TEXAS CHRISTIAN UNIVERSITY
2021 Boller Review: Journal of Undergraduate Research and Creativity

Inclusive Design and Web Accessibility for Autism and Cognitive Disabilities

Makenzie Ashley

INTRODUCTION

Every morning, I wake up at eight o'clock in the morning to finish homework or jump into a meeting for my job. Every morning, I leave my room where my desk is to perform my duties in the living room. The birds that chirp in the tree next to my window, the train that passes at exactly eight thirty-two in the morning, the garbage truck going down the street, the light beaming in through the window competing with the screen on my computer, and the rattling of the screw that is slightly too loose on my air conditioning vent are all sensory stimulants for me. My computer screen and its contents are just more visual stimulants to my Sensory Processing Issues from my Attention Deficit Hyperactive Disorder.

This is a reality that 23.2 million individuals in the United States with cognitive disorders face (Taylor). Many of these individuals are able to remove themselves from situations that can cause adverse reactions. However, many are not able to. People with more severe cognitive disabilities such as Autism Spectrum Disorder do not have the cognitive ability to work through difficulties with web accessibility. In a world where technology is heavily relied on by all of us, whether it is virtual learning or working from home, websites and mobile applications should not be a hindrance to individuals with ASD or other cognitive disorders. The reality of web accessibility and individuals with cognitive disabilities is that the inability to process information or navigate content on websites and mobile applications can trigger adverse reactions because various aspects of User Interface design create an inaccessible web experience for them. There needs to be an opportunity for all individuals, regardless of ASD or other cognitive disabilities, that grants them equal opportunities and access to technology.

THESIS STATEMENT

This is the research and development process of a web accessibility experience that is inclusive to individuals with Autism Spectrum Disorder and Cognitive Disabilities. This was accomplished through extensive research in which I learned about potential symptoms of Autism Spectrum Disorder and Cognitive Disabilities and analyzed currently enforced Web Accessibility guidelines and the topics included in them. Based on my discoveries of these common symptoms and current guidelines, I identified opportunities to improve web accessibility on behalf of individuals with Autism Spectrum Disorder and Cognitive Disabilities. The final deliverables were the creation and branding of an organization called IDAC, which stands for Inclusive Design for Autism and Cognition. The main function of IDAC is to promote inclusivity and awareness of Autism and Cognitive Disabilities so that web accessibility can be universally accessible to all. The deliverables include the development of a website and publication with the IDAC web accessibility standards.

METHODOLOGY

Qualitative research was used to collect information pertaining to the prevalence of cognitive disabilities and Autism Spectrum Disorder in the United States of America. Descriptive and exploratory research was conducted to gain a greater understanding of the common symptoms associated with Autism Spectrum Disorder and Related Cognitive Disorders. Anecdotal research also provided empathetic insight into user needs regarding web accessibility. Exploratory research revealed a gap in web accessibility standards regarding accessibility for cognitive disabilities. Sources included scholarly articles on Autism Spectrum Disorder, common symptoms, Sensory Processing Disorders, and Executive Dysfunction. Academic journals and

advocacy organizations on these topics were also reviewed. These sources provided insight into user base demographics, web accessibility solutions, design considerations, and background into web accessibility standards and potential solutions that can help create a more accessible web experience for individuals with Autism Spectrum Disorder and cognitive disabilities.

BACKGROUND INFORMATION

Defining Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder, hereafter referred to as ASD, is a developmental disability that affects not only an individual's social and behavioral development, but also an individual's cognitive development. ASD is difficult to define with one singular definition because every individual with ASD develops unique symptoms that may not affect others with the same condition. Most commonly, ASD is defined as "a set of heterogeneous neurodevelopmental conditions, characterised by early-onset difficulties in social communication and unusually restricted, repetitive behaviour and interests." (Lai, Meng-Chuan et al., 896).

The *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, or DSM-V, is the standard reference used by healthcare providers to diagnose behavioral and mental conditions created by the American Psychiatric Association. The DSM-V holds the reputation of being the sole guideline for the diagnosis of ASD and other conditions. Therefore, the DSM-V lists complete explanations of various symptoms that those with ASD may demonstrate. The DSM-V describes the possible symptoms of those with ASD and continues on to provide the table shown below regarding the severity of those with ASD. This table defines three "levels" to assist in categorizing the severity of ASD in order to assist in diagnosis and treatment. Reference the chart below:

Severity level	Social communication	Restricted, repetitive behaviors
Level 3 "Requiring very substantial support"	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches.	Inflexibility of behavior, extreme difficulty coping with change, or other restricted/ repetitive behaviors markedly interfere with functioning in all spheres. Great distress/ difficulty changing focus or action.
Level 2 "Requiring substantial support"	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and who has markedly odd nonverbal communication.	Inflexibility of behavior, difficulty coping with change, or other restricted/ repetitive behaviors appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/ or difficulty changing focus or action.
Level 1 "Requiring support"	Without supports in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to social overtures of others. May appear to have decreased interest in social interactions. For example, a person who is able to speak in full sentences and engages in communication but whose to-and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful.	Inflexibility of behavior causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.

Figure 1: DSM-V Autism Diagnostic Criteria (American Psychiatric Association)

Within these three levels, there are commonalities that can be found. Those include, but are not limited to: "inflexibility of behavior, difficulty coping with change, and distress and/or difficulty changing focus or action" (American Psychiatric Association). Based on the diagnostic criteria given by the DSM-V, there is reason to state that ASD affects a number of individuals, each in vastly unique ways.

Although ASD affects each individual uniquely, ASD is an extremely prevalent cognitive disorder. The Centers for Disease Control and Prevention (CDC) states that 1 in 54 children in the United States are affected by ASD, and it affects how those with ASD communicate, interact, behave, and learn ("What is ASD?"). According to a study performed by Cornell University in 2011, there are an estimated 5.5 million individuals with ASD in the United States of America (Dietz, Patricia M., et al.). ASD is just one cognitive disability amongst many. According to the

U.S. Census Record report on disabilities, in 2014, there were an estimated 23.2 million individuals with a neurodevelopmental disability which can include learning disabilities, Attention Deficit Hyperactive Disorder (ADHD), and many others (Taylor).

Related Symptoms

According to Ashlea McKay, a User Experience Researcher with ASD, those with ASD are "neurodiverse" (McKay). She continues on to explain that every neurodiverse individual with ASD and other cognitive disabilities is unique, and therefore, symptoms vary. There can be common symptoms that affect a large population of those with ASD, and these symptoms commonly overlap with symptoms of other cognitive disabilities as well. For example, the DSM-V states under Section B of the ASD diagnostic criteria:

> 4. Hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement) (American Psychiatric Association).

This excerpt from the DSM-V diagnostic criteria states the presence of sensory challenges within the ASD community.

The American Speech-Language-Hearing Association (ASHA) defines common signs and symptoms of ASD. Related to this study, there are three main categories that are defined as common. The first of those is titled by the ASHA as "Impairments In Language and Related Cognitive Skills". Key symptoms to note under this category are as follows ("ASD: Overview"):

- Delayed or impaired acquisition of words, word combinations, and syntax

- Literacy deficits, including difficulty: reading for meaning, understanding narratives and expository text genres that require multiple perspectives (e.g., persuasive and comparative/contrastive), getting the main idea and summarizing, and providing sufficient information for the reader when writing.
- Executive functioning deficits, including, lack of or limited flexibility, poor problem solving, poor planning and organization, and lack of inhibition.

The second of these categories is titled "Behavioral and Emotional Challenges" and the notable symptoms regarding this study are ("ASD: Overview"):

- Problems dealing with changes in routine and/or changing from one activity to the next; problems generalizing learned skills; using objects in unusual ways and uncommon attachments to objects
- Problems with self-management

The final category of symptoms related to this study as defined by the ASHA under the title "Sensory and Feeding Challenges" is ("ASD: Overview"):

- Sensory modality difficulties, including over-responsiveness, under-responsiveness, or mixed responsiveness patterns to environmental sounds, smells, light, tactile stimulation, movement, visual clutter, and social stimuli (e.g., social touch, proximity of others, voices); preference for nonsocial stimuli leading to intense interests with sensory aspects of objects and events

According to these specific symptoms as defined by the ASHA, those with ASD have common challenges regarding sensory modality, executive function, literacy, change, and self-management to name a few ("ASD: Overview"). Based on these common symptoms, and her

personal experience not only as an individual with ASD, but also her career experience as a User Experience Researcher, McKay states that when designing for accessibility regarding neurodiverse individuals, designers should consider "supporting sensory overload, assisted experiences, and tools to manage Executive Dysfunction" (McKay).

COMMON SYMPTOMS & PAIN-POINTS

Executive Dysfunction

Defining Executive Function (EF)

One of the most common impairments that those with ASD and related cognitive disabilities face is challenges with Executive Function (EF). Executive Function is categorized as a self-regulation skill and is one of the key mental processes that enable individuals to plan, focus, remember and process instructions, and manage multiple tasks successfully. These skills are "crucial for learning and development" ("What is Executive Function?"). An article published by Harvard University compares EF to an air traffic control system. The study states, "Just as an air traffic control system at a busy airport safely manages the arrivals and departures of many aircraft on multiple runways, the brain needs this skill set to filter distractions, prioritize tasks, set and achieve goals, and control impulses." ("What is Executive Function?").

Another article published by the Child Development department at Harvard University explains the key functions of EF as "Being able to focus, hold, and work information in mind, filter distractions, and switch gears" and continues on to explain that EF is the same mental process that assists individuals in skills such as reading, writing, remembering steps, taking part in projects and/or discussions, monitoring errors, making decisions based on information, revising plans, and interacting with others ("Executive Function & Self-Regulation."). The

ability to employ this mental process successfully ultimately allows individuals to control oneself against taking quick action when frustrated.

Working memory, mental flexibility, and self-control are three skills that rely on Executive Function. An article published by Harvard University describes these three components. Working Memory governs our ability to retain and manipulate distinct pieces of information over short periods of time. Mental flexibility helps us to sustain or shift attention in response to different demands or to apply different rules in different settings. Inhibitory control or self control enables us to set priorities and resist impulsive actions or responses ("Executive Function & Self-Regulation.").

A published study titled *Developing Usable Software Applications for Users with Autism: User Analysis, User Interface Design Patterns and Interface Components* analyzed the connection between Executive Function and users with Autism. The study claims, "A growing body of work suggests that many of the symptoms of Autism originate with impairments in the Executive Functions, such as in working memory, cognitive flexibility, planning, generativity, self-monitoring and inhibition." (Mejia-Figueroa, Andres, et al.). The study continues on to discuss how given the fact that Executive Dysfunctions affect life skills such as academic performance, planning, memory, and overall cognitive performance, the statement can reasonably be made that challenges with EF can lead to challenges with human-computer interaction.

Executive Function and ASD

An example that the study gives regarding usability challenges and EF is what is known as Cognitive Load. Cognitive Load is defined by the study as, "mental resources that a person

has available for problem solving or completing a task in a certain time" (Mejia-Figueroa, Andres, et al). Working memory is a mental process that relies on Cognitive Load. As previously mentioned, working memory is the ability to store and process information "leading to the assumption that, if Cognitive Load affects Working Memory, then Executive Functions dependent on Working Memory, such as Planning and Cognitive Flexibility, are also affected, adding to, and probably serving as a cause, to usability problems with autistic users." (Mejia-Figueroa, Andres, et al.).

As stated, EF is responsible for working memory. Working, or short-term, memory is a key component regarding website accessibility. WebAIM explains that users with cognitive disabilities, including ASD, can have issues with web accessibility related to their challenges with memory. These challenges are explained by WebAIM: "Some users cannot remember how they got to content. If a complex form displays multiple error messages, the user may be unable to remember multiple errors, and may even forget the error information before they are able to address the error." ("Cognitive Introduction").

Aside from Working Memory, EF also affects other aspects of mental processing that may pose web accessibility challenges to those with cognitive disabilities. Other examples include, but are not limited to: challenges problem-solving which would lead users with cognitive disabilities to abandon a site/task, trouble focusing one's attention on main content or functionality, and challenges with reading comprehension. All of these challenges are related to Executive Dysfunction, and if taken into consideration, can assist in creating an accessible User Experience and User Interface for those who are with cognitive disabilities, such as ASD.

Sensory Overload

Understanding Sensory Perception Issues

According to a study titled "Sensory Perception in Autism", it is estimated that close to 90% of children and adults with ASD suffer from sensory perception impairments, commonly identified as Sensory Overload (Robertson and Baron-Cohen). Another study from 2009 states that up to 95% of individuals with ASD also have Sensory Processing Deficits (Crane, Laura et al.). As referenced prior, the DSM-V lists "Hyper- or hyporeactivity to sensory input" as a common symptom used by healthcare providers while diagnosing a person with ASD (American Psychiatric Association). Also priorly mentioned is the ASHA list of common symptoms regarding autism in which sensory modality challenges are explained and presented as a common challenge that those with ASD encounter ("ASD: Overview").

The International Journal of Mental Health Nursing published "Sensory overload: A concept analysis" with the goal to define what exactly sensory overload is. People with diagnosis of certain mental illnesses including ADHD and ASD, "the problem of sensory overload due to a disturbed stimulus filtering appears to occur more frequently" (Scheydt, Stefan et al.). The analysis explains that the result of such a condition can lead to stress reactions which are typically manifested as social isolation and/or aggressive behavior based on low filtration capacity and/or lack of coping resources within these individuals. The analysis analyzed published literature that have varying definitions and attributes of sensory overload in order to formulate a more definite explanation of the condition to provoke further research. The research explains that, "All definitions of sensory overload describe a powerful or an atypical sensory stimulation as the triggering event which may evoke sensory overload" (Scheydt, Stefan et al.).

Further, the study states that the term "'overload' refers to the failure of an individual's coping strategies and not to the quantity of the stimuli" and "stimuli seemingly manageable or even positively stimulating by one individual may be experienced as 'overload' or 'strain' by another" (Scheydt, Stefan et al.).

The study discusses that "sensory overload is rooted in an impaired cognitive capacity to process information resulting in a reduction in the stimulus level and thus rendering subordinate stimuli to be experienced as aversive or burdensome" (Scheydt, Stefan et al.). Ultimately the concept analysis revealed that those with sensory perception issues, another term for sensory overload, perceive the environment around them at a heightened level of intensity and/or diversity "which exceed the normally experienced level and are thus experienced as aversive" (Scheydt, Stefan et al.).

Color and Light Perception

Sensory perception is a concept which involves not only visual stimuli, but all of the five senses: auditory, olfactory, visual, tactile, and gustatory. This research is focused on the visual stimuli which contribute to sensory overload as a symptom of those with Autism. According to Autism Speaks, "many people on the spectrum are hypersensitive to bright lights or certain wavelengths" ("Sensory Issues"). Past research has proven that the perception of color variation including shades, hues, and other attributes are all results of light and the make-up of different wavelength frequencies of light. Knowing that sensory issues in ASD can lead to sensitivity to light, it can be assumed that those with sensory perception issues as a symptom of ASD have an atypical perception and preference of color.

A study titled “Color Perception in Children with Autism” found that there was a variety of anecdotal evidence that color perception differs in neurotypical children compared to children with Autism, but little evidence based on quantitative data and direct experimental investigation. Two experiments were performed under this study. The first experiment “assessed accuracy of color perception in children with autism using a visual search and delayed matching-to-sample task”, while the second experiment “compared children with autism and typically developing children...in their accuracy and speed of color discrimination and the strength of categorical perception of color, using a target detection task” (Franklin, Anna, et al.). The first experiment showed that the children with ASD were “significantly less accurate at color memory and search” (Franklin, Anna, et al.). The results of the second experiment showed that the children with ASD were “less accurate...at detecting chromatic targets when presented on chromatic background, although were equally as fast when target detection was accurate. The strength of categorical perception of color did not differ for the two groups” (Franklin, Anna, et al.). Although the results of this study clearly showed that more scientific research needs to be directed towards color perception in Autism in order for conclusive findings to be made, the study did show evidence that children with ASD do have a slight variance in relation to color than neurotypical children.

Since sensory issues may lead to hypersensitivity with light, and therefore color, it can be assumed that individuals with ASD may have differing preferences to color than neurotypical individuals. Research found in a study titled “Atypical Color Preference in Children with ASD” has shown evidence for color preference within children with Autism. The study examines, much like the previous study mentioned, that there is a variety of anecdotal evidence that those with

neurodevelopmental disorders with unusual sensory processing perceive color differently then typically developing (TD) children. An example given of the anecdotal evidence is that the color green is often labeled as a preference. The study mentions that other research has led these researchers to "hypothesize...the enhanced sensitivity to sensory stimulation in general that is characteristic of ASD would influence color perception exhibited by people with this disorder, and this would result in aversion to some specific colors that are usually favored by neurotypical people" (Grandgeorge and Masataka).

The results of this study showed that typically developing children ranked brown as the least preferred color and red, blue, and yellow as the most preferred. Children with ASD scored yellow as low for preference and greens and brown were "conversely elevated" (Grandgeorge and Masataka). The study continues on to state, "the fact that the yellow color had the highest luminance value among the colors tested should not [be] dismissed. The observed aversion to this color might reflect hyper-sensitivity of children with ASD to luminance" (Grandgeorge and Masataka). Previous research has proven that yellow is actually the most fatiguing color. The study explains:

> It is well known that our eyes are provided with three different types of cone cells for color perception, L, M, and S, which correspond to the perception of red, green, and blue light, respectively. When yellow is perceived, however, both L and M must be involved. The perception of yellow should thus be the most heavily sensory- loaded of the perception of any type of color. Its perception is bearable for TD children, but could be over-loaded for children with ASD whose sensitivity to sensory stimulation is enhanced (Grandgeorge and Masataka).

Based on the information and research revealed in these two studies, it can be assumed that color and light perception is different in those with ASD in comparison to neurotypical individuals. The sensitivity to visual stimuli experienced by individuals with sensory perception issues leads to the conclusion that light and colors that are resulting from high frequency wavelengths can cause stress and sensory overload in individuals with ASD.

The Circadian Rhythm

Understanding the Circadian Rhythm

Regarding Executive Function as well as Sensory Processing Issues, it is important to take into consideration the indirect effects that technology and screen use can impose on individuals with ASD or related cognitive disabilities. Circadian Rhythm is described by the CDC as "can internally driven 24-hour rhythm that tends to run longer than 24 hours but resets every day by the sun's light/dark cycle" ("Circadian Rhythms and Circadian Clock"). The human body naturally controls its rhythms such as the production of the hormone melatonin based on the amount of light intake it is receiving. These rhythm shifts affect an individual not just physically, but also mentally and behaviorally.

Figure 2 is an image provided by the National Institute of General Medical Sciences (NIH) which is a visual depiction of how light enters into the brain through your eyes ("Circadian Rhythms"):

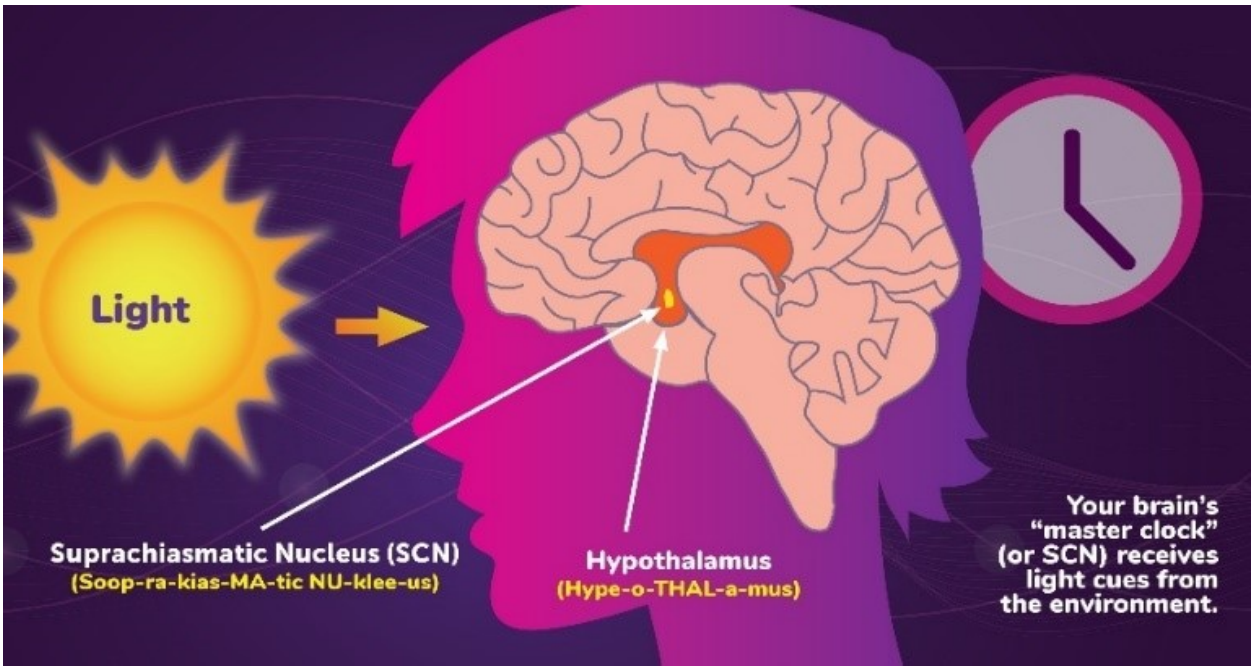


Figure 2: Circadian Rhythms (NIH)

According to the NIH, circadian rhythms are essential for a healthy lifestyle, and in neurotypical individuals, "Irregular rhythms have been linked to various chronic health conditions, such as sleep disorders, obesity, diabetes, depression, bipolar disorder, and seasonal affective disorder." ("Circadian Rhythms").

