



School of Information Technology and
Engineering at the ADA University



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APPLYING THE PRINCIPLES OF THE USER EXPERIENCE QUESTIONNAIRE (UEQ) TO
THE DESIGN AND EVALUATION OF MOBILE BANKING APPLICATIONS THAT
SUPPORT PERSONS WITH DISABILITIES

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THESIS ACCEPTANCE

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has been approved as meeting the requirement for the Degree of Master of Science in Computer Science and Data Analytics of the School of Information Technology and Engineering, ADA University.

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ABSTRACT

When mobile banks have supported mobile phone technology, the sector of the financial services has undergone revolutionary transformations that now provide alternative options to the customers for their affairs related to personal finances. While this fast advance in the digital technology has the benefits, on the other hand, accessibility problems for those people who have disabilities, like dyslexia and color blindness have come into light. Under this research, a detailed analysis of how mobile banking applications for disadvantaged populations can be improved with UEQ ideas in aspect of its design and implementation is to be conducted in this thesis. More than a sizable number of world population is affected by dyslexia and the incapability in tint vision and this has negative effects on their operations with computer interfaces. A neurodevelopmental issue called dyslexia, which affects in reading comprehension and language processing, and abnormalities in photoreceptors in the retina that cause a color blindness, which may have an impact on the ability to differentiate colors, are the conditions that influence the visual processing system. Such surroundings pose a number of hurdles to digital access and, therefore, make it impossible for the individuals and communities affected by them to fully benefit from digitization and retain social and economic disparities. The study employs the UEQ framework (through which user experience is rated on the substantial aspects amongst which are ease of use, predictability, visual appeal, transparency, and excitement) with the aim of promoting inclusive designs. The goal is to generate a collection of design with heuristics in mind, that is helpful to dyslexic/colorblind users or take their issues into the account. This is a mixed research method that has got user research, usability testing and the iterative development of a mobile application prototype. The objective of this project will be to ameliorate the design codes by cognizant feedbacks from stakeholders and disabled people which will abide the resolutions of accessibility laid down by the recognized authorities. The supposition of this dissertation is the widening of the scope of inclusive design in the case of the digital interface, especially for the unprejudiced financial industry. Our work mainly is to improve the inclusivity of people with abilities in the digital economic domain, and in consequence, this would contribute to the fair and equitable society, by making the digital infrastructure an environment that is well accommodating and all encompassing. To begin with, this work takes a step towards

the present product development design processes in the industry and also sets the standard of how the industry can move the future of all digital products forward when the main emphasis is placed on fun user experience and universal usability.

Keywords: dyslexia, color blindness, User Experience Questionnaire (UEQ), mobile banking applications, accessibility

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1. INTRODUCTION

In the previous few years, financial sector has undergone enormous transformation characterized by the rising mobile banking applications. Employing these apps, we have redefined the budget management by offering unmatched ease of access and convenience. Through mobile banking the checking account balance, money transfer and bill paying have become more comfortable than past times. But in the midst of this quick development of digital technology, a crucial problem has surfaced: such developments should not create a digital divide between the users. Hence, the apps should be designed to be accessible and inclusive by everyone who suffer dyslexia and color blindness or any other disability.

Navigation of digital interface is a big challenge as well as a challenging task for disabled people, especially for those suffering from mental diseases. Intricacy in design details, unpleasant navigation routes, and overcomplicated visual constructions tend to be the most efficient strategies that positively insulate the world with disabilities from full involvement into the digital economy. The exclusion which is imposed not only impedes them from getting the financial services they need, but actually keeps the social and economic status quo.

The fact that accessibility is a key component of the digital design is the focus of this thesis, and current issues will be tackled with the questionnaire for User Experience (UEQ) in the implementation as well as evaluation of mobile banking applications to cater for the needs of individuals with dyslexia and color-blindness. The purpose of this research is the development of mobile banking applications that are easier to use and navigate for people with disabilities. To do this, an exhaustive framework of the UEQ, which evaluates how users feel about processes like efficiency, predictability, attractiveness, clarity, and stimulation, is utilized. However, the project's main motive is to come up with the rules and techniques of designing of mobile banking applications for the people with dyslexia and color blindness.

Whilst the primary aim of the inclusive designing is to develop the products and services that are usable to the highest number of people, regardless of their age, ability, or level of IT skills, the concepts are far beyond just a simple compliance to the accessibility guidelines. Although mobility scooters made life difficult for others in the past, technology has come a long way to turn this situation into a win-win. Now in the U.S., we have a ZEV by law

that works to minimize pollution. There are two points to make about the inclusive design of the modern mobile banking applications, and understanding this would not only bring business growth but also shed moral obligation. Banks may have the opportunity to achieve a profitable industry with the possibility of entering an underserved market by making their banking apps easier to use for everybody which will increase the customer base and thus boost economy.

A very useful tool that may serve to analyse the extent to which certain digital products are used and their user-friendliness is User Experience Questionnaire (UEQ). Different from traditional usability methods, which measure user's performance and efficiency by completing certain tasks, the UEQ puts an accent on the user's perception, emotions, and added value. The UEQ aims to provide those crucial insights about the good and bad of a product's design through the examination of the user experience had by the user across many areas, which helps in identifying the points that require optimization and improvement.

