAPPING TO 3D
PHOTOREALISM: UNDERSTANDING EMERGING
INTERSECTIONS IN VISUALISATION PRACTICES AND
TECHNIQUES**

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Web-based visualization - Accessibility and Usability

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Overview

Early in the 1990s, web accessibility information was available from organizations such as the Trace Research and Development Centre and companies such as IBM. The City of San Jose Web Page Disability Access Design Standard was developed in 1996, and the AUS Standards for Accessible Web Design were available online in 1997. Also in 1997, the WWW Consortium established the Web Accessibility Initiative (WAI) [2] and in 1999 the Web Content Accessibility Guidelines (WCAG) 1.0 were finalized as a Recommendation.

The majority of website designers and developers were, in the recent past, not aware of accessibility issues. Awareness gradually increased with media articles on accessibility, in media, designer and developer websites, and also as accessibility began to appear in conference topics. While more people began to hear about accessibility, the majority of websites still did little to implement it. There are several reasons why so many websites were not accessible, besides lack of awareness, most designers, and developers, did not understand the benefits of providing accessible websites and so were not convinced that it was important for their business. Even those who did want to incorporate accessibility, had difficulties finding the resources. However, recent legal and regulatory activity changed that.

Usability is developed to provide principles for usable interface and interaction development within Company's NAME Products. To maintain position in an increasingly difficult market, the software that is easiest to use has the competitive advantage. Sales support staff report that NAME Products customers are shouting for products that are user-friendly, consistent and functional.

The Usability Group answered the call for greater usability by deploying usability practices, tactically to improve interface/interaction designs in specific locations on specific products. They have conducted prototype evaluations to inform design, interfaced with developers and provided creative design leadership for recent releases of some products. This will allow Company to produce a suite of products that will truly boast usability as its competitive advantage.

1- Introduction to Websites Usability

Websites offer users information, goods, services, and entertainment. However, many of these sites are hard to use, some of these websites do not perform properly,

and eventually don't attract or keep users. By following a usability engineering process, users' abilities to find information and satisfaction with websites should improve significantly. Website usability measures the quality of a user's experience when interacting with a website. In general, usability refers to how well users can learn and use a product to achieve their goals and how satisfied they are with that process. Two international standards further define usability and human-centered design:

- "Usability refers to the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of user." - ISO 9241-11
- "Human-centered design is characterized by: the active involvement of users and a clear understanding of user and task requirements; an appropriate allocation of function between users and technology; the iteration of design solutions; multi-disciplinary design." - ISO 13407

It is important to realize that usability is not a one-dimensional property of a user interface, rather than that usability is a combination of factors including: ease of learning, efficiency of use, memorability, error frequency and severity, and finally subjective satisfaction.

1.1 Usability employment and testing

User-centered design (UCD) is an approach for employing usability. It is a structured product development methodology that involves users throughout all stages of website development, in order to create a website that meets users' needs. This approach considers an organization's business objectives and the user's needs, limitations, and preferences [7].

Usability testing fits in as one part of the user-centered design process. In a usability test, representative users try to find information (or use functionality) on the website, while observers, including the development staff, watch, listen, and take notes. The purpose of a usability test is to identify areas where users struggle with the site and make recommendations for improvement. Usability testing is typically best implemented after completing earlier steps in the UCD process. It is better to clearly define problems, goals, and objectives before testing the website.

By including usability at the beginning of the project, it is more likely to identify usability issues at an early stage when it is still easy to make changes, whereas, usability problems found later in the development lifecycle are usually much more time-consuming and expensive to fix.

1.3 Usability measurement

Usability can be measured, and there is a range of metrics available to help measure the design improvements. Usability measurement can help to find out if the improvements are more efficient for users, easier to learn, and more satisfying to users. Measures of usability include: effectiveness, efficiency, satisfaction, ease of learning, memorability, and error frequency and severity. However, the three most

common factors measured in usability testing include: effectiveness, efficiency and satisfaction, where effectiveness is the user ability to successfully use a website to find information and accomplish tasks. Efficiency is the user ability to quickly accomplish tasks with ease and without frustration. Finally, satisfaction is how much a user enjoys using the website.