Circadian Rhythm as Related to Cognitive Disabilities

According to research studies, there are direct correlations between physical and behavioral problems and the deregulation of Circadian Rhythms of neurodiverse individuals. One of which suggests that regulating and maintaining a typical Circadian Rhythm "may be helpful to improve the health and to cope with several behavioral changes observed in ASD [individuals]." (Pinato, et al.). Figure 3 is a chart provided by the CDC which portrays a regulated Circadian Rhythm ("Circadian Rhythms Promote Wakefulness."):

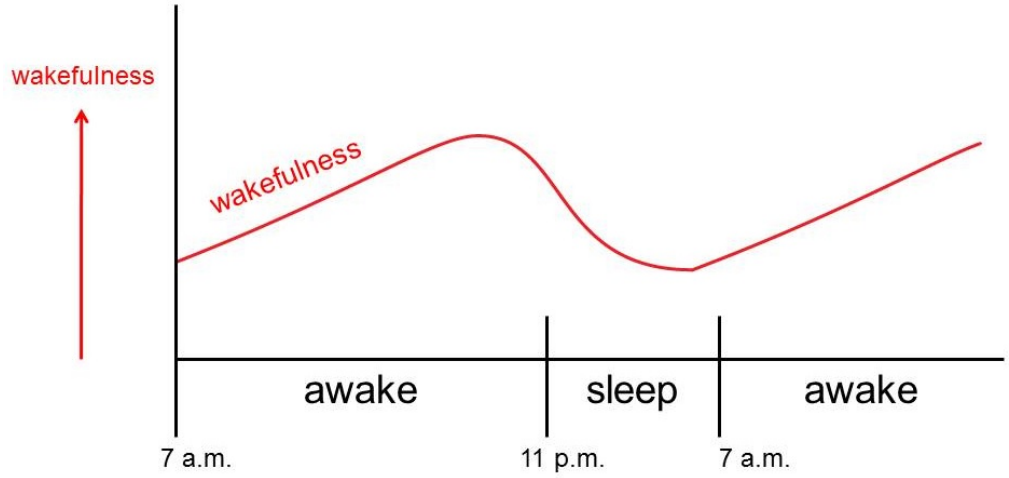


Figure 3: "Circadian Rhythms Promote Wakefulness." (CDC)

Maintaining a regular Circadian Rhythm is a difficult task specifically due to the development of artificial light, LED screens, etc. That being said, it is necessary for the well-being of those with ASD to take into consideration how User Interface Design can attempt to keep its contributions to a minimum regarding the disruption of Circadian Rhythms. The potential positive effects on those with ASD include deescalating a potential sensory overload problem due to light sensitivity, as well as supporting Executive Function skills by assisting with time management by keeping to a schedule which helps regulate the circadian rhythm.

Blue light is the main factor which disrupts the Circadian Rhythm. According to the CDC, blue light has the most impact, red light has no impact, and yellow/orange have a small amount of impact on the Circadian Rhythm ("The Color of the Light Affects the Circadian Rhythms"). That being said, by limiting the amount of blue light that an LED screen contains in its color wavelength composition, designers and developers can help control adverse potential

reactions that individuals with ASD might experience when interacting with websites or a mobile application.

The Kelvin Scale

The Kelvin Scale is a system which measures the composition of different lights. If a light composition projects more yellow, orange, or red, then it will measure on the lower end of the Kelvin scale. On the contrary, if a light composition projects more blue, then it will measure on the higher end of the Kelvin Scale of Color Temperature. Reference Figure 4 below provided by TCP ("Lighting Color Temperature"):

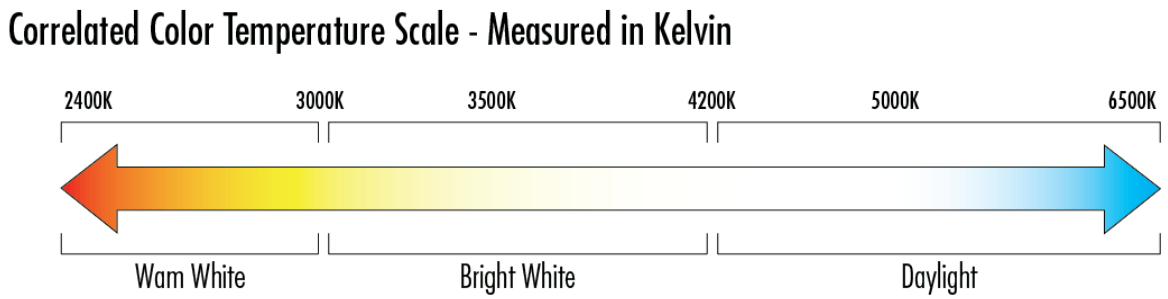


Figure 4: "Lighting Color Temperature." (TCP)

Light tuners which allow teachers to adjust lighting based on classroom activities have been praised in recent studies and teachers claim that different lighting settings help the students' focus and attention based on the situation. The U.S. Department of Energy (DOE) released a report in 2017 titled, "Tuning the Light in Classrooms: Evaluating Trial LED Lighting Systems in Three Classrooms at the Carrollton-Farmers Branch Independent School District in Carrollton, TX" which described the tunable lights as beneficial not only as a way to save energy, but also as a way to engage students. The report states, "The combination of spectral tuning and dimming in the classrooms provides greater opportunity to vary lighting parameters that may affect circadian

and behavioral responses for students, teachers, and other users of the classrooms, relative to the fluorescent systems." (Davis).

There are tactics such as hand held machines that allow users to measure the exact color temperature of a screen or light. This tactic of being able to tune the color temperature of lighting or designing screens to be composed of parameters which fall within a certain range on the Kelvin Scale can help eliminate features of websites and mobile applications which might trigger unfavorable behaviors due to the symptoms of individuals with ASD.

CURRENT ACCESSIBILITY GUIDELINES

Introduction

There are a variety of websites that are currently live and developed to include certain accessibility features. These features are helpful for overall accessibility, but one problem remains. In order to create a truly inclusive experience for those who live not only with cognitive disabilities but also visual processing disabilities as an entirety, these accessibility features should not be an added option. These features should be integrated into the websites without being a feature that reminds the user that they are different from those who are considered neurotypical.

Accessibility Guidelines

Section 508 of the The Americans with Disabilities Act (ADA) is something that developers and designers should be familiar with. The W3C is an organization that works to develop protocols and guidelines for websites. Within W3C, there are Web Accessibility Initiative (WAI) and its working groups which have developed the Web Content Accessibility Guidelines (WCAG) based on Section 508 of the ADA. OnTheMapMarketing explains that

"within these guidelines are four standards on how text, sound, code and markups should be created in order to make a website more accessible to users who are utilizing assistive technology to access a website" ("ADA Compliance Plugin"). These four principles include perceivable, operable, understandable, and robust ("Web Content Accessibility Guidelines").

According to WebAIM, an organization dedicated to helping individuals understand the ADA web accessibility standards and WCAG describes these four principles for better understanding. Perceivable is described as web content "made available to the senses - sight, hearing, and/or touch", operable is described as "Interface forms, controls, and navigation are operable", understandable is explained by WebAIM as "Information and the operation of user interface", and regarding robust, WebAIM states "Content must be robust enough that it can be interpreted by a wide variety of user agents, including assistive technologies" ("WebAIM's WCAG 2 Checklist").

WebAIM

In 1999, Web Accessibility in Mind (WebAIM) was established with the purpose of "expand[ing] the potential of the web for people with disabilities." ("About WebAIM"). WebAIM further describes its mission to create "accessible content" through their services which include training services to organizations and individuals, accessibility evaluation tools, instructional materials, an online community, research and policy dialogues. The organization is based at the Center for Persons with Disabilities (CPD) at Utah State University and describes itself as one of the "leading providers of web accessibility expertise internationally" ("About WebAIM"). Through these services which have been offered to not only individuals, but also

various businesses including Fortune 100 companies, WebAIM has grown into one of the most referenced and widely accepted standards for Web Accessibility.

In 2005, WebAIM began offering fee-based services which transitioned the training and consulting services they began offering in 1999 into more specialized and intensive training sessions that had a variety of options for organizations, businesses, and individuals to select from. Before the Covid-19 pandemic entered the United States in 2020, WebAIM offered Hosted Training only on location at Utah State University. Because of recent events, WebAIM has expanded to virtual training options either in small groups with other individuals and small organizations, or customized virtual training specific to an organization.

The most popular of these Hosted Training options that WebAIM offers to individuals, organizations, businesses, etc., is the "Virtual Web Accessibility Training". According to the WebAIM course registration website ("Virtual Web Accessibility Training"):

- **Where**: Online via Zoom
- **Timeframe**: Each training is held over two days with two 2-hour sessions per day
- **Cost**: $500/person ($400 each for groups of two or more)

Although these "Virtual Web Accessibility Training" options are highly requested by individuals and organizations, WebAIM limits the group sizes of each training session to 35 individuals in an attempt to create a comfortable and engaging environment for all participants to optimize learning. According to the WebAIM website, the training will include ("Virtual Web Accessibility Training"):

- This training session will teach basic web accessibility principles and advanced accessibility techniques.
- Learn what you need to know to ensure that your web site meets international guidelines and legal requirements.
- This training is primarily suited for web developers, though it will be valuable for designers, program managers, quality assurance experts, or anyone interested in gaining a deep understanding of web accessibility. A basic understanding of HTML is recommended.
- Training participants receive a complimentary enrollment for WebAIM's Document (Word, PowerPoint, and PDF) Accessibility online course—a $125 value.

These objectives are offered as an overall basis for participants to review when registering for the Virtual Training on Web Accessibility. However, there are customizable options such as the addition of a one-on-one 3 hour web accessibility session with a WebAIM professional to truly maximize one's knowledge on the subject and further tailor the experience to oneself and one's career needs.

According to the WebAIM Virtual Training on Web Accessibility registration site, the course is intended to be an intensive overview of Web Accessibility as a whole. The course will provide an overview on multiple topics. An overview of WCAG 2 and new 2.1 changes will be covered; captions and transcripts for Auditory Disabilities; a variety of topics in Visual Disabilities such as contrast, how screen readers work, ARIA & Landmarks, etc.; Photosensitive epilepsy; various Motor Disability standards including meaningful text links; keyboard navigation, and mobile accessibility to name a few; a limited number of topics regarding

Cognitive and learning disabilities which are understandable content, legible text, and animating and time-sensitive content; and lastly, Evaluating Web Accessibility content which reviews principles and methodologies for user testing, WAVE and other automated tools, keyboard testing, and screen reader testing ("Virtual Web Accessibility Training."). The final session of the training will be split into two breakout groups. The first is named "Advanced topics" and covers a variety of tools for developers and designers such as the rules for ARIA use, forms, ARIA labels and descriptions, Tabindex and scripting, and a few more advanced topics. The other topic that is available for participants is a "Document Accessibility Overview" which reviews accessibility in the creation of Microsoft Office documents such as Word and Powerpoint, converting Office to PDF, PDF principles, and PDF evaluation and repair in Acrobat ("Virtual Web Accessibility Training").

Alongside this popular course called Virtual Training in Web Accessibility, WebAIM offers a variety of resources so that businesses and individuals can customize their Web Accessibility learning to fit their industry needs. If the course resources and materials are not applicable to a potential customer or trainee, or if some of the materials are while others are not, there are options which allow trainees to select certain areas of training from the Virtual Training sessions. These include ("Accessibility Training"):

- Document accessibility workshop in which consumers will practice making accessible documents in Word, PowerPoint, and Acrobat
- StrategicA11y (Strategic web accessibility workshop) in which participants will engage in exercises and planning with expertise and peers, and will create a written plan to implement accessibility for your organization

- Customized training sessions such as onsite face-to-face training or customized virtual training in a variety of topics including those listed above as well as other options such as Web Accessibility guidelines and legislature (Section 508, WCAG 2, ADA, etc.), HTML, CSS, evaluating site accessibility, assistive technologies like screen readers, and more.

These training sessions have proved over the years as successful tools for businesses, developers, and individuals, as well as prove to be the most efficient and thorough way to teach and learn web accessibility for the workplace.

Overall, the WebAIM course format and ability to customize one's experience is something that the IDAC will be implementing through their Inclusive Design for Autism and Cognition training services. Following a similar format to WebAIM, the IDAC will aim to stress the importance of learning and studying more in-depth the web accessibility issues regarding Cognitive Disabilities due to the lack of information and current training resources that are currently available to businesses. Reviews of course materials will be accessible online for the ease and access of individuals and businesses and personalized training sessions like those offered by WebAIM will be offered to help participants fully implement and learn how Web Accessibility can assist in creative a universally inclusive design system.

The ADA Standards for Accessible Design

On July, 26, 1990, former President George H.W. Bush signed The Americans with Disabilities Act (ADA) into law. The ADA website describes this piece of legislation as, "one of America's most comprehensive pieces of civil rights legislation that prohibits discrimination and guarantees that people with disabilities have the same opportunities as everyone else to

participate in the mainstream of American life" ("2010 ADA Standards for Accessible Design"). The ADA website continues on to state that The Americans with Disabilities Act was modeled after the Civil Rights Act of 1964. The ADA is described as an equal opportunity law for those who live with disabilities.

In 1991, one year after the ADA was signed into law by former President George H.W. Bush, the Department of Justice published the Title III regulations which included the ADA Standards for Accessible Design. These standards were originally focused primarily on the design of infrastructure in and outside of buildings. However, in 1998, the United States Congress "amended the Rehabilitation Act of 1973 to require Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities" ("1991 ADA Standards for Accessible Design"). From this development of Section 508, various revisions have taken place in the last two decades to further develop more extensive guidelines for a more universally accessible web.

According to the Section 508 official website, the United States Access Board is the agency responsible for developing Information and Communication Technology (ICT) accessibility standards which will be incorporated into regulations that will and do govern Federal procurement practices ("About Us."). On January 18, 2018, a final rule issued by the U.S. Access Board went into effect. This final rule updated accessibility requirements governed by Section 508 and Section 255 Guidelines, which governs guidelines for telecommunications equipment. The U.S. Access Board developed this final rule based off of market trends and innovations in technology which allowed Section 508 guidelines to more closely unify with

similar standards such as those issued by the European Commission and the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG 2.0).

Though Section 508 of the Americans with Disabilities Act (ADA), and the ADA as a whole, have experienced a vast amount of revisions with the development of technology and society's rapidly increasing reliance on technology, the purpose of these guidelines and Federal regulations remain constant. According to the Executive Summary of the Information Communication Technology (ICT) Standards and Guidelines, previously referred to as the "final rule", the revised Section 508:

> …support the access needs of individuals with disabilities, while also taking into account the costs of providing accessible information and communication technology to Federal agencies, as well as manufacturers of telecommunications equipment and customer premises equipment. ("ICT Standards and Guidelines")

The document continues on to explain how these revisions are extremely necessary due to technological advances. The primary purpose of this final revision is described by the ICT Standards and Guidelines as the need to, "replace the current product-based approach with requirements based on functionality, and, thereby, ensure that accessibility for people with disabilities keeps pace with advances in ICT." ("ICT Standards and Guidelines").

Another important emphasis stated within the ICT Standards and Guidelines is the goal to "harmonize" with already developed international standards that relate to ICT accessibility. As stated, the WCAG 2.0 and other international accessibility standards are mentioned. The document states:

> Harmonization with international standards and guidelines creates a larger marketplace for accessibility solutions, thereby attracting more offerings and increasing the likelihood of commercial availability of accessible ICT options. ("ICT Standards and Guidelines.")

Not only is the harmonization of regulations for accessible technology important for the purpose of promoting widespread availability, but also the harmonization of regulations for accessible technology will promote a standard for technology that would potentially develop into every channel of technology being universally accessible. These new regulations from the U.S. Access Board were an important and necessary leap for the advancement of universally accessible technology.

From the recent developments of Section 508 of the ADA Standards for Accessible Design, various tools and compliance checking systems have been developed between the U.S. Access Board and other Web Accessibility agencies such as W3C. Below is a sample from a chart which compares W3C's WCAG 2.0 to current Section 508 Guidelines. According to the U.S. Access Board website, 22 of the 38 Level A and AA Success Criteria outlined by the WCAG 2.0 are "phrased differently but equivalent in substance to current 508 requirements." Figure 5 provides a sample from this chart ("U.S. Access Board"):

Proposed (WCAG 2.0 Success Criteria [Level])	Existing 508 Corresponding Provision	Summary	What would Change	Comment
1.1.1 Non-text Content [A]	1194.22(a)	Provides for text alternatives of images and other non-text content, including user interface components	Substantially Equivalent	Proposed standard provides additional detail for 8 common categories of non-text content.
1.2.1 Prerecorded Audio-only and Video-only [A]	1194.22(a)	Provides that prerecorded audio is available in a visible format and that silent animations are available in an audible format		
1.2.2 Captions (Prerecorded) [A]	1194.22(b) and .24(c)	Provides for synchronized captioning of prerecorded video and multimedia.	Substantially Equivalent	Proposed standard distinguishes between live and prerecorded media.
1.2.3 Audio Description or Media Alternative (Prerecorded) [A]	1194.22(b) and .24(d)	Provides for audio description of prerecorded video and multimedia		
1.2.4 Captions (Live) [AA]	1194.22(b) and .24(c)	Provides for captioning of live video and multimedia		
1.2.5 Audio Description (Prerecorded) [AA]	1194.22(b) and .24(d)	Provides for audio description of live video and multimedia		
1.3.1 Information and Relationships [A]	1194.22(e) through (h)	Provides that information, structure, and relationships conveyed visually are available to users of assistive technology Provides that semantic markup be used for headings, lists, emphasized or special text, and tabular data, including the association of data cells with their headers	Substantially Equivalent	Proposed standard is written broadly and is technology neutral, whereas existing standard is specific to HTML image maps and data tables.

Figure 5: Comparison Table of WCAG 2.0 to Existing 508 (U.S. Access Board)

Other tools for testing accessibility are available on the official Section 508 website as well. These tools have been developed recently as technology and website design and development has become available to more and more consumers. Figure 6 is from the official Section 508 website where a "Test" page in the website's navigation bar is easily noticed ("Test for Accessibility"):

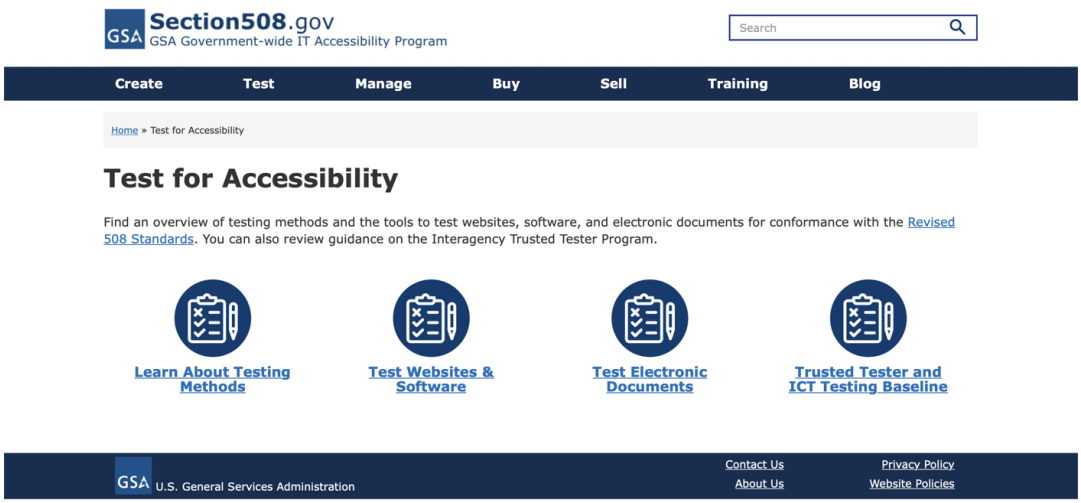


Figure 6: Test for Accessibility (Section508.gov)

Within these four sections, the "Learn About Testing Methods" clearly outlines to users the three methods in which users can evaluate their websites for compliance: automated, manual, and hybrid. Automated testing of a site relies on technology to scan and analyze a website for compliance in a variety of manners such as color contrast and text which can be identified by page scanners to name a few. Manual testing "uses a documented, consistent, repeated process" which is outlined by the Section 508 website ("Overview of Testing Methods for 508 Conformance"). Lastly, Hybrid testing is a combination of both manual methods and automated methods, and therefore, is arguably the most reliable form of compliance testing.

Since the onset of the Americans with Disabilities Act in 1990 by former President George H.W. Bush, web accessibility standards have developed rapidly alongside the advancements of modern technology. The ADA Standards of Accessible Design' Section 508 are guidelines that are easily accessible by any user and provide access to tools and other guidelines which prove necessary in the development of universally accessible technology. As Section 508 continues to develop alongside technology, the harmonization with other standards should continue as a goal within the U.S. Access Board and agencies which work towards web accessibility in order to advance to a society in which accessible technology is common practice.

Accessibility Plugins

Various websites include an accessibility plugin that allows users to customize their individual experience based on the needs their disability presents. This plugin is described by the website as an "ADA compliance Plugin" ("ADA Compliance Plugin"). The OnTheMapMarketing plugin is based on these standards. The web page continues to explain how their widget works to meet various levels of the standards set by WCAG. There are three levels of WCAG compliance that websites can achieve through incorporating widgets based on Section 508 of the ADA. WebAim summarizes theses three levels of compliance as ("Web Content Accessibility Guidelines"):

- Level A is a basic requirement for some users with disabilities to be able to access and use web content.
- Level AA indicates overall accessibility and removal of significant barriers to accessing content.

- Level AAA provides improvements and enhancements to web accessibility for some users with disabilities.

The website describes their plugin that will "help you meet the standards in Section 508 as well as the most recent WCAG level A and level AA compliance guidelines ("ADA Compliance Plugin")." Finally, the OnTheMapMarketing explains that, "Most government websites, schools, universities and privately owned websites try to achieve a level AA conformance so that their website can be accessible to many individuals with disabilities." ("ADA Compliance Plugin").

Accessibly Plugin

Bison Coolers is a website that is developed to include the accessibility plugin called "Accessibly" made by OnTheMapMarketing. This icon is easily noticeable by users and the widget in itself does open up to include a variety of options that the user can filter through to turn off and on such as contrast, a bigger cursor, inverting colors, and more ("Bison Coolers"). Figure 7 shows the widget icon as well as the popup that appears when the icon is clicked on to reveal various accessibility options to adjust elements such as contrast, inserting a reading line, and enlarging text. Figure 8 demonstrates the reading line and contrast features of the settings in use.