The UEQ is potentially very effective to highlight the areas that can affect user experience in mobile phone scenarios. These include the difficulties experienced by people with disabilities as they attempt to navigate a mobile banking app. By receiving the opinion of end-users with disabilities and taking those views into consideration and visiting UEQ framework to gauge their experiences, the designers can use the knowledge of the particular problems encountered by this category of users and design more efficient solutions based on it. The UEQ could recommend or guide the implementation of tailored solutions that consider such specialized needs as simplifying the navigational experience for cognitively disabled individuals, or increasing the readability of content for visually impaired individuals.

This dissertation is dedicated to exactly mobile banking applications and further is going to contribute toward ongoing expositions around needs-based interface design and accessibility in the digital world. The study will explore how the universal design for informed use tenants can be put into practice to increase the UI and ADA compliance of mobile banking applications through a combination of user research, literature review, usability testing and designing the informative usability model. These investigations have designed to help accomplish not only a

more accessible and inclusive digital place but also an environment where everyone can make full use of the digital sphere as well as the whole society.

2. LITERATURE REVIEW

Understanding Dyslexia: Challenges and Strengths in Reading and Language Processing

Through the lens of “Dyslexia. However it is a neurophysiological disorder affecting reading and language processing, it sets the stage for dysfunction in the educational setting and others areas of life (Shaywitz & Shaywitz, 2005). Roughly 5 to 10 percent of humans have dyslexia and the percentages of them are 5-10% of global population (Peterson, Pennington, 2012). People who are dyslexia-affected identify difficulties of phonological processing with a set of decoding words and limited reading comprehension (Shaywitz & Shaywitz, 2005). Genetic studies have confirmed that dyslexia has a genetic component and that the gene variants can be identified. Besides, structural and functional brain differences found in individuals with dyslexia are mostly at impacted regions with language processing, including the left temporoparietal and occipitotemporal regions (Norton et al., 2014).



Figure 1. Dyslexia at a Glance

Caused by deficiencies in cognitive processes such as learning and visual interpretation, both dyslexia and color blindness have far-reaching effects to the life of individuals. Nonetheless, with the correct interventions and adjustments, individuals can address these challenges adequately. By means of the employment of early signs, specific assistance and accepting attitudes, the society can help in setting up conditions in which the people with dyslexia and color blindness will be positioned well to proceed.

Navigating Color Blindness: Challenges and Solutions

Color-blindness, which is characterized by the inability to detect some color shades, is a fairly common type of defect. People with this type of defect comprise 8% of the male and 0.5% of the female population of broadly Northern European origin (Cole, 2006). The problem is that there is an optic disfunction in order of a decreased photopigment flow in cones and no perception of deep red and greenish hues (Birch, 2012). Color blindness has a wide impact on daily living because it may bring a lot of difficulty when performing simple tasks such as driving or reading colored information that might be required in the educational or work environment.

People who see differently are usually hindered when performing tasks that require sophisticated color differentiation. This extends to positions such as graphic design, as well as electrical wiring and aviation, where accurate identification of color is critical. Take for instance the example of color blindness which can put you at a disadvantage when you are not able to guarantee that the different colors are distinguishable from each other, thus creating unsuccessful and mediocre designs. For example, as with misinterpreting color codings while doing electrical wiring or flying aviation, the consequences would be catastrophic (Cassel & Bernstein 2007). Another aspect to this is that color blindness can have an impact on the way people relate and communicate as they may find it hard to understand some hues or if one is unable to share with others the full order of colors in art or nature (Graves 2009).

Although transcending color blindness could be an issue, people with this disorder can do it by introducing some adjustments and the general knowledge of this condition. The fact that society should be educated about the colorblindness is essential because this is vital for majority to be inclusive and tolerating. The ignorance and stigmatization that come along with the

condition can be decreased by the public awareness on the amount of people affected and what it does to them (Birch, 2012). Besides that, adopting these inclusive methods at various times and/or places will assist in ensuring people with these disadvantages have the fulfillment of accessible participation.

In the education sector, instances where everyone has to read colors, such as different books (Birch, 2012), teachers may provide different ways to classify subjects or use the textures themselves, apart from the colors, in order to accommodate students who have the color blindness. Also enhanced use of educational sources and materials which are color-blind-friendly will help students in their learning process. A wide range of color-blind-friendly software tools and design methods are capable of detecting and solving the problems that may arise from color vision deficient users in professional settings. They may properly and effectively handle and display visual data and information for the users with color vision deficits (Meyer and Greenstein, 2006).

Moreover, technological advancements have as well triggered the refinement to assistive technologies that target the requirements of those who are color blind (Birch, 2012). Such solutions as color-blind-friendly programs and browser extensions allowing to modify color options on digital platforms are very helpful. They improve the accessibility to online sources. Along with wearing gadgets, sophistication wagers have become widely available such as augmented reality which gives near instantaneous color spectrum correction to the color-blind person to see more accurately what surrounds them (Birch, 2012).