2. Websites Accessibility

Web accessibility is about people being able to get and use web content. It is about designing web pages that people can present and interact with according to their needs and preferences. The larger scope of accessibility includes benefits to people without disabilities. 15% and 30% of the general population have functional limitations that can affect their ability to use technology products, which represents 50 million people in the US alone, and over 750 million worldwide [4]. As business is all about increasing sales by addressing the range of constraints that could limit the customers' use of the website. It is estimated that people with disabilities control a discretionary income of over £78 billion annually in the US alone [3].

2.1 Accessibility and Usability

Accessibility is a subset of a more general pursuit: usability. As discussed earlier. Many would agree with the concept of accessibility being related to usability, it is often not how accessibility is approached in practice. Many designers and developers were recently introduced to accessibility because of the new regulations. In such cases, the focus of accessibility is often limited to meeting standards and guidelines. Often this means technical aspects get emphasized at the expense of the human interaction aspect. A simplified example of something that can "pass" an automated check for accessibility and still not be usable is the alternative text for an image.

It is important to recognize that usability is also an important aspect of accessibility. Addressing 'usable accessibility' helps to clarify the difference between what meets minimum accessibility standards and what is usable by people with disabilities. However, to evaluate for usable accessibility, there is a need to interact with the rendered web pages in various configurations, preferably including usability testing that involves participants with disabilities.

2.2 Example of Web Accessibility

A large proportion of accessibility standards and accessibility testing software tools address the more technical aspects of accessibility. These tend to be easier to understand, quantify, and test. Text equivalents for images, is one of the most common and powerful examples of incorporating accessibility on the Web. Text equivalents are also a common example of an accessibility technique that is of great benefit beyond accessibility to people with disabilities – including indexing, search, and mobile computing [8].

Web pages often include images, but many web page visitors cannot see those images, as some of them use a screen reader; others have turned off image downloading for a reason or another. Viewing pages without images is addressed when web designers include equivalent text descriptions for images. Called 'alt text', short for alternative text, these text descriptions are displayed when the mouse pointer hovers over the image, and displayed when images are not downloaded, and read by screen readers and voice browsers [8].

2.4 Accessibility and User-Centered Design

Many websites are designed based on the individual designer's preferences, abilities, and environment. A large percentage of website designers are without disabilities. Therefore, that is the user profile they tend to design for. Even when specific user analysis is conducted, the range of users considered is often too narrow. Mainly because of a simple lack of awareness, designers tend not to include people with disabilities and people operating in more unusual environments in their user analysis.

In order to design inclusively, designers need to consider the widest range of possible users and environments. The Web Content Accessibility Guidelines (WCAG) notes that many users may be operating in contexts very different from the designers' context [5]:

- They may have an early version of a browser, a different browser entirely, a voice browser, or a different operating system.
- They may be in a situation where their eyes, ears, or hands are busy or interfered with.
- They may have a text-only screen, a small screen, or a slow Internet connection.
- They may not be able to see, hear, move, or may not be able to process some types of information easily or at all.
- They may have difficulty reading or comprehending text.
- They may not have or be able to use a keyboard or mouse.
- They may not speak or adequately understand the language in which the document is written.

When all possible users and environments are considered in website design, the process can be called Universal design. The term universal design was originally used in association with buildings, and has more recently been used in describing an approach to accessibility for information and communication technologies. Universal design is the process of creating products and systems which are usable by people with the widest possible range of abilities, and operating within the widest possible range of situations [6].

Accessibility Motivations

There are several motivations for accessibility, including:

- Compliance with regulatory and legal requirements
- Exposure to more people: people with disabilities and seniors
- Exposure to more situations: new places, new devices
- Better design and implementation
- Cost savings

Conclusion

The fields of accessibility and usability in web-based visualization are massive and far too much to cover in a single paper. This paper gave an introduction and highlighted key points for consideration. Although over the past few years a considerable improvement has been made in the accessibility and usability of many websites, there is still much to be done to ensure the universal design i.e., everything is accessible to all. This paper has identified various principals of good practice, including some examples and the reasoning behind them. It has shown in a limited sense that by making a site accessible to users with specific disabilities it almost inevitably becomes more usable to people without such disabilities.

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