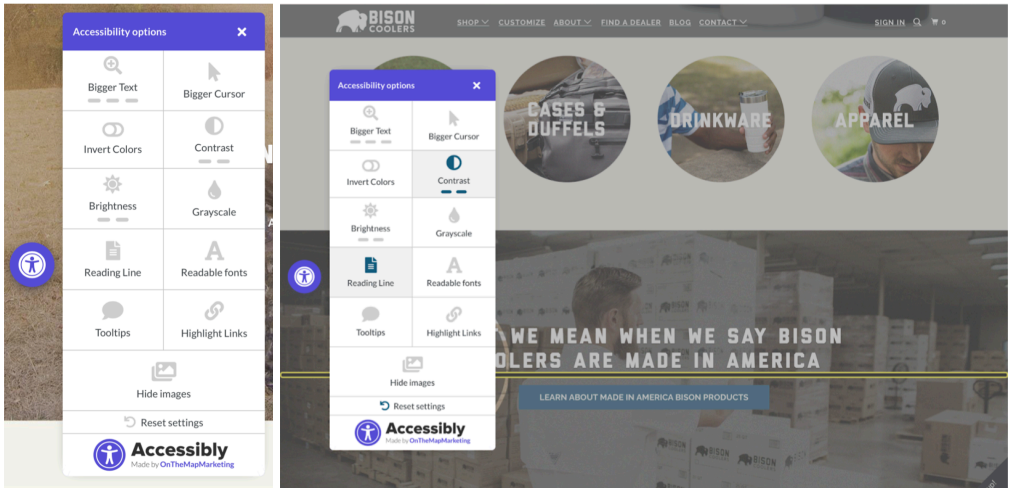


Figure 7 and Figure 8: Accessibility Settings in Use (OnTheMapMarketing)

Other Accessibility Features

There are a variety of other features that websites have incorporated over time in attempt to comply with the WCAG guidelines that have been developed to create a more inclusive web experience for those with disabilities. Although websites do feature accessibility options, these options are often difficult to find, and also do not alter the user experience of the website based on the user interface changes that occur.

An example of these accessibility features is found on the footer of the Benefit Cosmetics website. Figure 9 is an image of the website's footer where the accessibility features can be found which proves the difficulties that users may have finding the features. Figure 10 and Figure 11 show the use of the "change contrast" option that is an accessibility feature on the website. The buttons and typography change from vibrant pink to a grayscale version for more contrast, however, the other features do not change in contrast which could be factors which can provoke symptoms of cognitive disorders such as sensory overload ("Benefit, Official Site and Online Store").

As seen by the examples of websites in Figure 9, Figure 10, and Figure 11 below, there are accessibility features that can be found currently on websites which will allow users to alter the user interface in order to better accommodate one's accessibility to a website. Although these current features can be viewed as a progressive step towards creating an accessible web experience for everyone, there are various obstacles which come alongside these features.

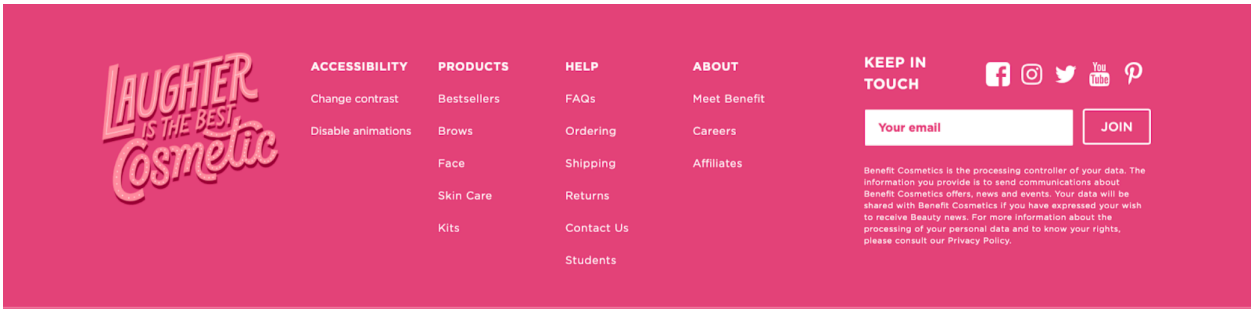


Figure 9: Benefit Website Footer (Benefit Cosmetics)

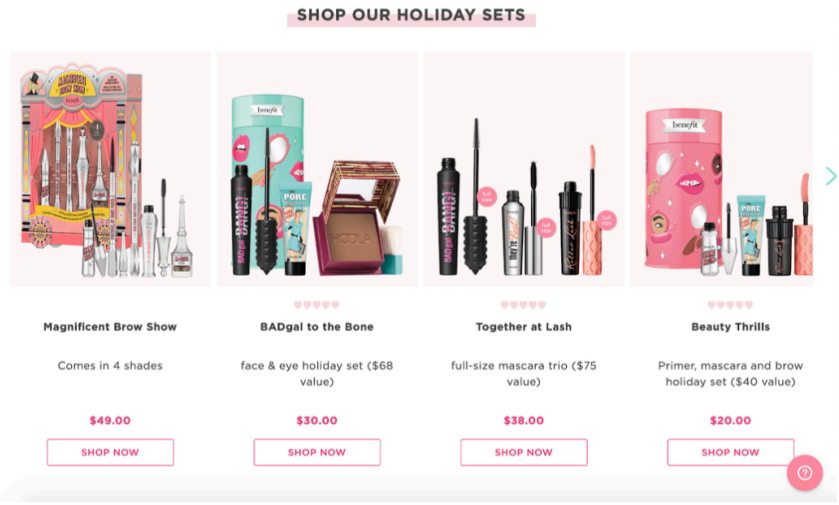


Figure 10: Website Original (Benefit Cosmetics)

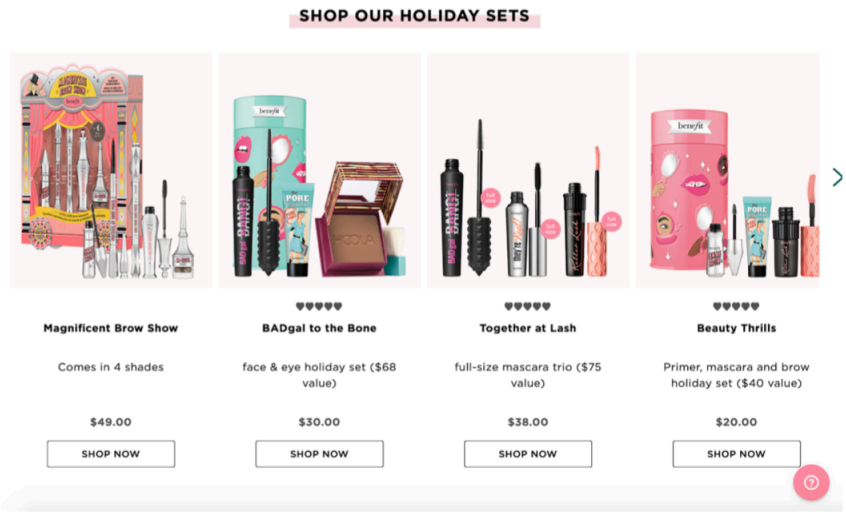


Figure 11: Accessibility Features (Benefit Cosmetics)

As noted by the examples of websites above, there are accessibility features that can be found currently on websites which will allow users to alter the user interface in order to better accommodate one's accessibility to a website. Although these current features can be viewed as a progressive step towards creating an accessible web experience for everyone, there are various obstacles which come alongside these features.

As noted, the ease of access to these features can be difficult such as finding them. Some of these features, such as on the Benefit Cosmetics website, are far too minimal. Other features, such as those found on the Bison Coolers website with the Accesibly plugin, can be extremely useful, but also overwhelming to those who are trying to use the features. Above all, the main problem that can be noted with these current accessibility features is that they remind the user that their cognitive function is different than that of neurotypical individuals. This is counterintuitive to creating and employing accessibility features because the significance of them is to create an all-inclusive user experience for everyone involved.

ACTIONS TAKEN

Brand Identity

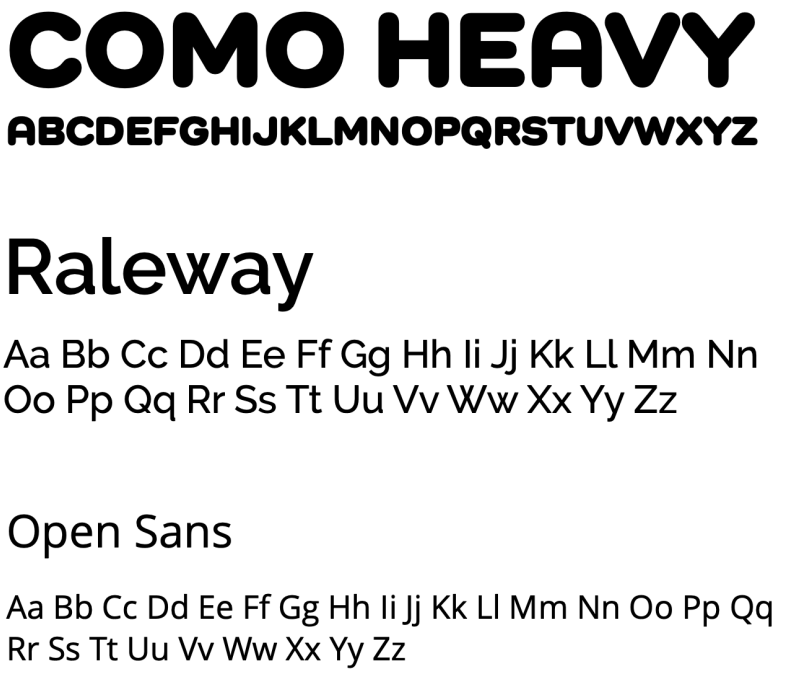
IDAC is an organization dedicated to creating inclusive web accessibility standards focused on promoting inclusivity, accessibility, and awareness of cognitive disabilities. Through IDAC, businesses or organizations and individuals can get IDAC certified, reference IDAC standards, and receive an IDAC accessibility audit simply by pasting their url into a box.

Naming

IDAC stands for Inclusive Design for Autism and Cognition. It was chosen because it not only describes the function of the organization through its name, but it also is an acronym that is easily memorable as well as has corporate and professional attributes.

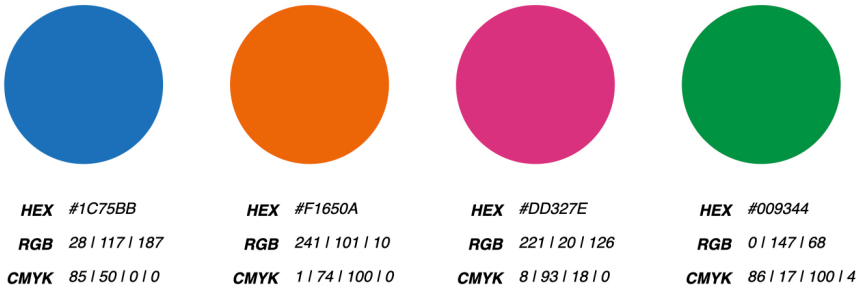
Typography

To continue with creating an environment of inclusivity and welcomeness, typefaces were carefully selected. The rounded sans-serif typeface called Como was chosen for the logo because it contains characteristics that communicate a sense of friendliness and childlike curiosity. The typeface selected for secondary type is Raleway. The body copy typeface selected is Open Sans. Both Raleway and Open Sans were selected because they are web-safe fonts which are crucial for accessibility because they are easy to read and easily comprehended.



Colors

Color theory was referenced when deciding on brand colors. These four colors were selected because they each represent different individuals. Inclusivity is at the core of IDAC's mission, and these cheerful colors are welcoming to all. Blue is representative of the loyal and trustworthy characteristics that IDAC wants to communicate to users. Orange was chosen because it represents the welcomeness and determination of IDAC. Further, pink was chosen because it is representative of love and acceptance. Lastly, green represents the harmony and safety on the web that IDAC wants to create for individuals.



Logo

The IDAC logo represents inclusivity and representation through the colors and typography. The logomark is an eye which is representative of the careful consideration that the IDAC takes in mitigating visual stimulants.

THE IDAC STANDARDS

The IDAC standards created cover thirteen different topics in User Interface Design and web accessibility within the categories of use of color, layout and grouping, and comprehension.

Use of Color

Blue Light and Circadian Rhythm

Standard: Use bright, saturated colors sparingly to reduce Blue Light emission.

Introduction

The human body naturally controls its rhythms such as the production of the hormone melatonin based on the amount of light intake it is receiving. These rhythm shifts affect an individual not just physically, but also mentally and behaviorally. Research studies show direct correlations between behavioral problems and the deregulation of Circadian Rhythms in individuals with Autism Spectrum Disorder. Regulating and maintaining a typical Circadian Rhythm has the potential to improve health and behavior changes in individuals with Autism Spectrum Disorder. Maintaining a regular Circadian Rhythm is a difficult task specifically due to the development of artificial light through LED screens. It is crucial to take into consideration how User Interface Design can attempt to keep its contributions to a minimum.

The potential positive effects on those with Autism Spectrum Disorder include deescalating a potential sensory overload problem due to light sensitivity, as well as supporting Executive Function skills by assisting with time management by keeping to a schedule which helps regulate the circadian rhythm. By limiting the amount of blue light that an LED screen contains in its color wavelength composition, designers and developers can help mitigate

potential adverse reactions that individuals with ASD may experience when interacting with websites or a mobile application.

The Kelvin Scale:

The Kelvin Scale is a system which measures the composition of different lights. If a light composition projects more yellow, orange, or red, then it will measure on the lower end of the Kelvin scale. On the contrary, if a light composition projects more blue, than it will measure on the higher end of the Kelvin Scale of Color Temperature. Sunlight at 12pm or noon is averaged at 5500k on the Kelvin Scale. If LED screens or any other light sources are equal to or higher than 6500k on the Kelvin Scale, then the blue light composition will be actively disruptive to a user's Circadian Rhythm.

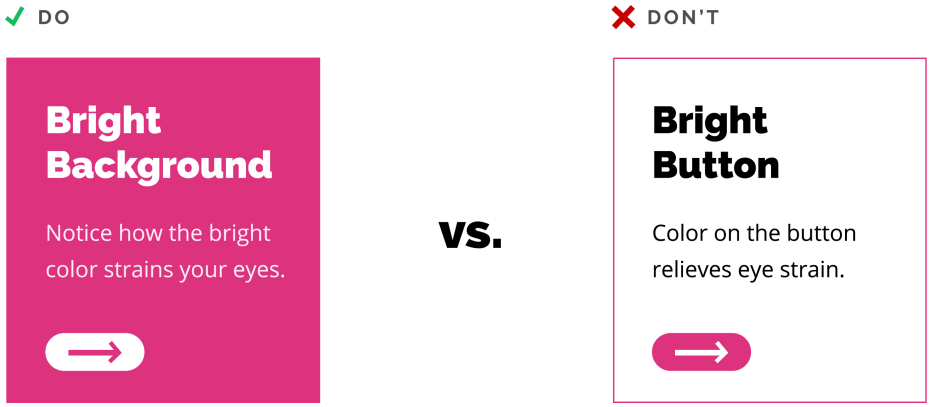
- Daylight standard on the Kelvin Scale is 5500k, but once it reaches 6500k, it is disruptive.
- The ideal Kelvin range for LED Screens is between 1200k and >6500k

Solutions or Ways to Test:

Screens and anything digital use RGB which is also known as Additive Color. Therefore, the brighter a screen is, the more light is emitted.

- Lower saturation by lowering the RGB numbers. Brightness decreases the white within a color causes blue light emission to be more. In the example on the left, the colors are difficult to look at and create a vibrating sensation. The example on the right is much easier on the eyes even though the colors are only 10% lower in saturation.

- Use bright colors sparingly. Notice that the card with the bright pink background and white text creates an over-stimulating, vibration effect due to over-saturation. Although the same pink is used on the right, the minimal use of the pink directs user eye-flow towards the button, but since it is used on a graphic element rather than textual content that needs to be focused on, the pink causes less vibration and disruption.



Other Resources

Below are three tools that are available for designers and developers to utilize to measure the blue-light composition of digital LED screens:

- www.Fluxometer.com is a software available to measure the overall light spectral output of screens. There is downloadable software available as well as physical devices that measure.
- Colorimeters are physical machines that developers and designers can purchase to measure blue light composition.
- Spectrometers are also physical machines that developers and designers can purchase to measure blue light composition.

Contrast and Hierarchy

Standard: Provide ample contrast between foreground and background.

Introduction

Past research has proven that the perception of color variation including shades, hues, and other attributes are all results of light and the make-up of different wavelength frequencies of light. Knowing that sensory issues in Autism Spectrum Disorder can lead to sensitivity to light, it can be assumed that those with sensory perception issues as a symptom of Autism Spectrum Disorder have an atypical perception and preference of color.

Sensory issues may lead to hypersensitivity with light, and therefore color, an assumption can be made that individuals with ASD or related cognitive disabilities may have differing preferences to color than neurotypical individuals. Sensitivity to visual stimuli experienced by individuals with sensory perception issues proves that light and colors that are resulting from high frequency wavelengths can cause stress and sensory overload in individuals with ASD or other cognitive disabilities.

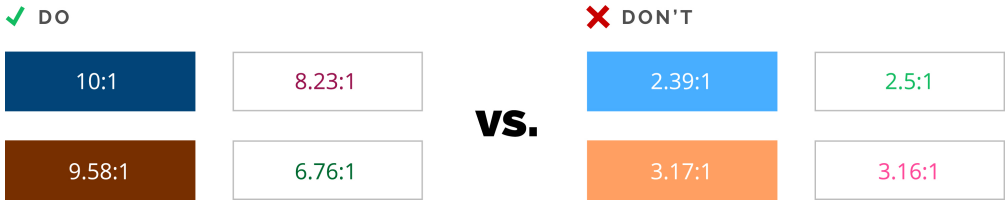
Color Ratio

Color ratio, also referred to as luminance, refers to the brightness between two colors. Luminance, or color ratio, is fundamental to the user's ability to perceive content that is on a website or mobile application.

- 1:1 is the ratio between white to white
- 21:1 is the ratio of black on white
- 1:21 is the ratio of white on black

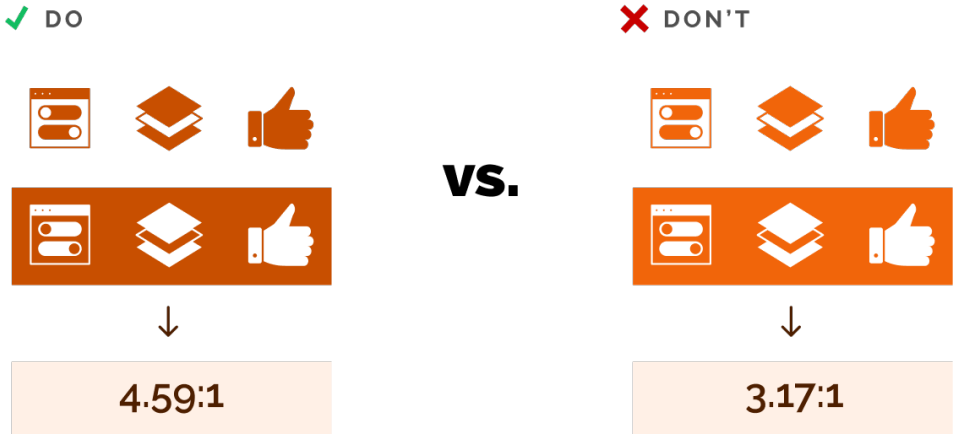
Typography

To be in compliance with the WCAG standards, the minimum contrast ratio of text or images of text must have a contrast ratio of at least 4.5:1 (or 3:1 for large text). However, in order advance web accessibility to include individuals with cognitive disabilities, the IDAC suggests that all contrast ratios follow a minimum of 4.5:1.



Graphic Elements

The WCAG 1.4.11 states that non-text elements must have 3:1 contrast. These elements include social media icons, regular icons, and anything that does not include text content. Although overly saturated, bright colors may fall within the range of contrast equal to or greater than 3:1, these colors can be over-stimulating for individuals with Sensory Processing Issues.



Notice that although both sets of icons above technically have a minimum contrast ratio of 3:1, the icons on right compared to the set of icons on the left cause a vibrating effect. This is

attributed to the saturation of the orange color used. In comparison, the icon set on the naturally are easier on the eyes even though the orange used is only 10% darker than that on the right. The IDAC states that the minimum color contrast ratio for all elements should be 4.5:1.

Resources

For more information on the WCAG 2.0 Guidelines, visit www.w3.org. Below are links to various contrast checker websites that you can use to check contrast ratios between foreground and background colors.

- https://webaim.org/resources/contrastchecker/
- https://contrastchecker.com

Application of Color

Standard: Be intentional with the application of color as a design element.

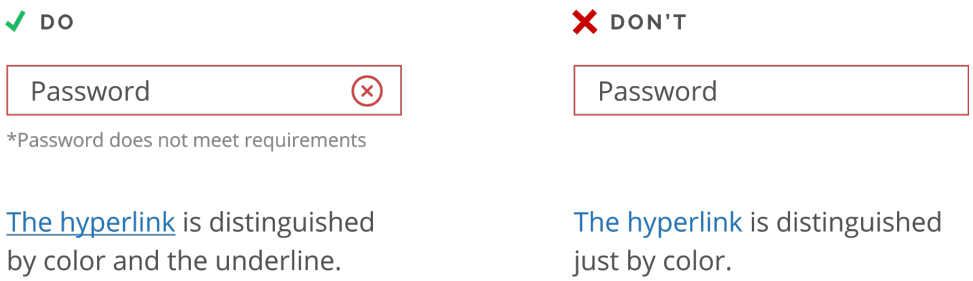
Introduction

Due to hypersensitivity and overstimulation that can be attributed to color application in User Interface design, it is crucial to understand the importance of intentional application and utilization of color. Intentional use of color can help mitigate adverse reactions caused by deficiencies in Executive Function and Sensory Processing in individuals with cognitive disabilities. Color is a design element that can make a user's experience with an interface either a success or a failure because color can determine how users comprehend and process content.

Color to Convey Information

Color should never be used alone to convey a message to users. Although color can be successful in communicating certain messages such as an alert or error, it is not a reliant design

element by itself to convey a function or message to users. It is important to use color in this method as an enhancement alongside other forms of conveying a message rather than as the only signal of communicating as it cannot be assumed that this message will be clearly comprehended as intended.