Therefore, the most comprehensive way of dealing with the colorblindness issue should be based upon information, awareness and therefore transition to the multisensory way of life and the usage of the inclusive technologies and practices. Giving an opportunity for dynamism and diversity through the use of diverse design and communication may be the key form of development of the spaces which will provide for the visual demands of color vision deficient and will allow the members of this group to take part in all activities in society on a maximum level.

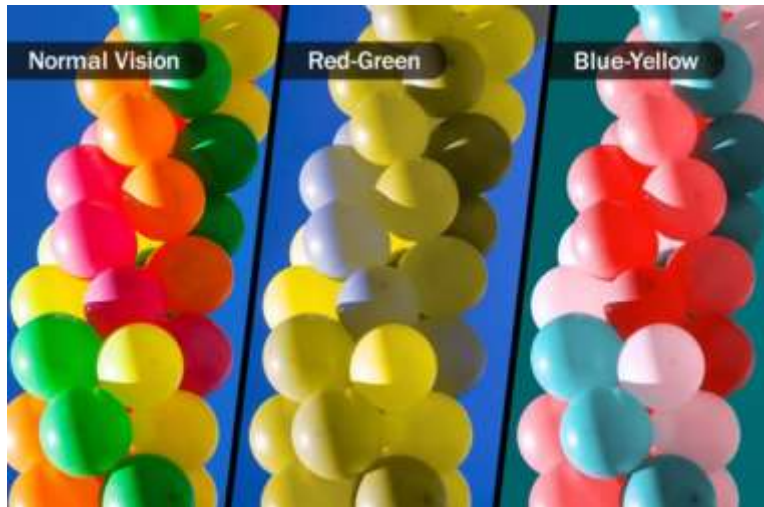


Figure 2. The different degrees of Color Blindness

Understanding User Experience Questionnaire (UEQ)

To assess the subjective feelings, the interaction and purchasing decision of customers relative to a specific or a group of products, services, or systems, User Experience Questionnaire (UEQ) is the most widely used tool. It provides an approach for evaluating the different aspects of the users experience, like usability, reliability, aesthetics, stimulation as well as the efficacy. The UER can be used by product designers, developmentalists and researchers as a means to get important detail regarding the positive and negative aspects of the user experience at different levels of details.

Within UX research, in the domain of user experience, designing successful and appealing interactive products and systems asks the researchers to investigate what users feel and think of the system. The User Experience Questionnaire (UEQ) is a tool we all know in the field of Human-Computer Interaction that supplies designers and researchers with an organized system to interpret, evaluate and analyze the users' perception, feelings and the level of satisfaction that they have towards the product.

Components of UEQ

The primary objective of the UEQ is to assess accurately the different interdependencies that arouse the various facets of the user experience. The UEQ, unlike the case with conventional

usability measures, is a more comprehensive yardstick that takes care of speed not only in task completion but also in efficiency. The principle seem to consider the points such as appeal, clearness, being fit for purpose, dependability, stimulation and novelty.

- This is related to the aspect of aesthetics and visual beauty of the interface, which includes its visual appeal or how it looks through the attractiveness dimension. It embraces the use of factors such as typography, color schemes and overall flow within the same parameters as creating strong first impressions and holding a user's undivided attention.
- Scalability assesses if interface elements are simple to understand and be used while this second attribute takes into account the peremptory and straightforward nature of a system. The design aspect of supporting cognitive function which influences the completion of aimed tasks effortlessly is what brings up the importance of this dimension.
- Efficiency assesses how promptly tasks executed within the combined environment. It seeks after things like speed, UI/UX, and matters of all-over smoothness of user interactions. Usability plays an important part in this matter because mocking a viable interface makes it easier for users to finish tasks fast and unhandy ways.
- Account of this dimension consists in dependence on the system's reliability and truthfulness. Dependability is given credit as one of the strong points of the proposed system. This one is composed of activities like error handling, system stability, and the standardization of the end results. Users will be more confident and will not worry, as they are not likely to come across problems such as frustration or uncertainty when using an interface that is reputable.
- The amount of engagement provided by the interface is in direct proportion with the amount of stimulation it incites. The concept of gamification not only regards aspects like feedback loops, dynamic elements, and space for exploration and

practice-oriented learning. An impressive user interface becomes a factor for attraction for users which eventually result in a longer stay.

- The last criteria is the element of “newness” which is related to how fresh and unique the interface presents itself. This item covers the questions of what the interface include and since they are novel or distinguish it from the competitors. What makes the interface user-friendly?

Using a carefully thought-out approach users’ experiences are considered and assessed in light of the dimensions provided, from this the UEQ offers researchers and designers a comprehensive understanding of the ways people engage with interactive systems. The openness of their minds to their assessment tools will position them in a place where they can exploit the open spaces for improvement, make the necessary adjustments, and consequently provide more interesting and pleasant user experiences. The research objective that will be pursued is the development of both the guidelines and the heuristics related to mobile banking app design that are catered to the requirements of the color blind and dyslexic users. The interactions and visuals referenced are intended to serve as usability guidelines and heuristics. Based on the questionnaire results from the UEQ, the study tries to single out the main variables affecting the interaction of this age group with websites and its interfaces and make concrete recommendations for interface developing that meet the demand of this category of users.