Practicality First

As mentioned, color as a design element can hinder or assist users in their experience with an interface. Using color for practicality first before aesthetic reasons will help user interaction with a website or mobile application. Limit the potential of disruptive color usage by concentrating on functional requirements (like status states or alerts) first. Then, use color for enhancement purposes to reinforce or balance the aesthetic of the content.

Grouping and Layout

One of the most common impairments that those living with Autism Spectrum Disorder face is challenges with Executive Function. Executive Function is categorized as a self-regulation skill and is one of the key mental processes that enable individuals to plan, focus, remember and process instructions, and manage multiple tasks successfully. Another common impairment experienced by both neurotypical and neurodiverse individuals is called Sensory

Overload, or Sensory Processing Deficits, which is most commonly described as hyperactivity to sensory input. Sensory processing deficits can lead to stress reactions which are typically manifested as social isolation and/or aggressive behavior based on low filtration capacity regarding stimuli and/or lack of coping resources within these individuals called Sensory Overload. Sensory overload refers not to the number of stimuli causing the reaction, but to the lack of coping strategies an individual may have.

Gestalt Grouping Principles can assist with a user's ability to process information which is crucial in comprehending content. Utilizing Gestalt Grouping Principles while designing digital content can assist users with Autism or related cognitive disabilities by mitigating adverse effects and reactions related to deficits in processing information caused by Executive Function impairments and Sensory Processing Deficits.

Similarity

Standard: Similar elements help users comprehend functionality of objects.

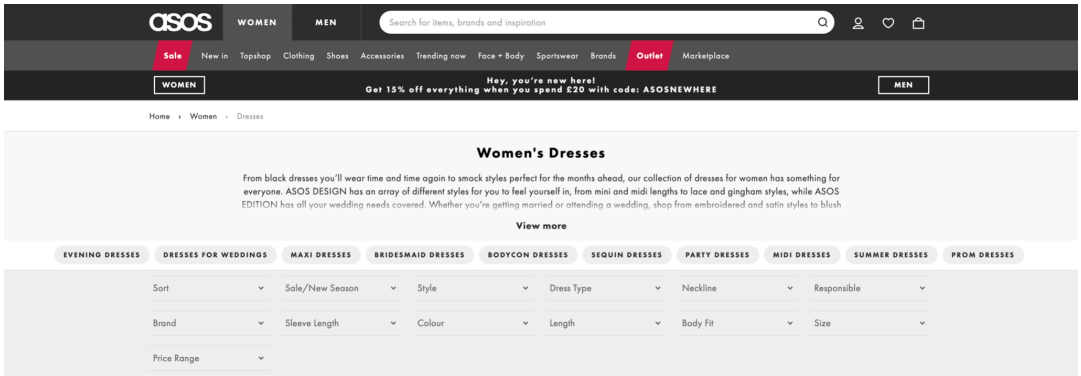
Introduction

According to the principle of similarity, an individual naturally will group objects together when the individual objects appear to be similar to each other. The most common design elements used by designers to apply the principle of similarity are shape and color. Not only does the principle of similarity assist users in visually grouping together various elements, but also similarity suggests that specific objects perform the same or similar functions which proves helpful for processing digital content and the overall layout of a website or mobile application.

Based on Shape

In interface design, similar or the same shapes should be applied to elements of the UI design to increase the user's ability to comprehend and process various functionalities of certain objects. For example, buttons often follow a rectangular format or the pill format. When presented with various components or lots of content to process, the human brain naturally wants to group things together to make information easier to process especially when there is a lot of content on a screen. In this example, your brain naturally groups together the circles and the rectangles based on similarity shape since there are no other characteristics to identify groups.

Notice in the image below from Asos that the sub-categories in the pages are noticeably grouped together because of the pill that is consistently used for each one.

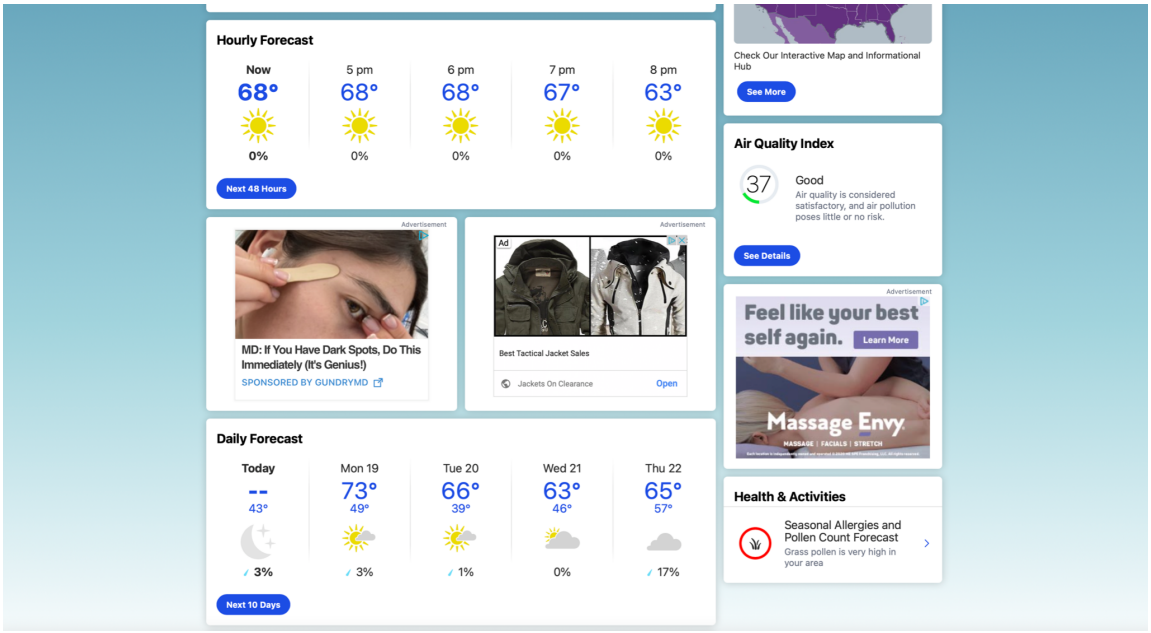


Based on Color

As mentioned, color as a design element can hinder or assist users in their experience with an interface. Using color for practicality first before aesthetic reasons will help user

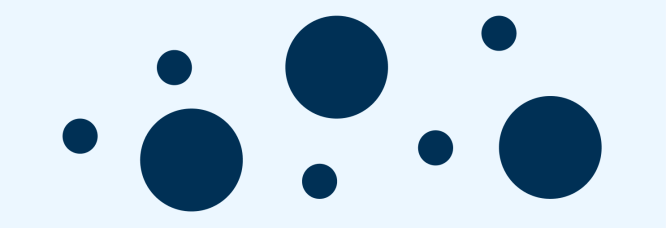
interaction with a website or mobile application. Limit the potential of disruptive color usage by concentrating on functional requirements (like status states or alerts) first. Then, use color for enhancement purposes to reinforce or balance the aesthetic of the content. In this abstract example, color is used strategically alongside using shapes to differentiate based on similarity to assist in the emphasis of the two groups. Color is used to clarify and is not used by itself for aesthetic purposes.

In the example below, the blue buttons are used to highlight the functionality of the buttons. Notice that the same button style and color is continued throughout the web page allowing users to associate the bright blue with buttons. This consistency in the use of color helps users to group together all of the buttons and comprehend the function of a singular element.



Based on Size

Using similarity in size is another useful tool when using the rule of similarity. In the example below, similarity in size causes the larger circles to stand out and form a group even though they are separated by other smaller circles. This same idea can be applied in User Interface design to create organization through layout.



Each category in the BBC News headlines follows this same format. Notice how your eye is directed to the larger headlines on the right. The larger stories are similar in size to each other which allows users to recognize these as featured headlines standing out amongst other stories.

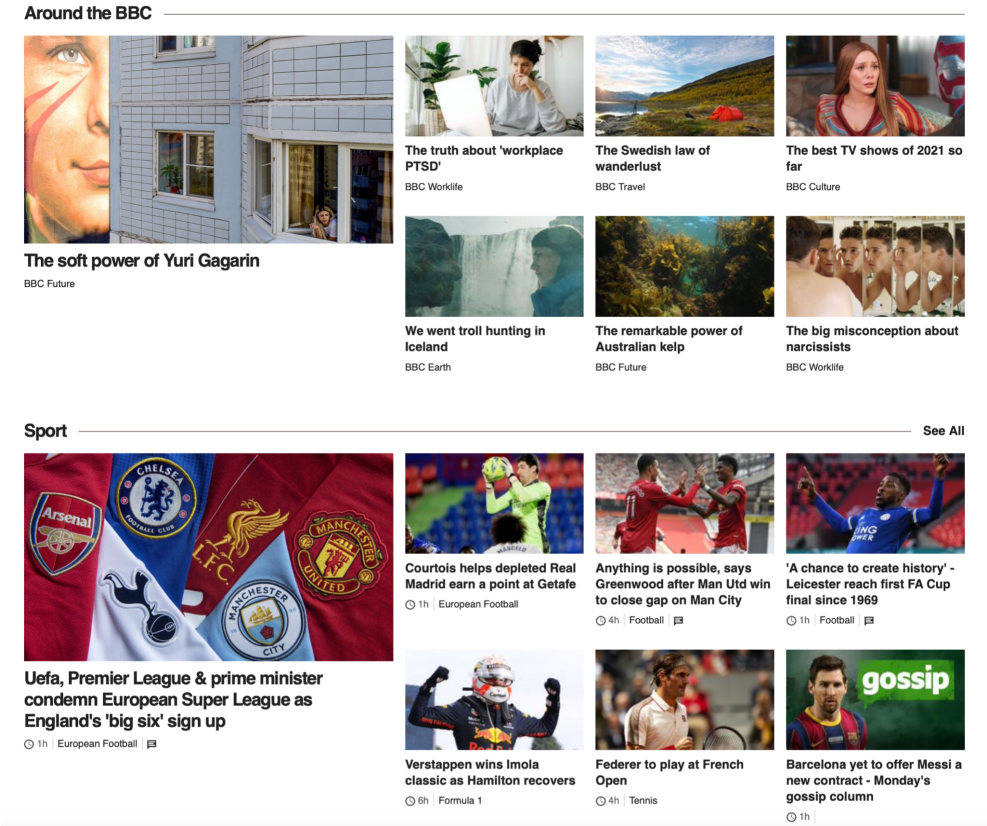


Figure-Ground

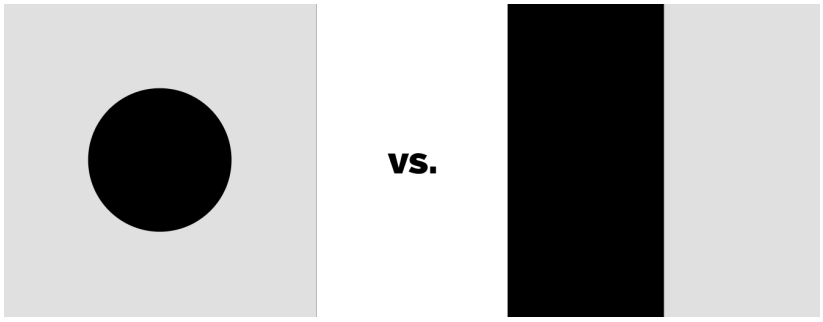
Standard: Create depth and promote function through proper use of figure-ground.

Introduction

The principle of figure-ground states that individuals instinctively identify an object as being either in the foreground or the background as an object either stands out in the front (the figure) or the object recedes to the back (the ground). Figure-ground can assist users in processing which objects should be focused on and which objects can be ignored. The principle of figure-ground in design can be thought of as the use of positive and negative space.

Ambiguity

Ambiguous application of the principle of figure-ground versus stable figure-ground is an important concept to comprehend when designing an interface. Stable figure-ground leads users to direct one's attention to a specific element or object. In the example on the left below, the circle holds an individual's focus and attention and the background appears to be unnecessary to pay attention to. This is because of the stability of the full visibility of the circle in contrast to the shapeless background behind it.

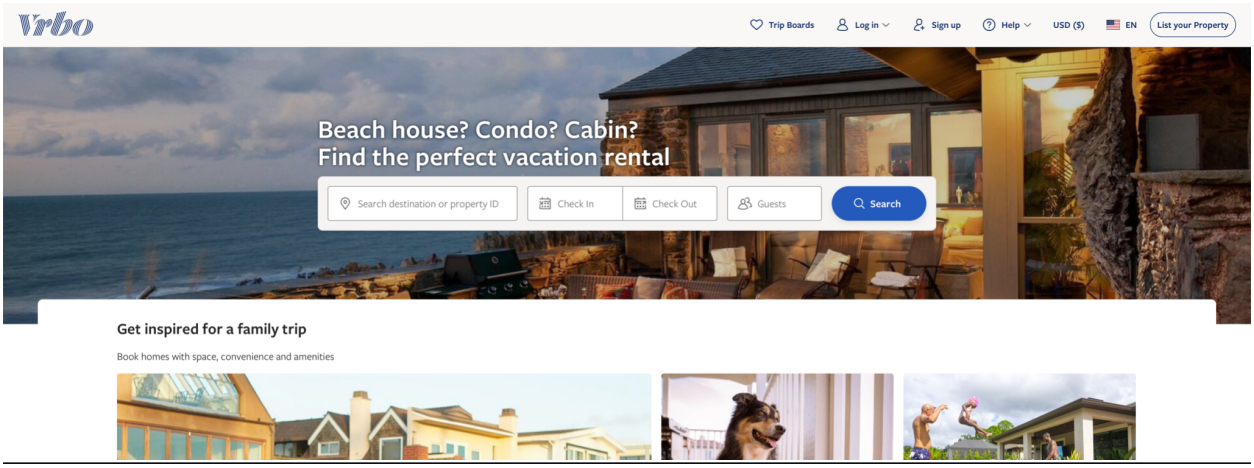


In comparison, the example on the right demonstrates the potential for figure-ground to be ambiguous and confusing for users. In this example, the figure and the ground are both equal

sizes and essentially reversible. Notice how this perceptual ambiguity causes your eyes to dart and alternate back and forth between the figure and ground. Although this concept of perceptual ambiguity can create interesting optical illusions, this ambiguous nature can create confusion for users.

Creating Depth

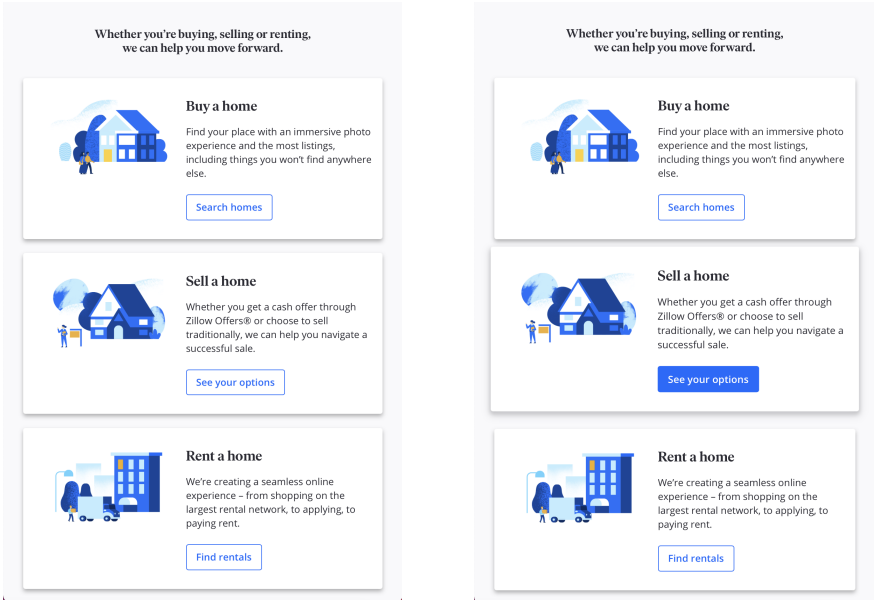
The figure-ground principle can be used to create the illusion of depth within web design. This implied depth created through the proper use of the principle can assist in directing the user's attention to specific elements on a page. Simply put, figure-ground helps direct, hold, and focus user attention. In this image below, the depth created by the contrast between the white quick search bar compared to the shadowed image in the background. This depth helps to promote the function in the header as well as direct the user's focus towards the focal point which helps create hierarchy.



Promoting Functionality

Figure-ground can be used as a means to help users understand the function of an object on a page. The two images below demonstrate the function of the button below. To create a fully comprehensible experience on a site, feedback to users is important. In this example from the

Zillow website, when the user hovers over one of the boxes, the user gets feedback through the movement of the box that occurs. Notice that the button becomes inverted and the hovered box appears to move toward the user by increasing in slightly increasing in scale and a more noticeable drop shadow occurs creating a more in-depth figure-ground relationship with the content. This helps the user receive feedback knowing that a correct function is being performed.



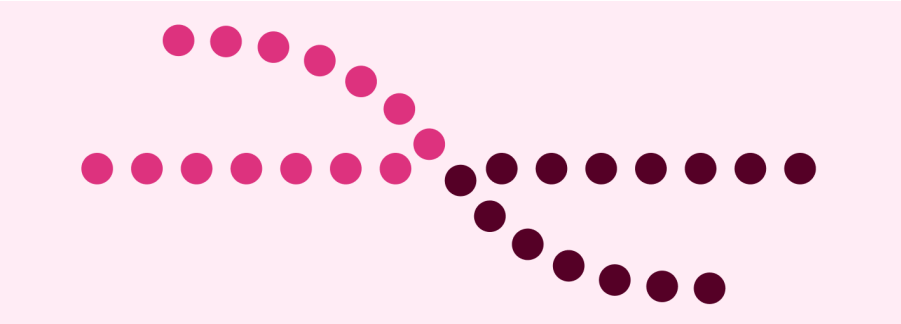
Continuity

Standard: Use consistency between elements on a line to direct eyeflow.

Introduction

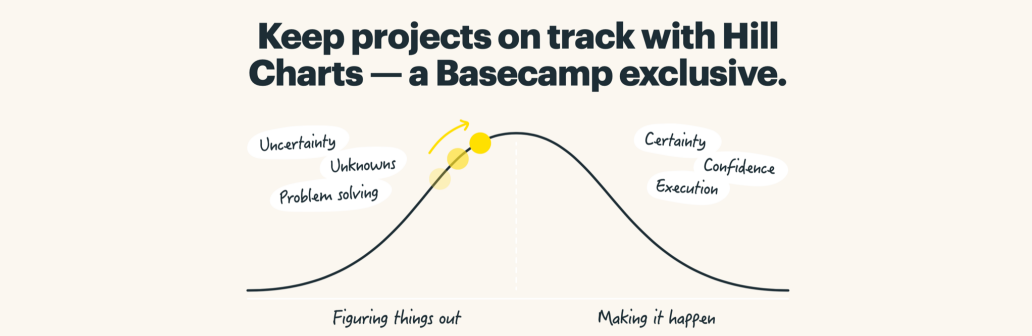
The principle of continuity applies to user eye-flow and refers to the concept that once the human eye begins to follow an object in a direction, the eye-flow will continue until it reaches another object. In other words, objects that are arranged in a continued curve or line are perceived to be related more than those objects that are not arranged in a line or curve. Notice in the example below that your eye naturally follows the curved line even though the colors

alternate between the two lines of dots. This is proof that the continuation of the curved line is a stronger visual stimulant of relatedness than the similarity in colors.



Communicate Information

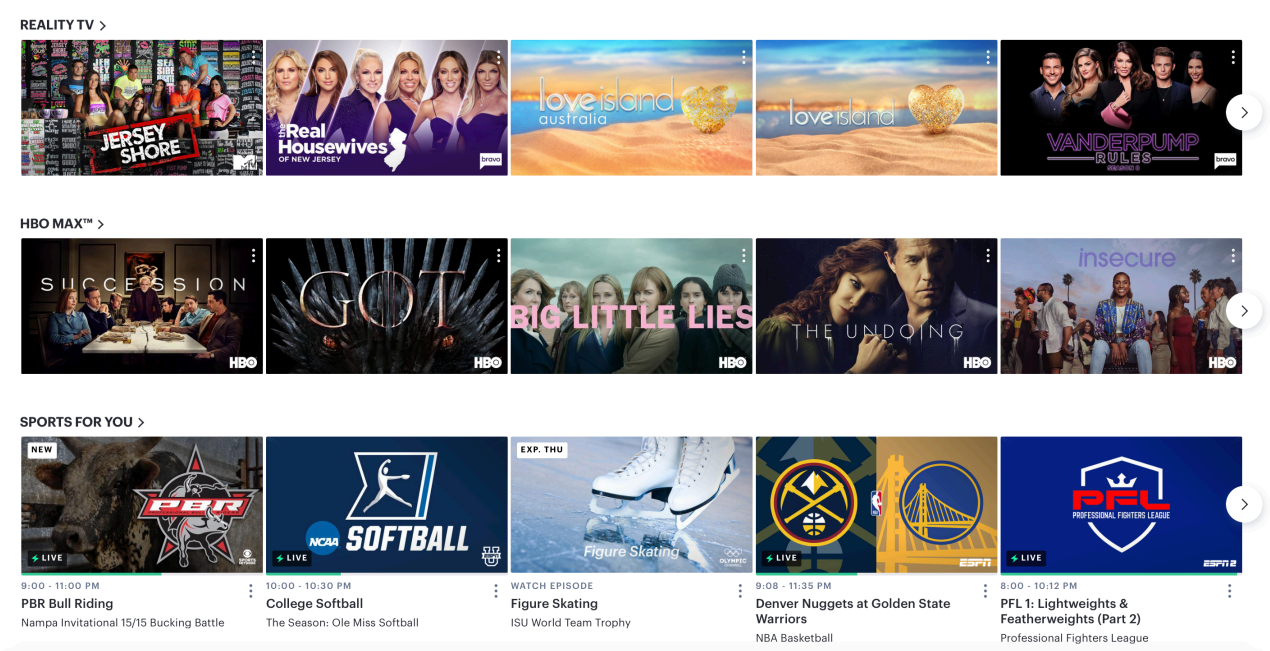
The principle of continuity helps with communicating information to users. In the image below from Basecamp, the graphic is utilized as a tool to communicate the features of the product in a simplified manner. Notice that the description of the features follows the arrow, line, and circles which creates easy eyeflow and comprehension for users.



Directing Eyeflow

The principle of continuity is fundamental in directing user eyeflow and promoting functionality. In order to properly employ and utilize this principle, it is important to use it as a means to keep consistency of space and alignment between elements to avoid disruptions. It is

also suggested that this principle is used to suggest direction and that there is more content to follow if there is. In the example below from Hulu, the consistency of spacing and alignment help to create a horizontal eyeflow for users. Further, the arrow at the "end" of the line assists users in knowing that there is clearly more content within these groups following those on the screen.



Closure

Standard: Add additional elements alongside the principle of closure for clarification.

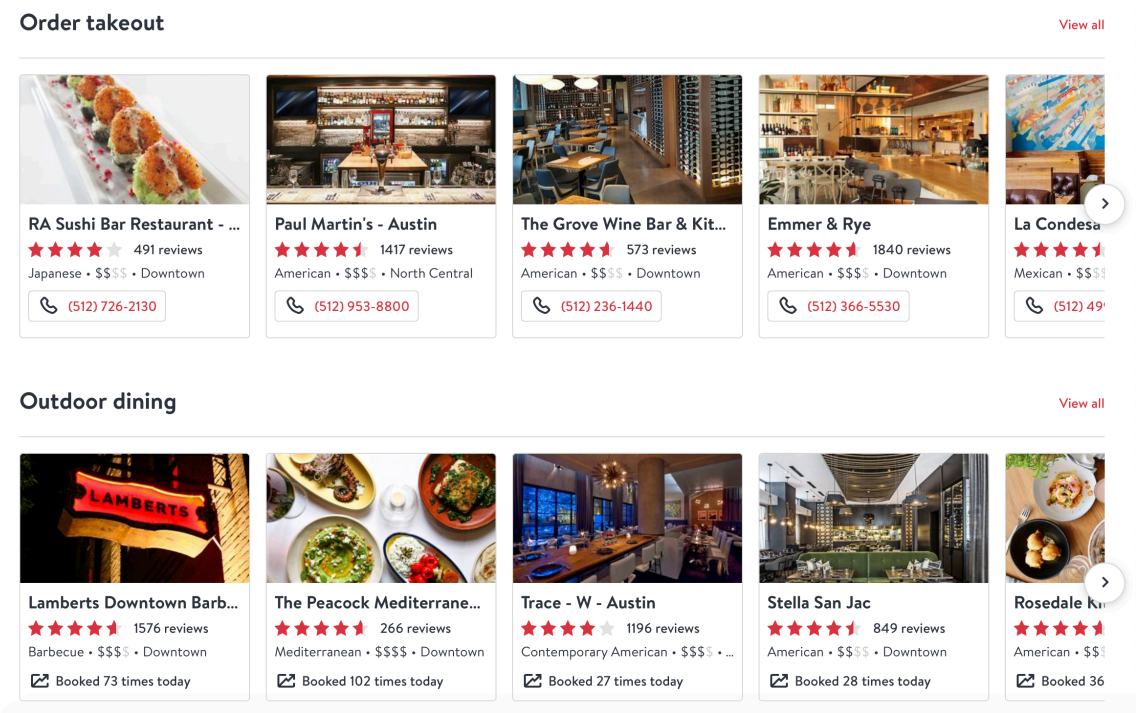
Introduction

According to the principle of closure, when the human brain identifies a collection of complex objects, it will search out a pattern in an attempt to make sense of the objects. When an individual sees an object or image with incomplete or missing parts, the individual's brain will fill in the blanks in order to complete the image and recognize a pattern.

The WWF logo seen below is a great example to comprehend the fundamentals of the principle of closure. The human brain automatically connects to the fact that the image is a panda even though the image is not complete.

Closure in Design

Notice that the card at the right of the screen is incomplete and appears to be cutoff. This is an example of using closure to promote functionality. Users will understand that there is more content following these restaurants in the group. The human brain makes this assumption because the content is abruptly cut off. Common sense tells that there is more content. To make this more obvious to users, it is necessary to add another element to fully communicate the continuation of information. In this instance, the arrow acts as clarification to communicate this.

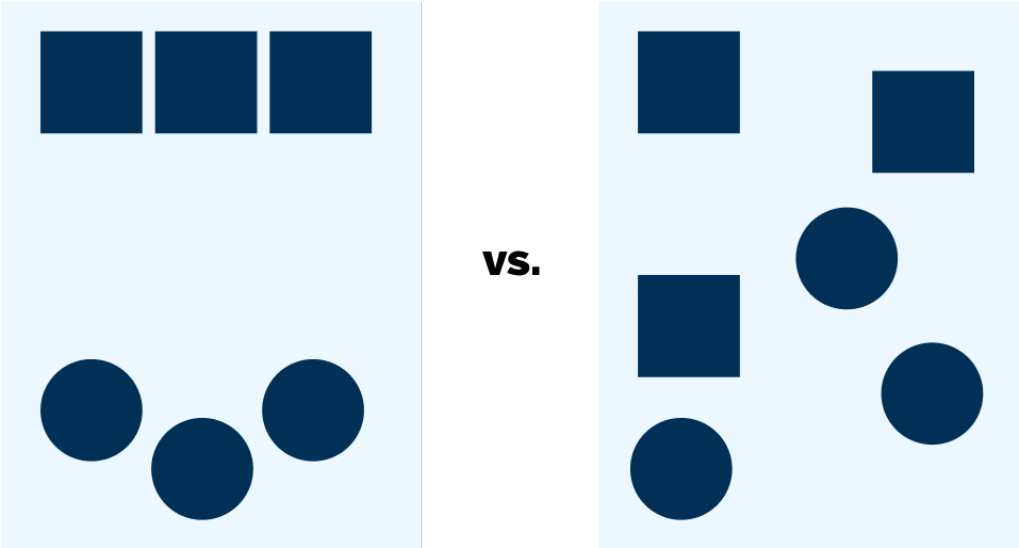


Proximity

Standard: Create depth and promote function through proper use of figure-ground.

Introduction

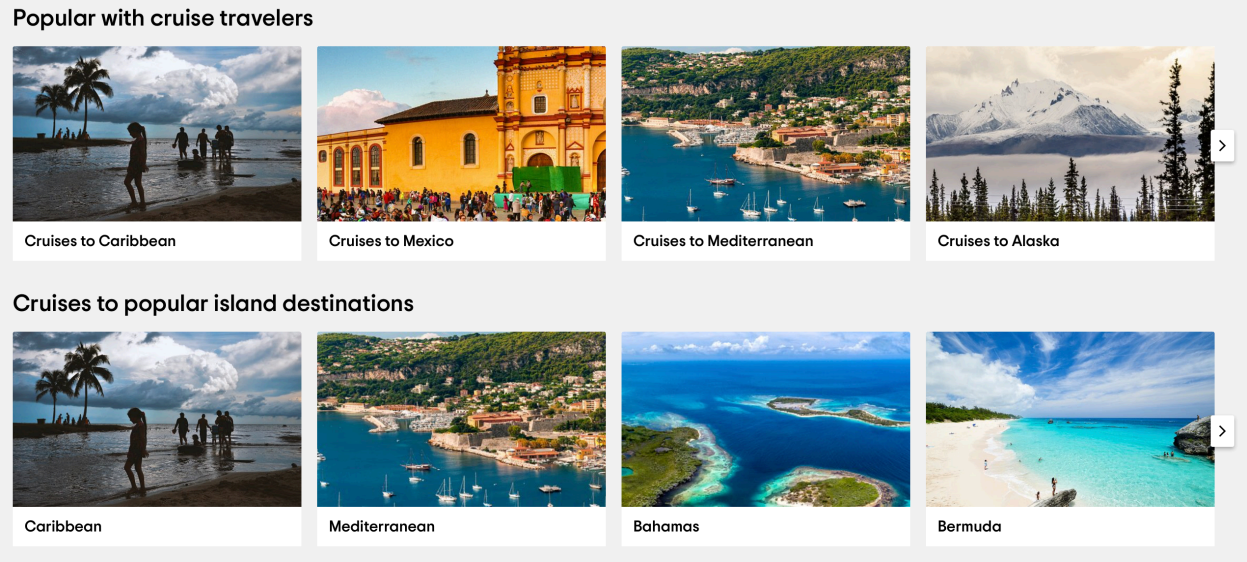
The principle of proximity relies on the design element of space. The human brain naturally groups together objects that are closer together and separates those objects from other objects that are further away. In the left graphic, the circles are close to each other and the squares are close to the squares vs. on the right, the shapes are intermixed and there's no uniformity in proximity. This principle is easy to apply in design because it does not rely on any external force other than the arrangement and space used to arrange certain objects.



Organizing Content

In the screen below from Tripadvisor, the law of proximity works to help separate the two groups of different lists. Notice that the small amount of space in between the cards on the same rows is a much smaller space than that between the two rows. This helps users to visuals group

the two lists together rather than just seeing an overwhelming amount of cards repeated. Grouping content into smaller groups such as the example below helps users to fully comprehend large amounts of content on their screen. This directly mitigates deficits in Executive Function as well as Sensory Processing.



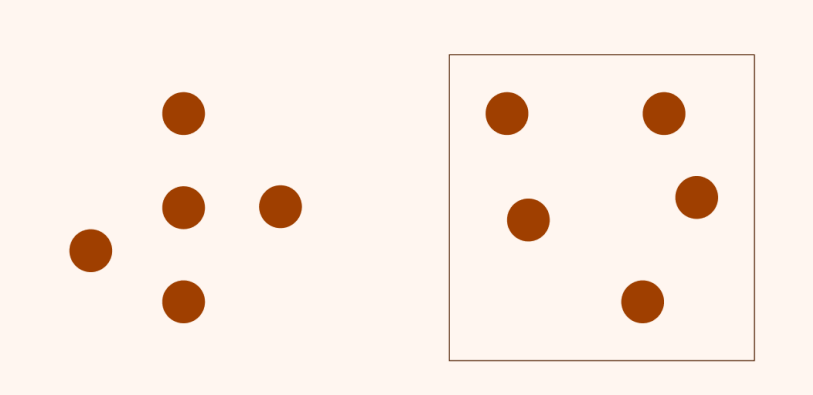
Common Region

Standard: Clarify that elements are grouped by creating enclosed regions.

Introduction

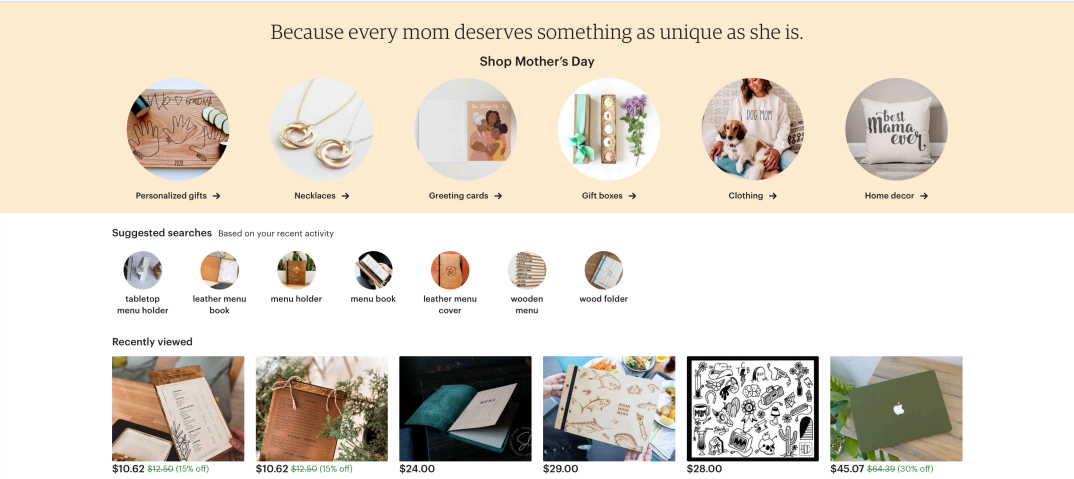
Closely related to the principle of proximity, the principle of common reason implies that individuals instinctively group together objects that are within the same closed region. Objects within these closed regions also appear to be separate from other objects. In other words, items or objects that share the same enclosed region of space, they are perceived as being related or connected to one another. In the example below, the circles within the box are actually farther

apart than those they are not in the box. However, due to the enclosed border around the circles, the circles within the box appear to be more of an obvious group than those that are outside of it.



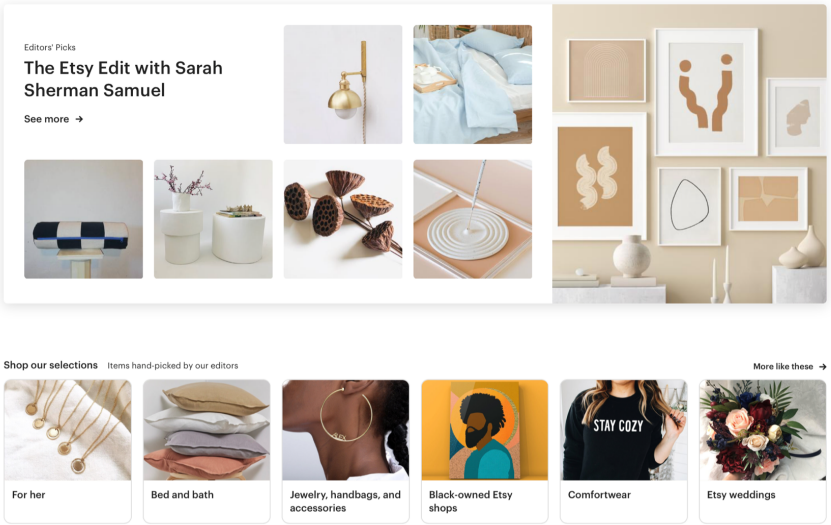
Within Design Elements

Creating an enclosed region of space around an object is one of the simplest ways to demonstrate grouping to users who may not have fully developed Executive Function skills. The images below from Etsy show three of the most common ways to employ the principle of common region: changing the background color, card with a drop shadow, and borders. Notice in the example below, how the section at the top is distinguishably a different group of content. This is made obvious by the light orange being the background of the section. The change of color as a background not only differentiates the objects as a group, but also directs the user's focus to this area establishing hierarchy.



Notice in the image above, how the section at the top is distinguishably a different group of content. This is made obvious by the light orange being the background of the section. The change of color as a background not only differentiates the objects as a group, but also directs the user's focus to this area establishing hierarchy.

The image below contains two examples of common region as a means of grouping elements. The first one is the card with a drop shadow. Although the drop shadow is subtle, the card very clearly defines the "Editors' Picks" as a separate group of objects than the other groups of products on the page. Second in this image, the "Shop our selections" group of cards is an example of using a border as a means to group objects. The borders on these images allows for users to easily and quickly identify which image belongs to which category name.



Focal Point

Standard: Minimum of 1 and maximum of 3 focal points per screen view.

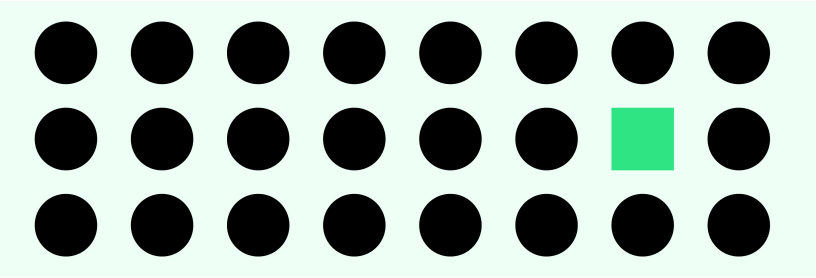
Introduction

The principle of focal point suggests that when one object stands out from a group of objects as different or the object stands out visually, the human eye will be attracted to this object

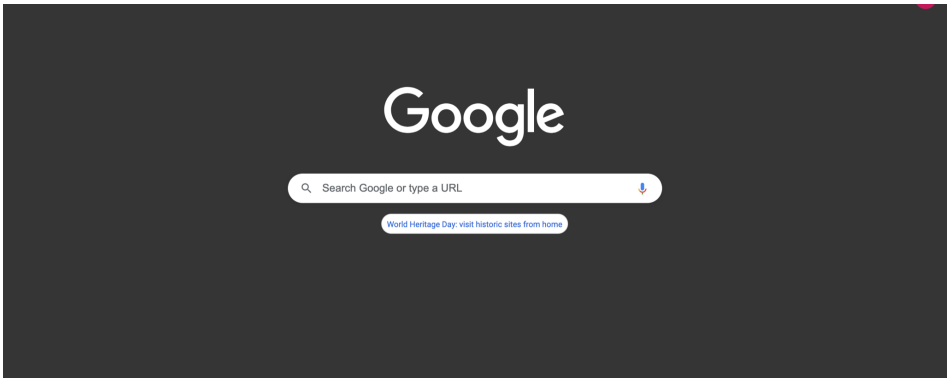
first and this object will hold a user's attention. When the principle of focal point is employed in website design, this principle can help the users understand what is important on the page and can mitigate sensory over by allowing users to focus on one thing at a time as well as help with Executive Function by visually prioritizing information on a web page.

Good Use of Focal Points

Notice in the image below, your eye is directed to the single green square first. After looking at the green square, your brain continues to process the rest of the information in the composition. This is proper use of the focal point principle.

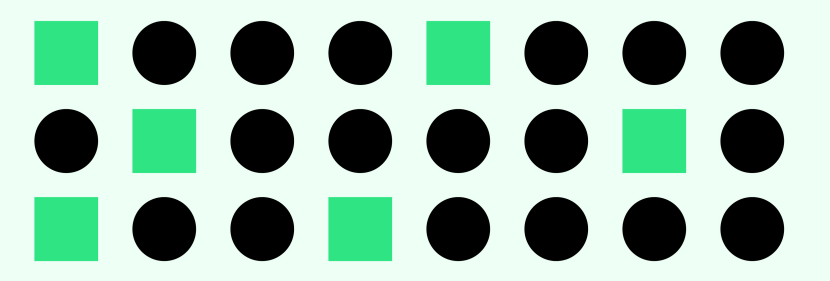


In the image below of the Google search engine, the focal point is clearly the search bar. This example employs multiple Gestalt Principles such as focal point and figure-ground. However, all principles work together to direct the user's attention to the main function of the page. The contrast of the white against the dark background creates a very distinct contrast between the background and the search bar.

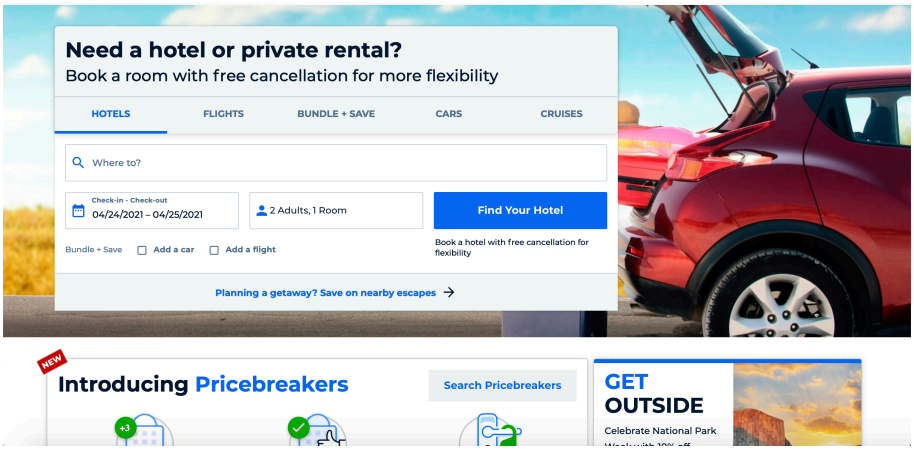


Overuse of Focal Points

The principle of focal point can be very beneficial to individuals with Sensory Processing issues because it directs the user focus towards one particular thing when applied properly. It is crucial to avoid overusing focal points or this will do more harm than help. Notice in the image below how multiple green squares cause your eyes to dart all over the graphic which is over stimulating even to neurotypical individuals.



Here is an example of a web page with too many focal points. Notice how your eyes dart around the page and never find a resting place. This is due to the overly saturated header image, the lack of negative space on the page, and the multitude of elements with the bright blue color. Further, the addition of the saturated pink banner at the top of the web page is adding another focal point. This is confusing to the users which can lead to sensory overload through making it difficult to identify where to look. Overuse of focal points can also lead to lack of user eye-flow ability which is disruptive for individuals with Executive Dysfunction.



Content Comprehension

Individuals with ASD and other cognitive disabilities tend to have difficulty with comprehending content and visual processing due to impairments in Sensory Processing and Executive Function. Cognitive Load and Working Memory are two components of Executive Function which are reduced functions when an individual has difficulties with Executive Function. Cognitive Load is described as the mental resources that an individual has available to problem solve or complete a task. Working Memory relies on Cognitive Function and is similar to short term memory. Less working memory can affect the user's ability to navigate a website and users with this impairment tend to forget how they got to a certain touchpoint on a website and how to return to other touch-points. Deficits in Executive Function also affects other aspects of mental processing such as: challenges problem-solving which would lead users to abandon a site/task, trouble focusing one's attention on main content or functionality, and challenges with reading comprehension.

Typography

Standard: Use typefaces with simple letterforms to increase legibility.

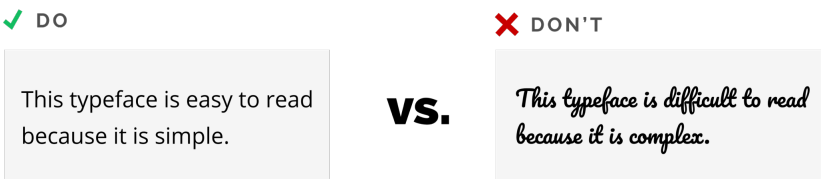
Introduction

Typography is a crucial design element that is fundamental in making digital content accessible and comprehendible. Web safe fonts and point sizes of fonts can assist not only those with reduced reading comprehension deficits related to Autism Spectrum Disorder, but also can improve the user experience for individuals with other cognitive disabilities such as dyslexia and other learning disabilities specifically to name a few.