3. METHODOLOGY

In the next aspect methodology, the principles and ways of thinking are developed and refined by the iterative procedure. Main ideas that regulate the development of mobile banking applications for people with dyslexia and color blindness will be emphasized, and they will be offered supported by the information obtained from the UEQ analysis. Some of the main points contain readability, color contrast, intuitive navigation, and inclusive design, which are to be covered as the guidelines. Beside that, some heuristic principles which are useful guidelines or

best practices will be created to actualize these ideas in innovative interface design and evaluation.

Stakeholder engagement played here by taking their ownership and contribution will be sought out to ensure these principles and heuristics apprehensiveness and applicability. Engaging with SMEs, conducting usability tests with true users, and periodic validation against accepted accessibility standards and best practices all this while going through iterative refinement process should help refine a website design.

The key points of a research giving an overview of a research procedure can be illustrated in the way, that firstly a thorough investigation of the UEQ data will be carried out, and then its results will guide in the development of the guidelines and heuristics directly aimed at dyslexia and colorblindness. The design concepts of mobile banking services will be based on evidence-based arguments that do not contradict an inclusive, usable and satisfying user experience. This will help not only those with cognitive or visual disability who can perfectly be on the same par with everyone as regards money services.

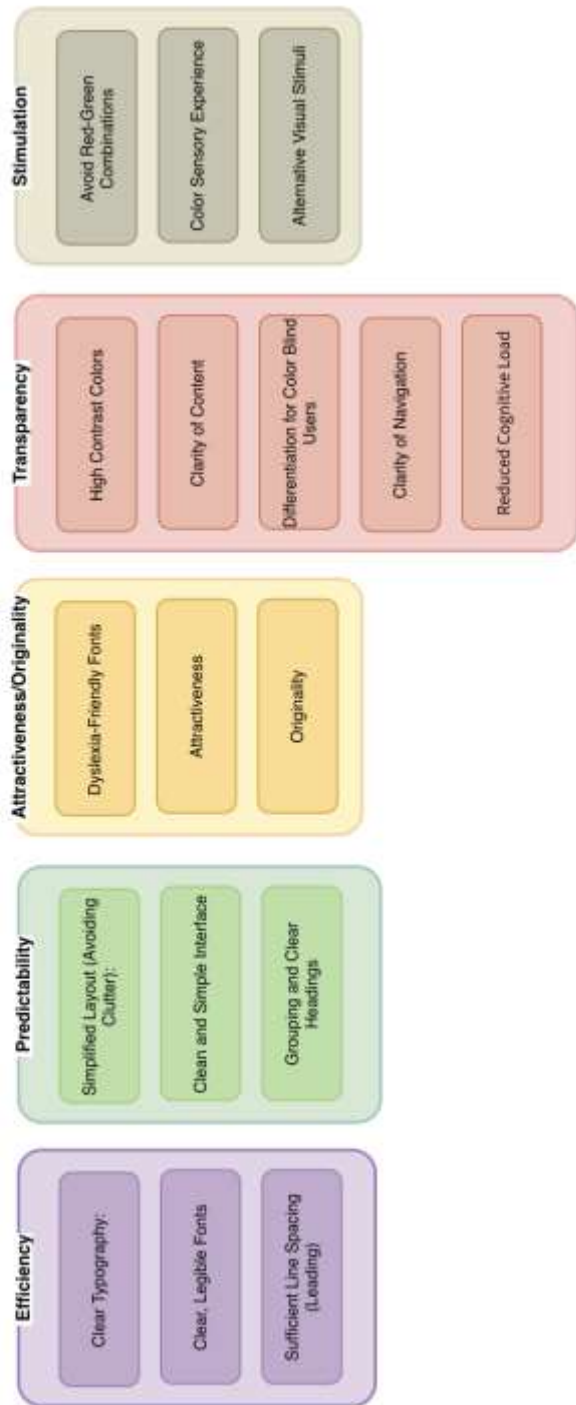


Figure 3. Principles of Web Design Accessibility

The aforementioned diagram is made up of divisions and sub-divisions clearly articulated, thus making it user-friendly and easy to grasp the concept of how each principal is incorporated in the design for accessibility.

Efficiency

Efficiency, which is the capacity of website to meaningfully communicate and send the information to the users, is not an easy process to make which user can easily process in a quick and clear way. Clear typography, with a focus on addressing dyslexia, contributes to this efficiency in several ways: Clear typography, with a focus on addressing dyslexia, contributes to this efficiency in several ways:

1. Clear, Legible Fonts:

- If a website has clear fonts that are legible, with simple, well-defined 'characters', it assures the readability of the textual content by a wide range of users information, including those dyslexia.
- Dyslexia is a neurocognitive disorder that can make it difficult for people to recognize and decipher characters, or they can be highly complex, as well as impossible to distinguish. Information is made available to people with with the use of fonts that conveniently and clearly show characters

2. Sufficient Line Spacing (Leading):

- Implementation of enough line space, usually known as spacing, be indispensable for text obstruction. Too many words on the web can make it very difficult for the dyslexic reader to read and comprehend the content of the website.
- Not overlooking a line height, visual isolation among the lines of text is pretty easy, which users can use to focus their eyes on a single line of text without really being distracted by the text around. This spacing in the lines makes it less hard for people, suffering from dyslexia, who are likely to have troubles reading to undue the confusion the lines can produce when they come closer.

In this regard, typography has two aspects: the fonts should be easy to read and there must be sufficient spacing between lines. By taking into account these two factors, a website will

have a better chance to make its content more accessible to a broader audience, including the ones who have dyslexia. When users can instantly avoid the hassle of misreading and understand the content easily, it boosts their experience and let them gracefully find what they are looking for on the site. Therefore, this better organization is profit-making not only for learning-impaired readers but for all readers as it will be helpful to one user and all others in constructing a more user-friendly and inclusive design.

Predictability

The predictability of web design and accessibility with respect to the target audience of the specific design should be such that audience, including dyslexic users, can be confident in their use to get the targeted information as expected. These principles contribute to predictability in the following ways: These principles contribute to predictability in the following ways:

1. **Clean and Simple Interface (Avoiding Clutter):**

- Streamlined looks and minimalist design create a simple and easy-to-grasp communication that makes navigating the website easier rather than complex or distract-driven. This predictability in turn corresponds to users, notably the ones with dyslexia, could easily identify and familiarize with the interface and thus find the required information or content they seek quickly.
- Messy organization and superfluous complications can be very confusing to anyone even a regular customer, but they are unimaginably difficult for people with dyslexia. When you're reducing the visual complexity and taking out the unnecessary clutter you enable your users to be able to anticipate where important information is supposed to be.

2. **Grouping and Clear Headings:**

- The inclusion of the related data through clear headings will help you to create content structure in a consistent manner. Readers who find this resource and those that have dyslexia can predict that content about some topics or designs will be built together and headers indicate what comes then.

- The UI of the app is so easy to use and predictable that the order of the content is organized in groups and provided with good headings to enable you to navigate the app without any difficulty. They understand the navigation mechanism that takes them directly to the specific piece of info they are searching for which creates a smooth and fast user flow.

In general, acceptability is crucial for the use by users, when speaking about dyslexic people, as it lowers the amount of questions while interacting with a digital interface. Simplifying the design with no clutter and clearly structured into headings and groupings will make it possible for the user to be able to foresee where they will find the information much easier and more effortless, hence improving usability and accessibility of the app or website.

Attractiveness/Originality

The reasonableness of web design principal “Attractiveness/Originality” essentially concerns the graphical attractiveness on a website or app. In the context of "Dyslexia-Friendly Fonts (Dyslexia)," the use of fonts like OpenDyslexic or Dyslexie contributes to this principle as follows: In the context of "Dyslexia-Friendly Fonts (Dyslexia)," the use of fonts like OpenDyslexic or Dyslexie contributes to this principle as follows:

1. **Attractiveness:**

- Dyslexia-friendly fonts are created specially for the readers that are dyslexic and they help people with this condition to read smoother and with the given results people with this condition are less struggling with reading process. Such fonts are composed of character sets that possess certain characteristics such as space increases between letters, bottoms with a weight, and unique shapes for the letters that in turn give the text pleasant appearance to these readers.
- By employing that font those apps and websites can both help out the individuals with dyslexia and also show a nice and friendly graphics approach. Professionally

selected and functional fonts but visually appealing ones can be one of the tools to get and keep the attention of a wider audience.

2. **Originality:**

- One of the creative design techniques used is using a font specifically designed for dyslexic individuals such as OpenDyslexic or Dyslexie to add originality in design. One type of these fonts is categorism with the help of unique features which distinguish them from the standard fonts. This feature of originality will allow a website or an app to be distinct and for users to be left with a striking and persistent impression.
- Accessibility is an important factor of design, and it doesn't mean that originality has to be a denial for design. Here we find the spectacular blend of originality and a sense of inclusiveness as the customized fonts are used to meet the needs of those who live with reading.

Showing that you follow a web design principle that is both good looking and distinctive by the use of dyslexia-friendly fonts, it becomes apparent that a website or software application is interested in providing an enabling environment which ensures that all the users' accessibility and inclusivity requirements are not only met but greatly enjoyed. This applies both to people with dyslexia who will find it more reading-friendly and also to users without dyslexia who will still appreciate the content for its design's visuality and freshness. This way of doing it is both eye-catching and effective, in addition, being a means to make it accessible.

Efficiency

Effectiveness in web designing and accessibility can be defined as a webpage's ability to convey information to users without any difficulty and uphold the interest of the user at the same time. Typography, particularly with regard to addressing dyslexia, significantly influences this efficiency through the following mechanisms: Typography, particularly with regard to addressing dyslexia, significantly influences this efficiency through the following mechanisms:

1. Use of Visual Cues:

- Visuals cues, i.e. icons, are effective tools for disseminating information abruptly. In case of icon, they are mostly more recognizable and processable than the text, anyhow making the users of content easier to understand and interact with the content.
- Icons become especially useful, indeed, for users with dyslexia, who may have difficulties in reading and understanding what is written in the text. They do some job for them because they bring visual imagery of the thing (i.e. action or content) that was written. This may be utilized by users to navigate the Application and enable them to use the information more quickly and user-friendly way.