Typefaces

Typefaces, also referred to as fonts, are an important design element that can create an accessible and inclusive user experience for individuals with cognitive disabilities. Typefaces with simple characteristics allow an individual's brain to comprehend content easier because the brain recognizes the familiar shapes and patterns created by the text. Complex and fonts that are too decorative create a confusing user experience for both neurotypical individuals and neurodiverse individuals because the complex characteristics of the letterforms require more energy, focus, and overall cognitive function to comprehend.

- Avoid typefaces with ambiguous letterforms.



- Limit the number of typefaces used across the entire website or digital experience to promote consistency.

- Use appropriate letter-spacing through consistent and clear tracking and kerning.

Font Sizing

The size of the text and content can drastically improve or hinder the user's ability to understand and process. The smallest copy on a page is typically the body copy. According to the WCAG guidelines, the suggested minimum font size is 9 points. However, to promote full user accessibility, the IDAC suggests that the minimum should be 12 points.

Readability

Standard: Create content that is concise and simplified in style.

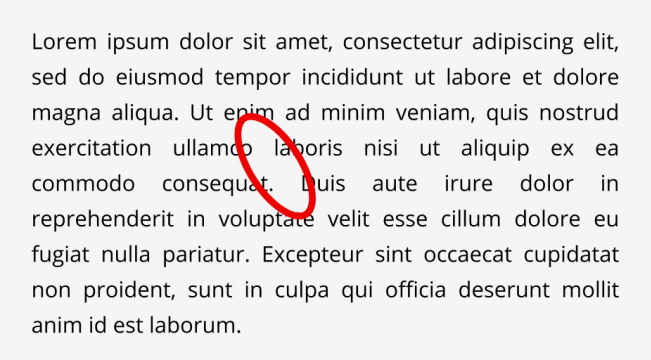
Introduction

Readability of digital content is an important foundational element which will improve the user experience for people with cognitive disabilities. Implementing various guidelines regarding the stylization of text can improve an individual's ability to process content -- specifically those with reduced Executive Function. Another important factor in improving readability is the content itself and how it is written.

Stylization of Text

Things to keep in mind:

- Left justified text is the easiest to read because it provides a consistent starting place to each line.
- Rivers created through fully justified text decrease legibility significantly.



- Do not indent paragraphs to signal a start. White space and Gestalt Grouping Principles to separate paragraphs increase readability and comprehension.
- Line length should stay between 50 characters and 120 characters for ideal readability and user eye-flow. If you have lengthier lines or paragraphs, increase line spacing.

Content

It is important that copywriters, designers, developers, and anyone else involved in the content creating process of a digital experience acknowledge that clear and concise content is a crucial element for inclusive digital design. No two individuals comprehend and understand content in the same manner. It is difficult to set a rule or guideline for how complex or simple text and content should or should not be. However, here are some guidelines to keep in mind while creating content:

- Be direct and avoid the use of fluff words.
- Short phrases and paragraphs are easier for all individuals to process.
- Short phrases and paragraphs are easier for all individuals to process.
- Write in a manner that accepts that the audience is intelligent, but do not write in a manner that assumes the user is an expert on the subject matter.

Hierarchy

Standard: Direct user eye-flow by creating defined hierarchy within content.

Introduction

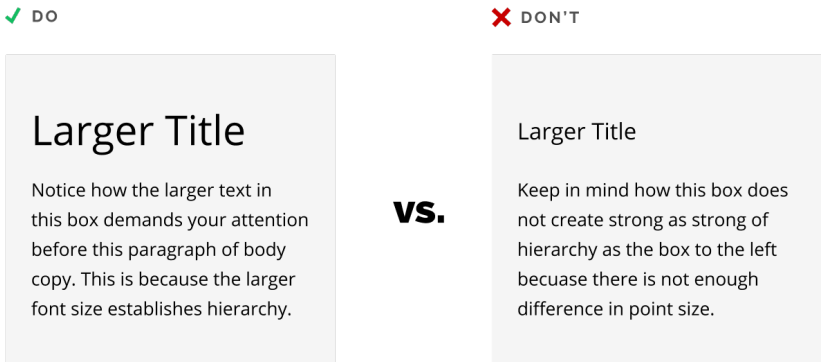
Individuals with Sensory Overload or Executive Function deficiencies have a difficult time with content comprehension. When a website or mobile application has too much content like text and media, it can provoke adverse reactions in an individual with Sensory Processing deficits. These reactions can lead the user to abandon and leave the website, become frustrated, etc. which creates an experience that is not accessible to those with these cognitive disabilities. Various considerations can be taken to mitigate these adverse reactions and also create an

inclusive experience for neurotypical and neurodiverse individuals. Creating hierarchy within a page layout can assist in directing user eye-flow in the intended direction of the page content.

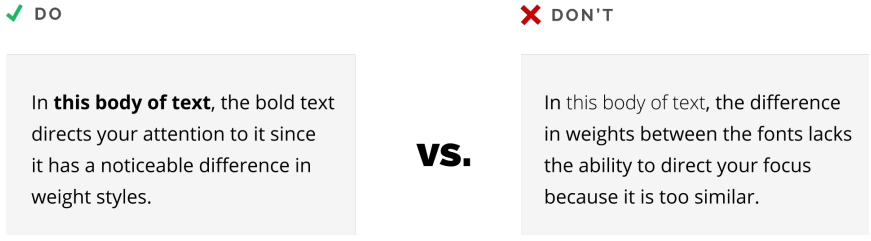
Typographic Hierarchy

Typographic hierarchy is a fundamental design element that ensures a user's ability to easily navigate a website, understand what is important, and quickly find specific information. Distinguishable headings, subtitles, and bullet points can assist in a user's ability to discern what is important at a glance. There are four main attributes that can be used to help create typographic hierarchy:

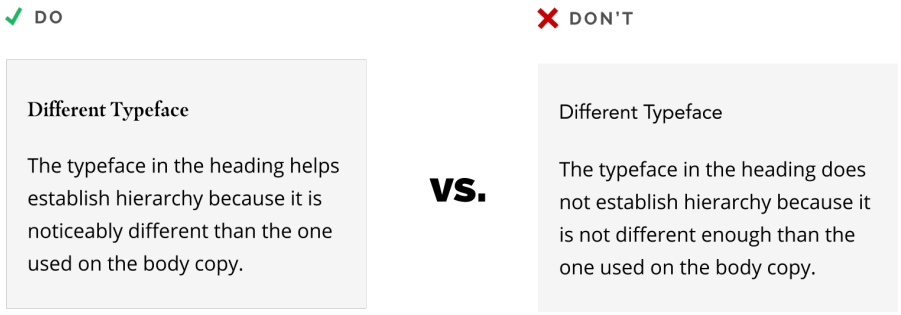
- Size can assist in creating hierarchy. Essentially, anything noticeably larger than the body copy establishes hierarchy. However, it is important to ensure that the difference in point sizes is large enough to ensure that hierarchy is established.



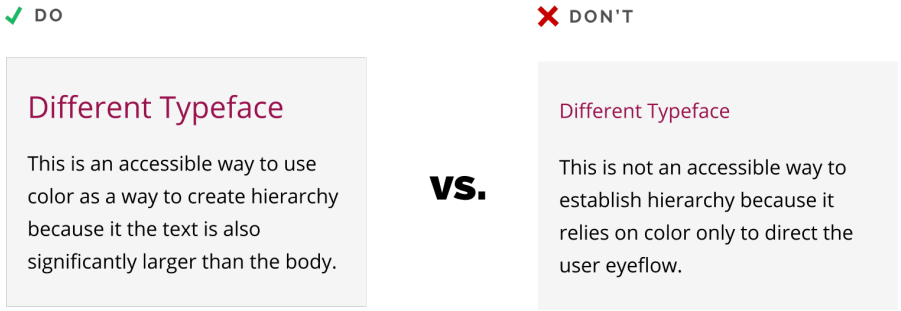
- Weight within font families can also assist in helping establish visual hierarchy. It is important to select weights that have distinguishable differences when using it as the only source of hierarchy in content.



- Contrast in typefaces can establish typographic hierarchy.



- Color can help to establish hierarchy and direct user eye-flow. Keep in mind that the color should be noticeable and due to disabilities that obstruct an individual's ability to perceive color, it should not be the only method used to establish hierarchy.



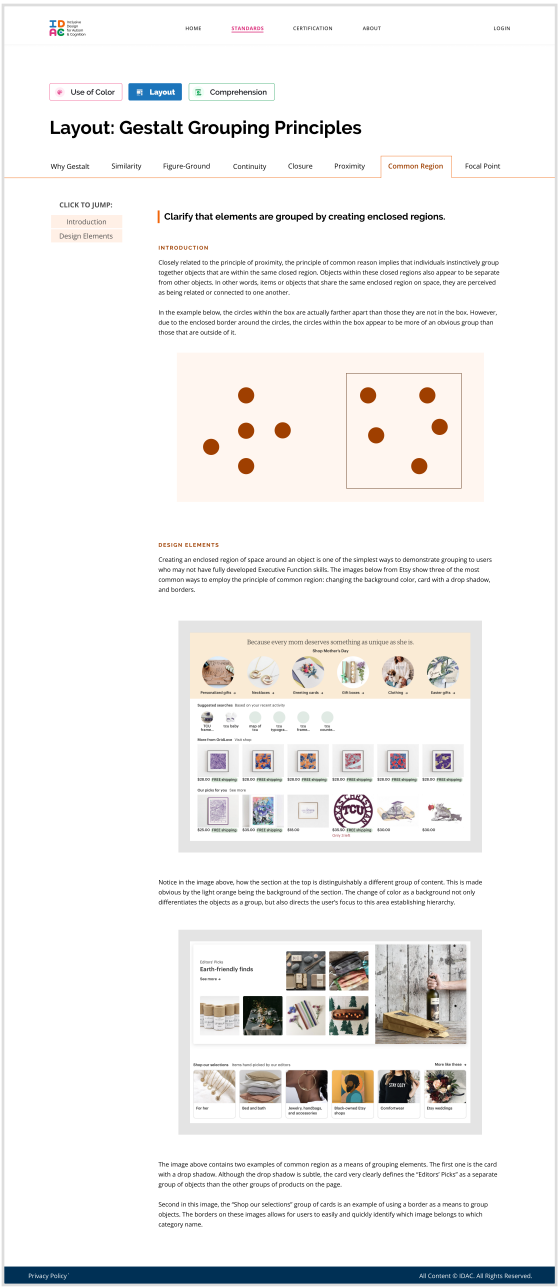
Other Deliverables

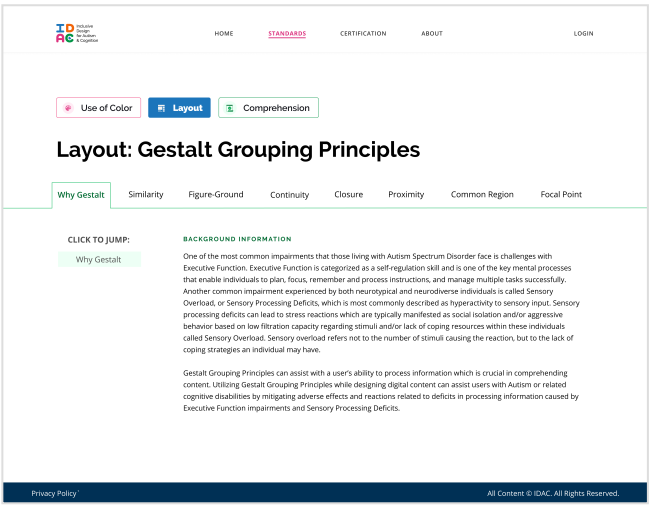
Website

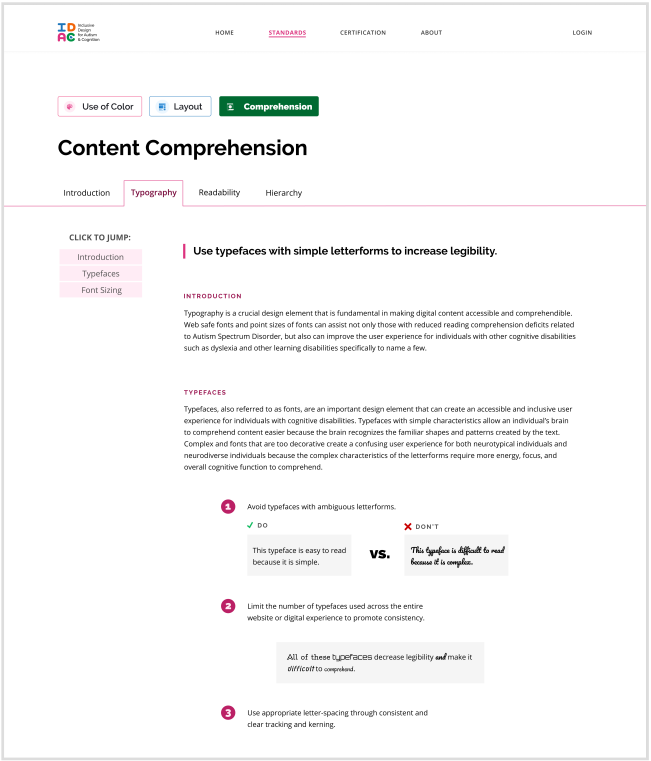
The IDAC website is designed to function as an all encompassing tool for inclusivity and web design. Through the website, businesses, organizations, and individuals can get certified on three levels of the IDAC standards: The Fundamentals, which covers common visual stimulants, Advanced Topics, and Specialties. The specialties certification will allow businesses, organizations, or individuals to craft a course that is crafted specifically to their company or

industry needs. Users will also be able to receive an IDAC accessibility audit simply by pasting their website url into a box on the website.

The most important function of the website is to act as a reference guide for the IDAC standards. Users will be able to view the thirteen topics of the fundamental IDAC standards with examples so that designers, developers, and other individuals can ensure they are creating websites that are universally inclusive and accessible for individuals with cognitive disabilities.







HOME STANDARDS CERTIFICATION ABOUT LOGIN

Inclusive Design For Everyone.

GET CERTIFIED

THE FUNDAMENTALS

Explore by category

Use of Color
Learn about blue light composition, contrast, and hierarchy.
Know more →

Layout
Discover layout adjustments that can be made through Gestalt Grouping.
Know more →

Comprehension
Explore suggested guidelines to improve user eyeflow and content readability.
Know more →

THE NUMBERS

Understanding the numbers.

23.2 Million
in U.S. with Cognitive Disabilities

5.5 Million
with Autism Spectrum Disorder

6.1 Million
in the U.S. with ADHD

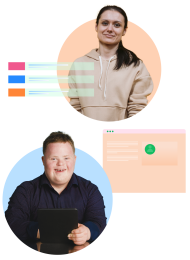
OUR MISSION

What is the goal?

INCLUSIVITY
In a world that relies more and more on technology and the internet, everyone should have the ability to access it.

AWARENESS
Although there are great resources out there making the web accessible, not everyone knows what accessible means.

ACCESSIBILITY
The digital world is accessibile to come, but not all. The time has come to create accessibility for all.



Check site accessibility.

Enter your website's URL in the box below. What is different about our website accessibility checker is that we will send you a full audit performed by IDAC professionals to ensure your site can be as accessible as possible.

SUBMIT

Privacy Policy All Content © IDAC. All Rights Reserved.

HOME STANDARDS CERTIFICATION ABOUT LOGIN

Use of Color | Layout | Comprehension

Use of Color

Blue Light | Contrast | Application

CLICK TO JUMP:
Introduction
Convey Information
Practicality

Be intentional with the application of color as a design element.

INTRODUCTION

Due to hypersensitivity and overstimulation that can be attributed to color application in User Interface design, it is crucial to understand the importance of intentional application and utilization of color. Intentional use of color can help mitigate adverse reactions caused by deficiencies in Executive Function and Sensory Processing in individuals with cognitive disabilities. Color is a design element that can make a user's experience with an interface either a success or a failure because color can determine how users comprehend and process content.

COLOR TO CONVEY INFORMATION

Color should never be used alone to convey a message to users. Although color can be successful in communicating certain messages such as an alert or error, it is not a reliant design element by itself to convey a function or message to users. It is important to use color in this method as an enhancement alongside other forms of conveying a message rather than as the only signal of communicating as it cannot be assumed that this message will be clearly comprehended as intended.

✓ DO
Password
*Password does not meet requirements

The hyperlink is distinguished by color and the underline.

✕ DON'T
Password

The hyperlink is distinguished just by color.

PRACTICALITY FIRST

As mentioned, color as a design element can hinder or assist users in their experience with an interface. Using color for practicality first before aesthetic reasons will help user interaction with a website or mobile application. Limit the potential of disruptive color usage by concentrating on functional requirements (like status states or alerts) first. Then, use color for enhancement purposes to reinforce or balance the aesthetic of the content.

Privacy Policy All Content © IDAC. All Rights Reserved.

HOME STANDARDS CERTIFICATION ABOUT LOGIN

THREE LEVELS

Certification Overview

LEVEL I The Fundamentals | LEVEL II Advanced Topics | LEVEL III Specialized Topics

What it covers:

The Kelvin Scale is a system which measures the composition of different lights. If a light composition projects more yellow, orange, or red, then it will measure on the lower end of the Kelvin scale. On the contrary, if a light composition projects more blue, then it will measure on the higher end of the Kelvin Scale of Color Temperature.

GET STARTED

USE OF COLOR
Blue Light
Color Contrast
Application

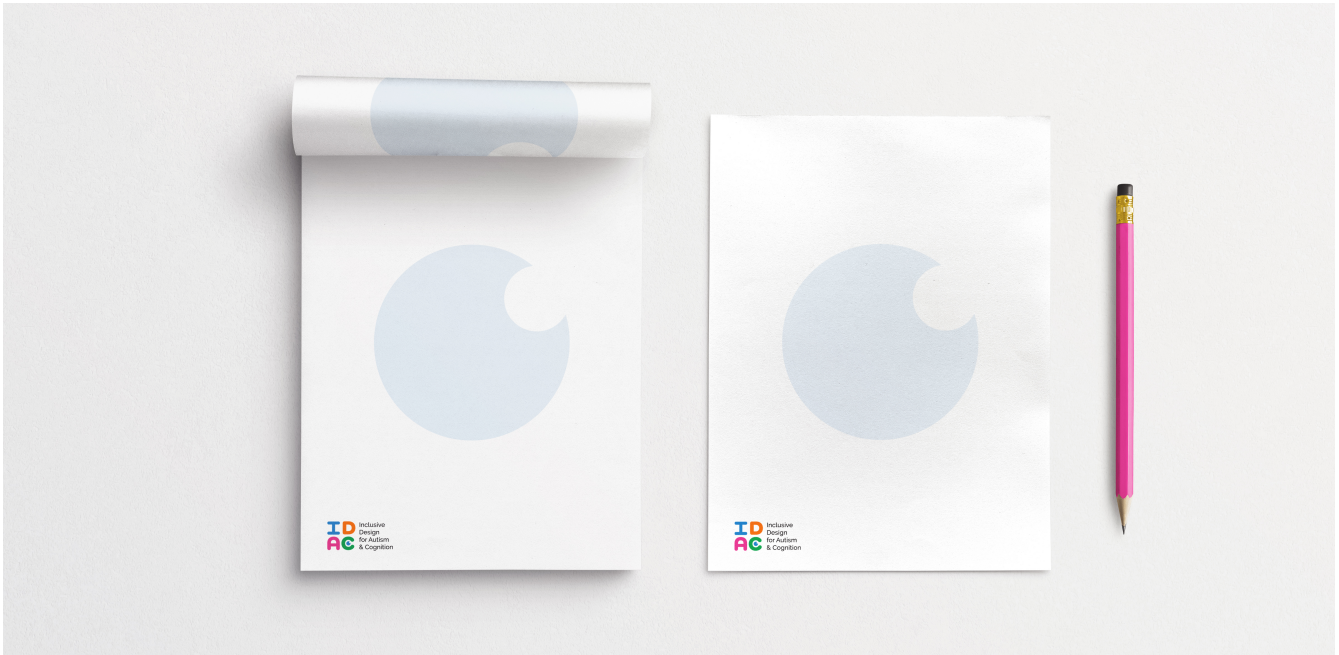
GROUPING • LAYOUT
Similarity
Proximity
Common Region
Focal Point
Continuity
Figure-Ground
Closure

COMPREHENSION
Typography
User Eyeflow
Readability

Privacy Policy All Content © IDAC. All Rights Reserved.

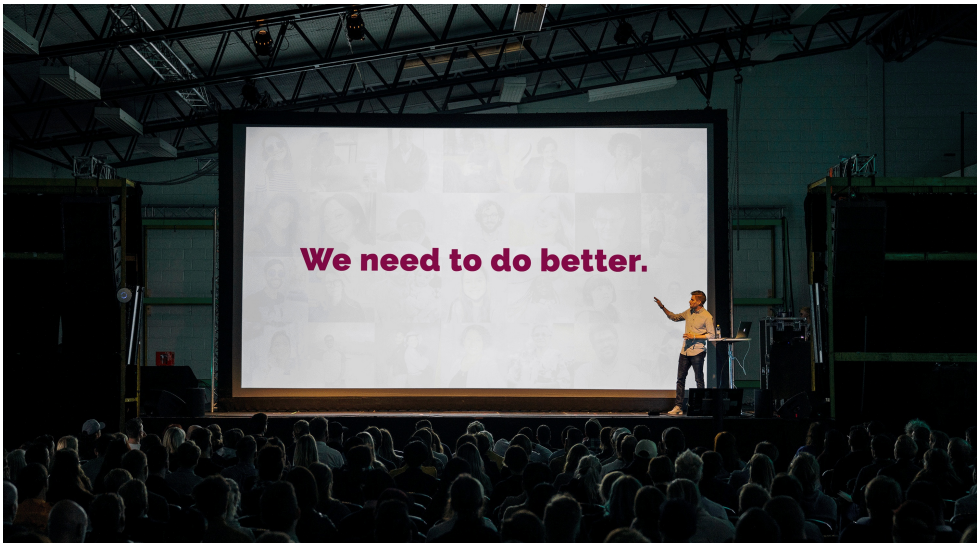
Collateral

To further promote awareness of IDAC, various collateral was developed for promotional uses which will help in spreading awareness of IDAC's mission in creating web accessibility guidelines that are inclusive of all disabilities including cognitive disabilities. Collateral can also build recognition of IDAC as a legitimate organization by creating awareness of the company as well. Pieces of collateral for IDAC includes hats, notepads, and desk calendars.