2. Use of Patterns and Text Labels:

- Visual easiness carries over beyond color and graphics stimulate brain's ability to include extra cues such as patterns and text labels that help more brain cells to stay responsive. Patterns used to identify separate element groups of webpage help in determining the connection of content, making navigation convenient for users.
- A tip with text labels that support icons or patterns facilitates added explanation and accuracy. These can be various, such as color legends, audio highlights or other types of captioning that allow users, no color blindness exceptions, to understand the purpose or meaning of the visual cues, hence improving the interaction performance.

These visual cues are not only for users with dyslexia and color blindness who find the resource helpful and enticing to navigate the website or app. Various communication methods, such as pictures, figures, and text labels, provide alternatives to text description, which is not language or color based, enhancing the interface capabilities to have access to all the user groups be it literate or not. By this way, the usage of such software gets easier and its using becomes active for everyone.

Transparency

In web design, the idea of "Transparency" consists of how well and easily users have the chances to see and navigate with a particular web page or application. In the context of "High Contrast Colors (Color Blindness)," this principle contributes to transparency in the following ways: In the context of "High Contrast Colors (Color Blindness)," this principle contributes to transparency in the following ways:

1. **Clarity of Content:**

- High contrast color pairings are located whereby prominent text and vital frontline items easily get recognition from the background. Such changes of the contrast values are beneficial for everyone, with particular reference to the people with color blindness, to better perceive and read the content with greater contrast.
- The problem of color blindness should not be ignored. The users that suffer from vision challenge will have difficulties in identifying one or more of the colors. In this way color bits become instead a powerful tool in making sure that the text and the most important elements are bright and clearly seen by all users.

2. **Differentiation for Color Blind Users:**

- For color blind user the identification of the content in different color can be a crucial factor in expression. Bright and strong contrast colors blur end optimal readability by providing clear differentiation between foreground and background elements as those help the partially sighted people and users to easily identify and interact with the content of the web.
- It is of great significance for making sure that color-blind users do not ignore any key information or elements on the website, thus enhance the experience significantly.

3. **Clarity of Navigation:**

- Consistency is the key factor in retaining the layout and organization variation throughout the application users can find the interface without confusion and with predictability. Consistency is imperative for color impaired users: it allows them

to define the overall structure of the pieces of application and where to look for the different elements.

- When the internal structure and interaction patterns are crystal clear and predictable, a color blind user can manage to perform the intended actions with more ease. They depend on a uniformity of usage that provides them with a basic map of the application and familiarize them with key features.

4. **Reduced Cognitive Load:**

- The jaw-dropping principle of consistency reduces mental load for everyone - color blind or not. Users easily distinguish what they need to do or learn, so they can avoid exploring the interface, but instead just use the familiar and predictable design elements to do or learn such a thing.
- The maintaining of a consistent layout for users with a difficulty in color perception is the removal of the additional barrier of coping with different design and layouts. It is a layout that is clearly marked out for one to view and manipulate the content with the necessary ease.

Such websites or applications with high contrast colors can clearly show all content making it more distinguishable and hence, enhance transparency. Particularly this transparency is beneficial for users with color blindness, yet it allows them to explore the material efficiently, the content which is desirable, and avoid the obstacles which can be caused by colors. Indeed, using this approach, it helps to raise a more responsible, just, and straightforward user experience.

Stimulation

The principle of "Stimulation" in web design relates to the fact that the attractiveness of the color choice as well as to the shape and pattern of the design elements helps to capture and keep the attention of the user's visual and cognitive senses . In the context of "Avoid Red-Green Combinations (Color Blindness)," this principle contributes to stimulation in the following

ways: In the context of "Avoid Red-Green Combinations (Color Blindness)," this principle contributes to stimulation in the following ways:

1. Color Sensory Experience:

Red-green combinations are the worst for people with color blindness especially for those who suffer from this type of color blindness which also is known as red-green color blindness and is the most prevalent of such deficiencies. These dual oppositions can be divided into groups which include those who will see the colors as either completely different or virtually identical shades making out a lot of mixture and subsequent confusion.

- Through this mechanism designers give birth to an experience that involves and facilitates wider and better understanding of the information that is being conveyed. This not only makes colorblind users see more on the screen, but neutral color users perceive and comprehend the content more deeply.

2. Alternative Visual Stimuli:

- The suggestion is that when there's not the need to distinguish by shapes or patterns of the same colors, it is advisable to utilize green and red respectively. With this type of disruptions, the structure becomes clear and in addition, viewers find a variety of attractive things.
- Designers achieve that by the usage of shapes or patterns highlighting their differences and creating differing visual representation of the same content. The multiple color ranges may also help to lift up the design, hence capturing the interest of users who do not have a color deficit. Example: The timeless appeal of the high-fashion industry is deeply ingrained in our psyche since the dawn of time.

The primacy of keeping away from red-green combinations and using another place of demarcation is basically an idea to boost the design that is friendly to users as well as appealing. It enables color blind users to see content without any difficulty, and it gives such additives to the design like shapes and patterns, which could exclusively support the website or application design, through the stimulation of more visual interests.

4. GUIDANCE FOR WEB DESIGN AND ACCESSIBILITY

Digital experience in need of each user being accommodated by creating the max number of accessible options becomes newer definition of online world nowadays where no discrimination or dissatisfaction with services is allowed. Applying the mentioned principles designers may not only go with standards or law, but also ensure that the website or app's user experience is flawless and exciting for people of all capabilities.

- **Typography and Layout:** Font clarity and well-thought-out layout should be also considered key elements of developing web resources within the scope of accessible design. Combination of the clean and uncluttered fonts as well as generous leading enhances legibility, thus being the benefit for vision and reading impaired people. Clear and tidy interfaces enhance a user's experience by releasing the cognitive load and also paving navigational pathways with ease. Usually, short headings and a clear information setting across the website or application enable users to know where they stand and what to do next.
- **Visual Elements:** Inclusiveness as well as representation through visual materials seamlessly is the key in creating equitable spaces. Unlike the standard font typefaces, OpenDyslexic or Dyslexie fonts are favored by the dyslexic users thus they increase readability (Schantz, 2020). Darker foreground colors on top of the lighter background colors make texts better readable for the persons with the visual problems or color opposition. It is important to avoid red-green combos and take the advantage of other cues such as shape or patterns to make sure that each user is able to read relevant information regardless of their impairments.
- **Interaction design:** In device creation, designing interaction plays an essential role in ensuring an intuitively understandable and simple user interface. Using visual methods, like for instance symbols and labels, helps users visualize and explore the interface. That would be easier for them as shown in (Preece et al, 2015). An unchanging layout and design patterns facilitate cognition. Therefore, users will become conditioned to look for content in the expected places or predict when the next page is coming up. By decreasing

cognitive load and duplicating design constituent parts known only by the user, interaction design contributes to usability.

Finally these tactics are not only for meeting the legal requirements but also they assist in taking into account the accessibility functions and user needs in digital designing. With the focus on the accessibility, the web designers/developers are the one who facilitate the online experiences apart from the improvement and engagement of customers of all abilities. Finally, the developers make the network more inclusive and can be accessed by people of all abilities.

1. Typography and Layout:

- Use clear, simple fonts for readability.
- Ensure sufficient line spacing to prevent crowding.
- Keep the interface clean and clutter-free.
- Use clear headings and group related content.

2. Visual Elements:

- Use dyslexia-friendly fonts.
- Incorporate unique design elements.
- Opt for high contrast color combinations.
- Avoid red-green combinations; use shapes or patterns instead.

3. Interaction Design:

- Provide visual cues like icons and labels.
- Maintain a consistent layout.
- Reduce cognitive load with familiar design elements.

Figure 4. The guidance for web design and accessibility

Undoubtedly, it will guide you in creating sites that are not only accessible to both abled aged and disabled persons regarding their level of abilities. Online websites and applications that take accessibility in consideration during the designing process will be created just for everyone and will include like spirit where even the people with the limitations will be participating equally in access to information, interact with the content, and have fun. The advantage of accessible design is not always limited to those who have impairments. While the benefits of having an accessible design increase comfort level, enjoyment, as well as the engagement; it also improves overall user experience for everybody. On the other hand, when we think that designing with inclusion in mind is a matter of course, they are able to straightforwardly use digital spaces, making them feel strong and belonging. In conclusion, by applying accessibility principles one can guarantee that the web makes no distinctions between who gets to benefit from it. Instead it makes diversity strong, it breaks down walls of any kind, and it offers possibilities for people with all kinds of abilities to take part. This way we make our digital world more egalitarian, more inclusive.

5. CONCLUSION AND FUTURE WORK

This guideline is in addition to the concepts undertaken on this guideline. Integrating User Experience Questionnaire (UEQ) standards in web design enhance the availability and level of convenience of online experiences. UEQ principles Principle of knowing users' needs, preferences, and behaviors is crucial aspect. This is how the better and engaging interactions emerge. UEQ principles can then be combined with accessible regulations, which if applied to the design phase may lead to digital experiences that ensure the technical accessibility, exceed user expectations and yet delivered with positive affect.

UEQ frameworks underline the significance of usefulness, usability, pleasure, and other principles which make users feel comfortable with and emotionally connected to the product. As such, it becomes the mission of every web designer and app developer to make the interface accessible and the information useful in order to meet the goals and wants of the user. Usability is however focused on building interfaces that are intuitive, efficient and simple to use at the same time, helping the users do what they should in the shortest time without any hassle.

In addition to that, the feeling of fulfillment in the users' satisfaction is crucial. This is because a digital product's overall happiness and fulfillment in the face of its user's interaction is reflected in their experience, In fact, the latter can easily be achieved through these ways: designers can improve customer satisfaction and create a positive attitude towards their products or services by designing experiences with visually appealing, responsive, and dependable interfaces. A top priority among the wingspan of the educational community should be to also add interactive components of enjoyment which would help create a lasting and satisfying learning experience by including features such as gaming, stories, and interaction.