Educational Spaces

To promote the IDAC mission of awareness and inclusivity, IDAC professionals will present to leaders in the UX and web design industry as well as the organizations which currently enforce ADA Section 508 guidelines such as the W3C and the U.S. Access Board to communicate the need to adopt IDAC standards into current web Accessibility standards. The IDAC organization will provide on-site trainings business and organizations interested in company-wide training sessions on the IDAC standards.



CONCLUSION

Although current web accessibility standards are robust and encompass a wide range of topics which help with disabilities, there is a gap in web accessibility standards for individuals with cognitive disabilities. IDAC was created to bridge this gap in web accessibility standards. In order to identify these opportunities to improve, common symptoms of Autism Spectrum Disorder and Cognitive Disabilities were identified through extensive research. The branding, collateral, and marketing of IDAC as an organization and the design standards covering thirteen topics were all developed to help close this gap and promote awareness of creating a web accessibility experience that is inclusive to everyone. Regardless of an individual's entry point, everyone deserves to have the same opportunities.

Works Cited

"About WebAIM." WebAIM: Web Accessibility in Mind, webaim.org/about/.

"About Us." *About Us | Section508.Gov*, U.S. General Services Administration, May 2018, www.section508.gov/about-us.

"Accessibility Training." *WebAIM: Web Accessibility in Mind*, webaim.org/services/training/.

"ADA Compliance Plugin: The #1 ADA Website Compliance Widget: On the Map Inc." *On The Map, Inc.*, 27 Oct. 2020, www.onthemapmarketing.com/accessibly/.

"Autism Spectrum Disorder: Overview." *American Speech- Language-Hearing Association*, ASHA, www.asha.org/ practice-portal/clinical-topics/autism/.

"Best Coolers: USA Made Roto-Molded Ice Chests Coolers." Bison Coolers, www.bisoncoolers.com/.

Bölte, Sven et al. "Gestalt perception and local-global processing in high-functioning autism." *Journal of autism and developmental disorders* vol. 37,8 (2007): 1493-504. doi:10.1007/s10803-006-0231-x

Brosnan, Mark J et al. "Gestalt processing in autism: failure to process perceptual relationships and the implications for contextual understanding." *Journal of child psychology and psychiatry, and allied disciplines* vol. 45,3 (2004): 459-69. doi:10.1111/j.1469-7610.2004.00237.x

"Circadian Rhythms Promote Wakefulness." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 1 Apr. 2020, www.cdc.gov/niosh/ emres/longhourstraining/wakefulness.html.

"Circadian Rhythms." *National Institute of General Medical Sciences*, U.S. Department of Health and Human Services, 13 July 2020, www.nigms.nih.gov/education/fact-sheets/Pages/circadian-rhythms.aspx.

"Cognitive Introduction." *WebAIM*, Center for Persons with Disabilities, webaim.org/articles/cognitive/.

"Color and Mood." *Products | ENERGY STAR*, Energy Star, www.energystar.gov/products/lighting_fans/ light_bulbs/color_mood.

Crane, Laura, et al. "Sensory Processing in Adults with Autism Spectrum Disorders." Autism, vol. 13, no. 3, May 2009, pp. 215–228, doi:10.1177/1362361309103794.

Davis, Robert G., and Andrea Wilkerson. "Tuning the Light in Classrooms." *Energy.gov*, U.S. Department of Energy, 2017, www.energy.gov/eere/ssl/downloads/tuning- light-classrooms.

Diagnostic and statistical manual of mental disorders: DSM-5 (5th ed.). (2017). Arlington, VA: American Psychiatric Association.

Dietz, Patricia M., et al. "National and State Estimates of Adults with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders*, vol. 50, no. 12, 10 May 2020, pp. 4258–4266., doi:10.1007/s10803-020-04494-4.

"Executive Function & Self-Regulation." *Center on the Developing Child at Harvard University*. (24 Mar. 2020). developingchild.harvard.edu/science/key-concepts/ executive- function/.

Franklin, Anna, et al. "Color Perception in Children with Autism." *Journal of Autism and Developmental Disorders*, vol. 38, no. 10, 2008, pp. 1837–1847., doi:10.1007/s10803-008-0574-6.

"Gestalt psychology." *Britannica Academic,* Encyclopædia Britannica, 26 May. 2020. academic-eb-com.ezproxy.tcu. edu/levels/collegiate/article/Gestalt-psychology/36624.

Grandgeorge and Masataka. "Atypical Color Preference in Children with Autism Spectrum Disorder." *Frontiers in psychology* vol. 7 1976. 23 Dec. 2016, doi:10.3389/fpsyg.2016.01976

"Information and Communication Technology (ICT) Standards and Guidelines." *Federal Registe*r, National Archives, 18 Jan. 2017, www.federalregister. gov/d/2017-00395.

Lai, Meng-Chuan et al. "Autism." *Lancet (London, England)* vol. 383,9920 (2014): 896-910. doi:10.1016/S0140- 6736(13)61539-1

"Lighting Color Temperature - Warm & Cool Lights: TCP Lighting Solutions." *TCP Lighting*, 13 Nov. 2020, www.tcpi. com/what-is-lighting-color-temperature/.

McKay, Ashlea. "The Autistic UXer: Designing with and for a Different Kind of Mind." *Medium*, Medium, 9 Aug. 2018, medium.com/@AshleaMcKay/the- autistic-uxer-designing-with-and-for-a-different-kind-of-mind-4fc1ccaf327b.

Mejía-Figueroa, Andrés et al. "Developing Usable Software Applications for Users with Autism: User Analysis, User Interface Design Patterns and Interface Components." 2016 4*th International Conference in Software Engineering Research and Innovatio*n, CONISOFT (2016): 195-203.

"Official Site and Online Store." benefitcosmetics.com/en- us/.

Overview of Testing Methods for 508 Conformance. May 2018, www.section508.gov/test/testing-overview.

Robertson, Caroline E, and Simon Baron-Cohen. "Sensory perception in autism." *Nature reviews. Neuroscience* vol. 18,11 (2017): 671-684. doi:10.1038/nrn.2017.1122

Scheydt, Stefan et al. "Sensory overload: A concept analysis." *International journal of mental health nursing* vol. 26,2 (2017): 110-120. doi:10.1111/inm.12303

"Sensory Issues." *Autism Speaks*, www.autismspeaks.org/ sensory-issues.

Taylor, Danielle M. "Americans with Disabilities: 2014." *United States Census Bureau*, U.S. Department of Commerce, 28 Nov. 2018, www.census.gov/library/ publications/2018/ demo/p70-152.html.

"Test for Accessibility", U.S. General Services Administration, www.section508.gov/test.

"The Color of the Light Affects the Circadian Rhythms." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 1 Apr. 2020, www.cdc. gov/ niosh/emres/longhourstraining/color.html.

"WebAIM's WCAG 2 Checklist." *WebAIM,* webaim.org/ standards/wcag/checklist.

"Web Content Accessibility Guidelines." *WebAIM*, webaim. org/standards/wcag/.

"What Are Gestalt Principles?" *The Interaction Design Foundation*, The Interaction Design Foundation, www. interaction-design.org/literature/topics/gestalt-principle.

"What Is Autism Spectrum Disorder?" *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 25 Mar. 2020, www.cdc.gov/ncbddd/ autism/facts.html.

"What Is Executive Function? How Executive Functioning Skills Affect Early Development." *Center on the Developing Child at Harvard University*, Harvard University, 30 Oct. 2020, developingchild.harvard.edu/resources/ what-is-executive-function-and-how-does-it-relate-to- child-development/.

Wong, B. “Gestalt principles (Part 1)”. *Nat Methods 7*, 863 (2010). https://doi-org.ezproxy.tcu.edu/10.1038/nmeth1110-863

“Virtual Web Accessibility Training.” *WebAIM*: Web Accessibility in Mind, 2021, webaim.org/training/virtual/.

“U.S. Access Board - Comparison Table of WCAG 2.0 to Existing 508 Standards.” *Home - United States Access Board*, U.S. Access Board, www.access-board.gov/ict/wcag2ict.html.

“1991 ADA Standards for Accessible Design.” *ADA.gov*, ADA, www.ada.gov/1991ADAstandards_index.htm.

“2010 ADA Standards for Accessible Design.” *ADA.gov*, ADA, www.ada.gov 2010ADAstandards_index.htm.

MAKENZIE ASHLEY
BFA Graphic Design | Senior Thesis 2021

Table of Contents

02 **INTRODUCTION**
03 Methodology
03 Thesis Statement
04 Background Information

06 **RESEARCH RESULTS**
06 Executive Dysfunction
07 Sensory Overload
09 Circadian Rhythm
11 Current Accessibility Guidelines

18 **BRAND IDENTITY**
18 Naming
18 Logo Lockups
18 Colors
18 Typography

20 **IDAC STANDARDS**
20 Use of Color
26 Layout and Grouping
40 Content Comprehension

46 **OTHER DELIVERABLES**
46 Website
48 Collateral
49 Educational Spaces

50 **CONCLUSION**
52 Sources

Introduction

Every morning, I wake up at eight o'clock in the morning to finish homework or jump into a meeting for my job. Every morning, I leave my room where my desk is to perform my duties in the living room. The birds that chirp in the tree next to my window, the train that passes at exactly eight thirty-two in the morning, the garbage truck going down the street, the light beaming in through the window competing with the screen on my computer, and the rattling of the screw that is slightly too loose on my air conditioning vent are all sensory stimulants for me. My computer screen and its contents are just more visual stimulants to my Sensory Processing Issues from my Attention Deficit Hyperactive Disorder.

This is a reality that 23.2 million individuals in the United States with cognitive disorders face (Taylor). Many of these individuals are able to remove themselves from situations that can cause adverse reactions. However, many are not able to. People with more severe cognitive disabilities such as Autism Spectrum Disorder do not have the cognitive ability to work through difficulties with web accessibility. In a world where technology is heavily relied on by all of us, whether it is virtual learning or working from home, websites and mobile applications should not be a hindrance to individuals with ASD or other cognitive disorders. The reality of web accessibility and individuals with cognitive disabilities is that the inability to process information or navigate content on websites and mobile applications can trigger adverse reactions because various aspects of User Interface design create an inaccessible web experience for them. There needs to be an opportunity for all individuals, regardless of ASD or other cognitive disabilities, that grants them equal opportunities and access to technology.

Thesis Statement

This is the research and development process of a web accessibility experience that is inclusive to individuals with Autism Spectrum Disorder and Cognitive Disabilities. This was accomplished through extensive research in which I learned about potential symptoms of Autism Spectrum Disorder and Cognitive Disabilities and analyzed currently enforced Web Accessibility guidelines and the topics included in them. Based on my discoveries of these common symptoms and current guidelines, I identified opportunities to improve web accessibility on behalf of individuals with Autism Spectrum Disorder and Cognitive Disabilities. The final deliverables were the creation and branding of an organization called IDAC, which stands for Inclusive Design for Autism and Cognition. The main function of IDAC is to promote inclusivity and awareness of Autism and Cognitive Disabilities so that web accessibility can be universally accessible to all. The deliverables include the development of a website and publication with the IDAC web accessibility standards.

Methodology

Qualitative research was used to collect information pertaining to the prevalence of cognitive disabilities and Autism Spectrum Disorder in the United States of America. Descriptive and exploratory research was conducted to gain a greater understanding of the common symptoms associated with Autism Spectrum Disorder and Related Cognitive Disorders. Anecdotal research also provided empathetic insight into user needs regarding web accessibility. Exploratory research revealed a gap in web accessibility standards regarding accessibility for cognitive disabilities. Sources included scholarly articles on Autism Spectrum Disorder, common symptoms, Sensory Processing Disorders, and Executive Dysfunction. Academic journals and advocacy organizations on these topics were also reviewed. These sources provided insight into user base demographics, web accessibility solutions, design considerations, and background into web accessibility standards and potential solutions that can help create a more accessible web experience for individuals with Autism Spectrum Disorder and cognitive disabilities.

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Background

DEFINING AUTISM SPECTRUM DISORDER

Autism Spectrum Disorder, hereafter referred to as ASD, is a developmental disability that affects not only an individual's social and behavioral development, but also an individual's cognitive development. ASD is difficult to define with one singular definition because every individual with ASD develops unique symptoms that may not affect others with the same condition. Most commonly, ASD is defined as "a set of heterogeneous neurodevelopmental conditions, characterised by early-onset difficulties in social communication and unusually restricted, repetitive behaviour and interests." (Lai, Meng-Chuan et al., 896).

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, or DSM-V, is the standard reference used by healthcare providers to diagnose behavioral and mental conditions created by the American Psychiatric Association. The DSM-V holds the reputation of being the sole guideline for the diagnosis of ASD and other conditions. Therefore, the DSM-V lists complete explanations of various symptoms that those with ASD may demonstrate. The DSM-V describes the possible symptoms of those with ASD and continues on to provide the table shown below regarding the severity of those with ASD. This table defines three "levels" to assist in categorizing the severity of ASD in order to assist in diagnosis and treatment. Within these three levels, there are commonalities that can be found. Those include, but are not limited to: "inflexibility of behavior, difficulty coping with change, and distress and/or difficulty changing focus or action" (American Psychiatric Association). Based on the diagnostic criteria given by the DSM-V, there is reason to state that ASD affects a number of individuals, each in vastly unique ways.

Although ASD affects each individual uniquely, ASD is an extremely prevalent cognitive disorder. The Centers for Disease Control and Prevention (CDC) states that 1 in 54 children in the United States are affected by ASD, and it affects how those with ASD communicate, interact, behave, and learn ("What is ASD?"). According to a study performed by Cornell University in 2011, there are an estimated 5.5 million individuals with ASD in the United States of America (Dietz, Patricia M., et al.). ASD is just one cognitive disability amongst many. According to the U.S. Census Record report on disabilities, in 2014, there were an estimated 23.2 million individuals with a neurodevelopmental disability which can include learning disabilities, Attention Deficit Hyperactive Disorder (ADHD), and many others (Taylor).

Severity level	Social communication	Restricted, repetitive behaviors
Level 3 "Requiring very substantial support"	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches.	Inflexibility of behavior, extreme difficulty coping with change, or other restricted/ repetitive behaviors markedly interfere with functioning in all spheres. Great distress/ difficulty changing focus or action.
Level 2 "Requiring substantial support"	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and who has markedly odd nonverbal communication.	Inflexibility of behavior, difficulty coping with change, or other restricted/ repetitive behaviors appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/ or difficulty changing focus or action.
Level 1 "Requiring support"	Without supports in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful responses to social overtures of others. May appear to have decreased interest in social interactions. For example, a person who is able to speak in full sentences and engages in communication but whose to-and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful.	Inflexibility of behavior causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.

Figure 1: *DSM-V Autism Diagnostic Criteria (American Psychiatric Association)*

IDENTIFYING COMMON SYMPTOMS

According to Ashlea McKay, a User Experience Researcher with ASD, those with ASD are "neurodiverse" (McKay). She continues on to explain that every neurodiverse individual with ASD and other cognitive disabilities is unique, and therefore, symptoms vary. There can be common symptoms that affect a large population of those with ASD, and these symptoms commonly overlap with symptoms of other cognitive disabilities as well. For example, the DSM-V states under Section B of the ASD diagnostic criteria:

> [Hyperactivity] to sensory input or unusual interests in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement). (American Psychiatric Association)

This excerpt from the DSM-V diagnostic criteria states the presence of sensory challenges within the ASD community. The American Speech-Language-Hearing Association (ASHA) defines common signs and symptoms of ASD. Related to this study, there are three main categories that are defined as common. The first of those is titled by the ASHA as "Impairments In Language and Related Cognitive Skills". Key symptoms to note under this category are as follows:

> Delayed or impaired acquisition of words, word combinations, and syntax; Literacy deficits, including difficulty: reading for meaning, understanding narratives and expository text genres that require multiple perspectives (e.g., persuasive and comparative/contrastive), getting the main idea and summarizing, and providing sufficient information for the reader when writing; Executive functioning deficits, including, lack of or limited flexibility, poor problem solving, poor planning and organization, and lack of inhibition. ("ASD: Overview")

The second of these categories is titled "Behavioral and Emotional Challenges" and the notable symptoms regarding this study are:

> Problems dealing with changes in routine and/or changing from one activity to the next; problems generalizing learned skills; using objects in unusual ways and uncommon attachments to objects; Problems with self-management ("ASD: Overview").

The final category of symptoms related to this study as defined by the ASHA under the title "Sensory and Feeding Challenges" is:

> Sensory modality difficulties, including over-responsiveness, under-responsiveness, or mixed responsiveness patterns to environmental sounds, smells, light, tactile stimulation, movement, visual clutter, and social stimuli (e.g., social touch, proximity of others, voices); preference for nonsocial stimuli leading to intense interests with sensory aspects of objects and events. ("ASD: Overview")

According to these specific symptoms as defined by the ASHA, those with ASD have common challenges regarding sensory modality, executive function, literacy, change, and self-management to name a few ("ASD: Overview"). Based on these common symptoms, and her personal experience not only as an individual with ASD, but also her career experience as a User Experience Researcher, McKay states that when designing for accessibility regarding neurodiverse individuals, designers should consider "supporting sensory overload, assisted experiences, and tools to manage Executive Dysfunction" (McKay).

Executive Dysfunction

UNDERSTANDING EXECUTIVE FUNCTION

One of the most common impairments that those with ASD and related cognitive disabilities face is challenges with Executive Function (EF). Executive Function is categorized as a self-regulation skill and is one of the key mental processes that enable individuals to plan, focus, remember and process instructions, and manage multiple tasks successfully. These skills are "crucial for learning and development" ("What is Executive Function?"). An article published by Harvard University compares EF to an air traffic control system. The study states, "Just as an air traffic control system at a busy airport safely manages the arrivals and departures of many aircraft on multiple runways, the brain needs this skill set to filter distractions, prioritize tasks, set and achieve goals, and control impulses." ("What is Executive Function?").

Another article published by the Child Development department at Harvard University explains the key functions of EF as "Being able to focus, hold, and work information in mind, filter distractions, and switch gears" and continues on to explain that EF is the same mental process that assists individuals in skills such as reading, writing, remembering steps, taking part in projects and/or discussions, monitoring errors, making decisions based on information, revising plans, and interacting with others ("Executive Function & Self-Regulation."). The ability to employ this mental process successfully ultimately allows individuals to control oneself against taking quick action when frustrated.

Working memory, mental flexibility, and self-control are three skills that rely on Executive Function. An article by Harvard University describes these three components. Working Memory governs ability to retain and manipulate distinct pieces of information over short periods of time. Mental flexibility helps to sustain or shift attention in response to different demands or to apply different rules in different settings. Inhibitory control or self control enables to set priorities and resist impulsive responses ("Executive Function & Self-Regulation.").

A published study titled Developing Usable Software Applications for Users with Autism: User Analysis, User Interface Design Patterns and Interface Components analyzed the connection between Executive Function and users with Autism. The study claims, "A growing body of work suggests that many of the symptoms of Autism originate with impairments in the Executive Functions, such as in working memory, cognitive flexibility, planning, generativity, self-monitoring and inhibition." (Mejia-Figueroa, Andres, et al.). The study continues on to discuss how given the fact that Executive Dysfunctions affect life skills such as academic performance, planning, memory, and overall cognitive performance, the statement can reasonably be made that challenges with EF can lead to challenges with human-computer interaction.

EXECUTIVE FUNCTION AND ASD

An example that the study gives regarding usability challenges and EF is what is known as Cognitive Load. Cognitive Load is defined by the study as, "mental resources that a person has available for problem solving or completing a task in a certain time" (Mejia-Figueroa, Andres, et al). Working memory is a mental process that relies on Cognitive Load. As previously mentioned, working memory is the ability to store and process information "leading to the assumption that, if Cognitive Load affects Working Memory, then Executive Functions dependent on Working Memory, such as Planning and Cognitive Flexibility, are also affected, adding to, and probably serving as a cause, to usability problems with autistic users." (Mejia-Figueroa, Andres, et al.).

As stated, EF is responsible for working memory. Working, or short-term, memory is a key component regarding website accessibility. WebAIM explains that users with cognitive disabilities, including ASD, can have issues with web accessibility related to their challenges with memory. These challenges are explained by WebAIM: "Some users cannot remember how they got to content. If a complex form displays multiple error messages, the user may be unable to remember multiple errors, and may even forget the error information before they are able to address the error." ("Cognitive Introduction").

Aside from Working Memory, EF also affects other aspects of mental processing that may pose web accessibility challenges to those with cognitive disabilities. Other examples include, but are not limited to: challenges problem-solving which would lead users with cognitive disabilities to abandon a site/task, trouble focusing one's attention on main content or functionality, and challenges with reading comprehension. All of these challenges are related to Executive Dysfunction, and if taken into consideration, can assist in creating an accessible User Experience and User Interface for those who are with cognitive disabilities, such as ASD.

Sensory Overload

SENSORY PERCEPTION ISSUES

According to a study titled "Sensory Perception in Autism", it is estimated that close to 90% of children and adults with ASD suffer from sensory perception impairments, commonly identified as Sensory Overload (Robertson and Baron-Cohen). Another study from 2009 states that up to 95% of individuals with ASD also have Sensory Processing Deficits (Crane, Laura et al.). As referenced prior, the DSM-V lists "Hyper- or hyporeactivity to sensory input" as a common symptom used by healthcare providers while diagnosing a person with ASD (American Psychiatric Association). Also priorly mentioned is the ASHA list of common symptoms regarding autism in which sensory modality challenges are explained and presented as a common challenge that those with ASD encounter ("ASD: Overview").