Together with the UEQ principles, designers take into account accessibility guidelines to make sure that digital environments do not only provide for the users with disabilities to easily navigate, therefore, ensuring superior experience both for them and for all users. By adopting this kind of strategy, these platforms are able to create inclusive, entertaining, and UX (user experience)-friendly digital experiences which are appealing to a wide range of people. The main value is the high degree of usefulness, simplicity, satisfaction, and fun. As a consequence, it is a means of gaining an online setting where everyone finds it easy and comfortable to use.

Then, besides UEQ principles, users' needs should be included as effective contributors to "user-centered design." Unlike previous forms of feedback, the UEQ questionnaires give critical insights into users' opinions and offers designers a solution to discover weaknesses as well as tweaks the user interface. UEQ evaluations provide qualified guidance to the iterations required it in order to entail higher usability, satisfaction and quality digital experiences.

Not only empathy and understanding are a foundation of UEQ, it regards so while constructing for different groups of users. A design team would be capable of developing such a digital experience that could be tailored to different users depending on their preferences and strengths after carefully analyzing the consuming behavior of users in different groups. This combined tactic ensures accessibility for everyone and brings about a sense of belonging as well as ann the impediment to all users.

Additionally, continued usage of UEQ standards and rules of accessibility is an effort to promote thus comprehensive design of digital products. While the rules take into account a selective technical compliance, as well as equal access to the user with the disability, UEQ principles are more broader and complete by integrating various dimensions of the user experience. While designers strive to create experiences that go beyond accessibility only but also enrich and pleasure consumers, the end result may be digital possessions that are located in the heart and minds of their owners bringing a long-term engagement and loyalty.

In conclusion, the design of web interfaces should consider the UEQ principles, which helps in making use of a digital environment that is actually user-oriented and inclusive. Designers might focus on creating digital stuff that will not only satisfy many groups of users undertaking tasks a certain way and with certain predictability, but also consider some of the more pleasant and positive features like aesthetics, hilarity, laughter, appealing-looking, attention grabbing, and faster speed, that will result in the more accessible, involving, and more user friendly digital environment overall.

Future work with other disabilities

To maintain web accessibility at the edge of the technology, however, it is vital to understand and satisfy the needs of people with different disabilities than the ones commonly known, e.g. the role of dyslexics and color-blindness. Screen reader friendly enhancement is an additional design attention point. Although there have been huge successes in this field, users often find obstacles in achieving seamless integration with a larger number of screen reader systems. The primary focus for the future should be on developing a better technology to make the websites more accessible. In this way, websites and screen readers will work without any problems (Schantz, 2020). Along with this, this area goes beyond deploying the rules of the "Web Content Accessibility Guidelines" and coming up with new options to represent the complex graphics, making them understandable for visual and tactile sensing (W3C, 2021). By means of develop technologies and design ideas, programmers could facilitate inclusive browsing experiences for visual-disabled people and pave the way to greater digital equity and multiculturalism.

Along with people with cognitive disabilities, providing for the underlying motor disability population of the Internet community is another important target for improvement of web disable-friendly standards. Individuals belonging to these groups often have webpage difficulties, especially when they are having extremely complicated interfaces or too little interactions. In order to improve the experience of this group of people, future initiatives shall target the interface design by making it possible through the wide clickable areas, the use of better keyboard navigation, together with voice commands or gesture interactions (W3C, 2021). Through the ease and the flexibility of accessing and moving through digital platforms, the designers of sites may help people with motion disabilities use digital services without any help and this may lead to the inclusivity and the usability of each such service.

Importantly, along with the problems of perception, there are some of the cognitive boundaries which call for special attention because without them the equal access to the information available online and resources cannot be provided. A simple design of the website and straight-forward content is needed to help people with cognitive disorders to go through

online content (W3C, 2021). This comprises using simple and direct communication channels reducing cognitive stress delivering an option to modify the details ensured based on personal interests and needs. Not only that, by making the addition of visual schedules, progress indicators, and streamlined task flows, the users with cognitive troubles can immerse fully in websites more effectively and deal with digital data in the ways respectively to cognitive abilities.

On the other hand, provided information sources in multimedia environments does continue to be a considerable obstacle to people with impairments. Many films, podcasts, and multimedia alike lack a number of the accessibility requirements including transcription and audio descriptions which disables various communities who have vision or hearing impairments from accessing them. The present problem could be solved only through the assurance that strong accessibility elements are included into the workflows of the multi-media content creation, therefore with all these efforts, all the groups of users, including the ones with some impairment, would enjoy and access digital content. Video makers can do this by incorporating audio descriptions, transcripts and also other accessibility elements into their content. Through this, they can create an inclusive online environment for people with disabilities to consume the available information or enjoy content at a fair level with everyone else.

In conclusion, broadening web accessibility are closely linked to an assiduous effort to tailor the accessibility options for a wide range of people with disabilities apart from dyslexia and color blindness. By giving adequate importance to screen reader optimization, improving navigation for those with motor impairments, simplifying content for people with cognitive disabilities, and point still working well on accessibility features form multimedia, web designers can create rather more inclusive, fair and consistent user experience for visitors on to we sites of no any kind.

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