The international Journal of Mental Health Nursing published "Sensory overload: A concept analysis" with the goal to define what exactly sensory overload is. People with diagnosis of certain mental illnesses including ADHD and ASD, "the problem of sensory overload due to a disturbed stimulus filtering appears to occur more frequently" (Scheydt, Stefan et al.). The analysis explains that the result of such a condition can lead to stress reactions which are typically manifested as social isolation and/or aggressive behavior based on low filtration capacity and/or lack of coping resources within these individuals. The analysis analyzed published literature that have varying definitions and attributes of sensory overload in order to formulate a more definite explanation of the condition to provoke further research. The research explains that, "All definitions of sensory overload describe a powerful or an atypical sensory stimulation as the triggering event which may evoke sensory overload" (Scheydt, Stefan et al.). Further, the study states that the term "'overload' refers to the failure of an individual's coping strategies and not to the quantity of the stimuli" and "stimuli seemingly manageable or even positively stimulating by one individual may be experienced as 'overload' or 'strain' by another" (Scheydt, Stefan et al.).

The study discusses that "sensory overload is rooted in an impaired cognitive capacity to process information resulting in a reduction in the stimulus level and thus rendering subordinate stimuli to be experienced as aversive or burdensome" (Scheydt, Stefan et al.). Ultimately the concept analysis revealed that those with sensory perception issues, another term for sensory overload, perceive the environment around them at a heightened level of intensity and/or diversity "which exceed the normally experienced level and are thus experienced as aversive" (Scheydt, Stefan et al.).

COLOR AND LIGHT PERCEPTION

Sensory perception is a concept which involves not only visual stimuli, but all of the five senses: auditory, olfactory, visual, tactile, and gustatory. This research is focused on the visual stimuli which contribute to sensory overload as a symptom of those with Autism. According to Autism Speaks, "many people on the spectrum are hypersensitive to bright lights or certain wavelengths"

("Sensory Issues"). Past research has proven that the perception of color variation including shades, hues, and other attributes are all results of light and the make-up of different wavelength frequencies of light. Knowing that sensory issues in ASD can lead to sensitivity to light, it can be assumed that those with sensory perception issues as a symptom of ASD have an atypical perception and preference of color.

A study titled "Color Perception in Children with Autism" found that there was a variety of anecdotal evidence that color perception differs in neurotypical children compared to children with Autism, but little evidence based on quantitative data and direct experimental investigation. Two experiments were performed under this study. The first experiment "assessed accuracy of color perception in children with autism using a visual search and delayed matching-to-sample task", while the second experiment "compared children with autism and typically developing children...in their accuracy and speed of color discrimination and the strength of categorical perception of color, using a target detection task" (Franklin, Anna, et al.). The first experiment showed that the children with ASD were "significantly less accurate at color memory and search" (Franklin, Anna, et al.). The results of the second experiment showed that the children with ASD were "less accurate...at detecting chromatic targets when presented on chromatic background, although were equally as fast when target detection was accurate. The strength of categorical perception of color did not differ for the two groups" (Franklin, Anna, et al.). Although the results of this study clearly showed that more scientific research needs to be directed towards color perception in Autism in order for conclusive findings to be made, the study did show evidence that children with ASD do have a slight variance in relation to color than neurotypical children.

Since sensory issues may lead to hypersensitivity with light, and therefore color, it can be assumed that individuals with ASD may have differing preferences to color than neurotypical individuals. Research found in a study titled "Atypical Color Preference in Children with ASD" has shown evidence for color preference within children with Autism. The study examines, much like the previous study mentioned, that there is a variety of anecdotal evidence that those with neurodevelopmental disorders with unusual sensory processing perceive color differently then typically developing (TD) children. An example given of the anecdotal evidence is that the color green is often labeled as a preference. The study mentions that other research has led these researchers to "hypothesize...the enhanced sensitivity to sensory stimulation in general that is characteristic of ASD would influence color perception exhibited by people with this disorder, and this would result in aversion to some specific colors that are usually favored by neurotypical people" (Grandgeorge and Masataka).

The results of this study showed that typically developing children ranked brown as the least preferred color and red, blue, and yellow as the most preferred. Children with ASD scored yellow as low for preference and greens and brown were "conversely elevated" (Grandgeorge and Masataka). The study continues on to state, "the fact that the yellow color had the highest luminance value among the colors tested should not [be] dismissed. The observed aversion to this color might reflect hyper-sensitivity of children with ASD to luminance" (Grandgeorge and Masataka). Previous research has proven that yellow is actually the most fatiguing color. The study explains:

> It is well known that our eyes are provided with three different types of cone cells for color perception, L, M, and S, which correspond to the perception of red, green, and blue light, respectively. When yellow is perceived, however, both L and M must be involved. The perception of yellow should thus be the most heavily sensory- loaded of the perception of any type of color. Its perception is bearable for TD children, but could be over-loaded for children with ASD whose sensitivity to sensory stimulation is enhanced (Grandgeorge and Masataka).

Based on the information and research revealed in these two studies, it can be assumed that color and light perception is different in those with ASD in comparison to neurotypical individuals. The sensitivity to visual stimuli experienced by individuals with sensory perception issues leads to the conclusion that light and colors that are resulting from high frequency wavelengths can cause stress and sensory overload in individuals with ASD.

Circadian Rhythm

INTRODUCTION

Regarding Executive Function as well as Sensory Processing Issues, it is important to take into consideration the indirect effects that technology and screen use can impose on individuals with ASD or related cognitive disabilities. Circadian Rhythm is described by the CDC as "can internally driven 24-hour rhythm that tends to run longer than 24 hours but resets every day by the sun's light/dark cycle" ("Circadian Rhythms and Circadian Clock"). The human body naturally controls its rhythms such as the production of the hormone melatonin based on the amount of light intake it is receiving. These rhythm shifts affect an individual not just physically, but also mentally and behaviorally.

Figure 2 an image provided by the National Institute of General Medical Sciences (NIH) which is a visual depiction of how light enters into the brain through your eyes ("Circadian Rhythms"). According to the NIH, circadian rhythms are essential for a healthy lifestyle, and in neurotypical individuals, "Irregular rhythms have been linked to various chronic health conditions, such as sleep disorders, obesity, diabetes, depression, bipolar disorder, and seasonal affective disorder." ("Circadian Rhythms").

CIRCADIAN RHYTHM & COGNITION

According to research studies, there are direct correlations between physical and behavioral problems and the dysregulation of Circadian Rhythms of neurodiverse individuals. One of which suggests that regulating and maintaining a typical Circadian Rhythm "may be helpful to improve the health and to cope with several behavioral changes observed in ASD [individuals]." (Pinato, et al.). Figure 3 is a chart provided by the CDC which portrays a regulated Circadian Rhythm ("Circadian Rhythms Promote Wakefulness").

Maintaining a regular Circadian Rhythm is a difficult task specifically due to the development of artificial light, LED screens, etc. That being said, it is necessary for the well-being of those with ASD to take into consideration how User Interface Design can attempt to keep its contributions to a minimum regarding the disruption of Circadian Rhythms. The potential positive effects on those with ASD include deescalating a potential sensory overload problem due to light sensitivity, as well as supporting Executive Function skills by assisting with time management by keeping to a schedule which helps regulate the circadian rhythm.

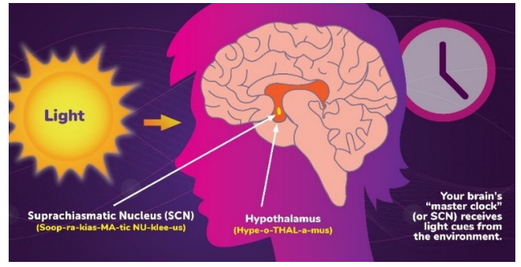


Figure 2: *Circadian Rhythms (NIH)*

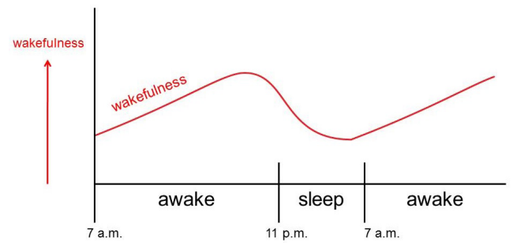


Figure 3: *"Circadian Rhythms Promote Wakefulness." (CDC)*

Blue light is the main factor which disrupts the Circadian Rhythm. According to the CDC, blue light has the most impact, red light has no impact, and yellow/orange have a small amount of impact on the Circadian Rhythm ("The Color of the Light Affects the Circadian Rhythms"). That being said, by limiting the amount of blue light that an LED screen contains in its color wavelength composition, designers and developers can help control adverse potential reactions that individuals with ASD might experience when interacting with websites or a mobile application.

THE KELVIN SCALE

The Kelvin Scale is a system which measures the composition of different lights. If a light composition projects more yellow, orange, or red, then it will measure on the lower end of the Kelvin scale. On the contrary, if a light composition projects more blue, then it will measure on the higher end of the Kelvin Scale of Color Temperature. Reference Figure 4 below provided by TCP ("Lighting Color Temperature").

Light tuners which allow teachers to adjust lighting based on classroom activities have been praised in recent studies and teachers claim that different lighting settings help the students' focus and attention based on the situation. The U.S. Department of Energy (DOE) released a report in 2017 titled, "Tuning the Light in Classrooms: Evaluating Trial LED Lighting Systems in three classrooms at the Carrollton-Farmers Branch Independent School District in Carrollton, TX" which described the tunable lights as beneficial not only as a way to save energy, but also as a way to engage students. The report states, "The combination of spectral tuning and dimming in the classrooms provides greater opportunity to vary lighting parameters that may affect circadian and behavioral responses for students, teachers, and other users of the classrooms, relative to the fluorescent systems." (Davis).

There are tactics such as hand held machines that allow users to measure the exact color temperature of a screen or light. This tactic of being able to tune the color temperature of lighting or designing screens to be composed of parameters which fall within a certain range on the Kelvin Scale can help eliminate features of websites and mobile applications which might trigger unfavorable behaviors due to the symptoms of individuals with ASD.

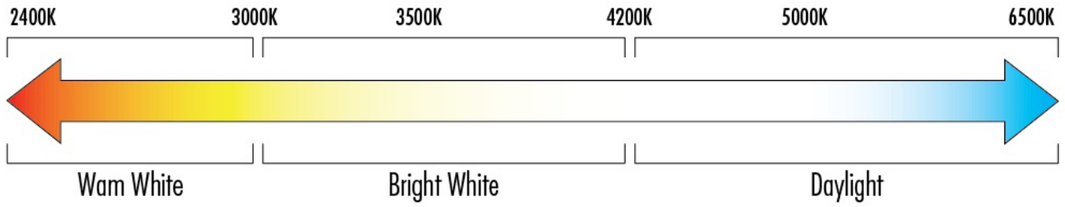


Figure 4: *"Lighting Color Temperature." (TCP)*

Current Accessibility Guidelines

INTRODUCTION

There are a variety of websites that are currently live and developed to include certain accessibility features. These features are helpful for overall accessibility, but one problem remains. In order to create a truly inclusive experience for those who live not only with cognitive disabilities but also visual processing disabilities as an entirety, these accessibility features should not be an added option. These features should be integrated into the websites without being a feature that reminds the user that they are different from those who are considered neurotypical.

ACCESSIBILITY GUIDELINES

Section 508 of the The Americans with Disabilities Act (ADA) is something that developers and designers should be familiar with. The W3C is an organization that works to develop protocols and guidelines for websites. Within W3C, there are Web Accessibility Initiative (WAI) and its working groups which have developed the Web Content Accessibility Guidelines (WCAG) based on Section 508 of the ADA. OnTheMapMarketing explains that "within these guidelines are four standards on how text, sound, code and markups should be created in order to make a website more accessible to users who are utilizing assistive technology to access a website" ("ADA Compliance Plugin"). These four principles include perceivable, operable, understandable, and robust ("Web Content Accessibility Guidelines").

According to WebAIM, an organization dedicated to helping individuals understand the ADA web accessibility standards and WCAG describes these four principles for better understanding. Perceivable is described as web content "made available to the senses - sight, hearing, and/or touch", operable is described as "Interface forms, controls, and navigation are operable", understandable is explained by WebAIM as "Information and the operation of user interface", and regarding robust, WebAIM states, "Content must be robust enough that it can be interpreted by a wide variety of user agents, including assistive technologies" ("WebAIM's WCAG 2 Checklist").

WEBAIM

In 1999, Web Accessibility in Mind (WebAIM) was established with the purpose of "expand[ing] the potential of the web for people with disabilities." ("About WebAIM"). WebAIM further describes its mission to create "accessible content" through their services which include training services to organizations and individuals, accessibility evaluation tools, instructional materials, an online community, research and policy dialogues. The organization is based at the Center for Persons with Disabilities (CPD) at Utah State University and describes itself as one of the "leading providers of web accessibility expertise internationally" ("About WebAIM"). Through these services which have been offered to not only individuals, but also various businesses including Fortune 100 companies, WebAIM has grown into one of the most referenced and widely accepted standards for Web Accessibility.

In 2005, WebAIM began offering fee-based services which transitioned the training and consulting services they began offering in 1999 into more specialized and intensive training sessions that had a variety of options for organizations, businesses, and individuals to select from. Before the Covid-19 pandemic entered the United States in 2020, WebAIM offered Hosted Training only on location at Utah State University. Because of recent events, WebAIM has expanded to virtual training options either in small groups with other individuals and small organizations, or customized virtual training specific to an organization.

The most popular of these Hosted Training options that WebAIM offers to individuals, organizations, businesses, etc., is the "Virtual Web Accessibility Training". According to the WebAIM course registration website ("Virtual Web Accessibility Training"):

Where: Online via Zoom
Timeframe: Each training is held over two days with two 2-hour sessions per day
Cost: $500/person ($400 each for groups of two or more)

Although these "Virtual Web Accessibility Training" options are highly requested by individuals and organizations, WebAIM limits the group sizes of each training session to 35 individuals in an attempt to create a comfortable and engaging environment for all participants to optimize learning. According to the WebAIM website, the training will include ("Virtual Web Accessibility Training"):

- This training session will teach basic web accessibility principles and advanced accessibility techniques.
- Learn what you need to know to ensure that your web site meets international guidelines and legal requirements.
- This training is primarily suited for web developers, though it will be valuable for designers, program managers, quality assurance experts, or anyone interested in gaining a deep understanding of web accessibility. A basic understanding of HTML is recommended.
- Training participants receive a complimentary enrollment for WebAIM's Document (Word, PowerPoint, and PDF) Accessibility online course—a $125 value.

These objectives are offered as an overall basis for participants to review when registering for the Virtual Training on Web Accessibility. However, there are customizable options such as the addition of a one-on-one 3 hour web accessibility session with a WebAIM professional to truly maximize one's knowledge on the subject and further tailor the experience to oneself and one's career needs.

According to the WebAIM Virtual Training on Web Accessibility registration site, the course is intended to be an intensive overview of Web Accessibility as a whole. The course will provide an overview on multiple topics. An overview of WCAG 2 and new 2.1 changes will be covered; captions and transcripts for Auditory Disabilities; a variety of topics in Visual Disabilities such as contrast, how screen readers work, ARIA & Landmarks, etc.; Photosensitive epilepsy; various Motor Disability standards including meaningful text links; keyboard navigation, and mobile accessibility to name a few; a limited number of topics regarding Cognitive and learning disabilities which are understandable content, legible text, and animating and time-sensitive content; and lastly, Evaluating Web Accessibility content which reviews principles and methodologies for user testing, WAVE and other automated tools, keyboard testing, and screen reader testing ("Virtual Web Accessibility Training."). The final session of the training will be split into two breakout groups. The first is named "Advanced topics" and covers a variety of tools for developers and designers such as the rules for ARIA use, forms, ARIA labels and descriptions, Tabindex and scripting, and a few more advanced topics. The other topic that is available for participants is a "Document Accessibility Overview" which reviews accessibility in the creation of Microsoft Office documents such as Word and Powerpoint, converting Office to PDF, PDF principles, and PDF evaluation and repair in Acrobat ("Virtual Web Accessibility Training").

Alongside this popular course called Virtual Training in Web Accessibility, WebAIM offers a variety of resources so that businesses and individuals can customize their Web Accessibility learning to fit their industry needs. If the course resources and materials are not applicable to a potential customer or trainee, or if some of the materials are while others are not, there are options which allow trainees to select certain areas of training from the Virtual Training sessions. These include ("Accessibility Training"):

- Document accessibility workshop in which consumers will practice making accessible documents in Word, PowerPoint, and Acrobat
- StrategicA11y (Strategic web accessibility workshop) in which participants will engage in exercises and planning with expertise and peers, and will create a written plan to implement accessibility for your organization
- Customized training sessions such as onsite face-to-face training or customized virtual training in a variety of topics including those listed above as well as other options such as Web Accessibility guidelines and legislature (Section 508, WCAG 2, ADA, etc.), HTML, CSS, evaluating site accessibility, assistive technologies like screen readers, and more.

These training sessions have proved over the years as successful tools for businesses, developers, and individuals, as well as prove to be the most efficient and thorough way to teach and learn web accessibility for the workplace.

Overall, the WebAIM course format and ability to customize one's experience is something that the IDAC will be implementing through their Inclusive Design for Autism and Cognition training services. Following a similar format to WebAIM, the IDAC will aim to stress the importance of learning and studying more in-depth the web accessibility issues regarding Cognitive Disabilities due to the lack of information and current training resources that are currently available to businesses. Reviews of course materials will be accessible online for the ease and access of individuals and businesses and personalized training sessions like those offered by WebAIM will be offered to help participants fully implement and learn how Web Accessibility can assist in creative a universally inclusive design system.

THE ADA GUIDELINES

On July, 26, 1990, former President George H.W. Bush signed The Americans with Disabilities Act (ADA) into law. The ADA website describes this piece of legislation as, "one of America's most comprehensive pieces of civil rights legislation that prohibits discrimination and guarantees that people with disabilities have the same opportunities as everyone else to participate in the mainstream of American life" ("2010 ADA Standards for Accessible Design"). The ADA website continues on to state that The Americans with Disabilities Act was modeled after the Civil Rights Act of 1964. The ADA is described as an equal opportunity law for those who live with disabilities.

In 1991, one year after the ADA was signed into law by former President George H.W. Bush, the Department of Justice published the Title III regulations which included the ADA Standards for Accessible Design. These standards were originally focused primarily on the design of infrastructure in and outside of buildings. However, in 1998, the United States Congress "amended the Rehabilitation Act of 1973 to require Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities" ("1991 ADA Standards for Accessible Design"). From this development of Section 508, various revisions have taken place in the last two decades to further develop more extensive guidelines for a more universally accessible web.

According to the Section 508 official website, the United States Access Board is the agency responsible for developing Information and Communication Technology (ICT) accessibility standards which will be incorporated into regulations that will and do govern Federal procurement practices ("About Us."). On January 18, 2018, a final rule issued by the U.S. Access Board went into effect. This final rule updated accessibility requirements governed by Section 508 and Section 255 Guidelines, which governs guidelines for telecommunications equipment. The U.S. Access Board developed this final rule based off of market trends and innovations in technology which allowed Section 508 guidelines to more closely unify with similar standards such as those issued by the European Commission and the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG 2.0).

Though Section 508 of the Americans with Disabilities Act (ADA), and the ADA as a whole, have experienced a vast amount of revisions with the development of technology and society's rapidly increasing reliance on technology, the purpose of these guidelines and Federal regulations remain constant. According to the Executive Summary

of the Information Communication Technology (ICT) Standards and Guidelines, previously referred to as the "final rule", the revised Section 508:

> ...support the access needs of individuals with disabilities, while also taking into account the costs of providing accessible information and communication technology to Federal agencies, as well as manufacturers of telecommunications equipment and customer premises equipment. ("ICT Standards and Guidelines")

The document continues on to explain how these revisions are extremely necessary due to technological advances. The primary purpose of this final revision is described by the ICT Standards and Guidelines as the need to, "replace the current product-based approach with requirements based on functionality, and, thereby, ensure that accessibility for people with disabilities keeps pace with advances in ICT." ("ICT Standards and Guidelines").

Another important emphasis stated within the ICT Standards and Guidelines is the goal to "harmonize" with already developed international standards that relate to ICT accessibility. As stated, the WCAG 2.0 and other international accessibility standards are mentioned. The document states ("ICT Standards and Guidelines."):

> Harmonization with international standards and guidelines creates a larger marketplace for accessibility solutions, thereby attracting more offerings and increasing the likelihood of commercial availability of accessible ICT options.

Not only is the harmonization of regulations for accessible technology important for the purpose of promoting widespread availability, but also the harmonization of regulations for accessible technology will promote a standard for technology that would potentially develop into every channel of technology being universally accessible. These new regulations from the U.S. Access Board were an important and necessary leap for the advancement of universally accessible technology.

From the recent developments of Section 508 of the ADA Standards for Accessible Design, various tools and compliance checking systems have been developed between the U.S. Access Board and other Web Accessibility agencies such as W3C. Below is a sample from a chart which compares W3C's WCAG 2.0 to current Section 508 Guidelines. According to the U.S. Access Board website, 22 of the 38 Level A and AA Success Criteria outlined by the WCAG 2.0 are "phrased differently but equivalent in substance to current 508 requirements." Figure 5 provides a sample from this chart ("U.S. Access Board"):

Proposed (WCAG 2.0 Success Criteria [Level])	Existing 508 Corresponding Provision	Summary	What would Change	Comment
1.1.1 Non-text Content [A]	1194.22(a)	Provides for text alternatives of images and other non-text content, including user interface components	Substantially Equivalent	Proposed standard provides additional detail for 8 common categories of non-text content.
1.2.1 Prerecorded Audio-only and Video-only [A]	1194.22(a)	Provides that prerecorded audio is available in a visible format and that silent animations are available in an audible format		
1.2.2 Captions (Prerecorded) [A]	1194.22(b) and .24(c)	Provides for synchronized captioning of prerecorded video and multimedia.	Substantially Equivalent	Proposed standard distinguishes between live and prerecorded media.
1.2.3 Audio Description or Media Alternative (Prerecorded) [A]	1194.22(b) and .24(d)	Provides for audio description of prerecorded video and multimedia		
1.2.4 Captions (Live) [AA]	1194.22(b) and .24(c)	Provides for captioning of live video and multimedia		
1.2.5 Audio Description (Prerecorded) [AA]	1194.22(b) and .24(d)	Provides for audio description of live video and multimedia		
1.3.1 Information and Relationships [A]	1194.22(e) through (h)	Provides that information, structure, and relationships conveyed visually are available to users of assistive technology Provides that semantic markup be used for headings, lists, emphasized or special text, and tabular data, including the association of data cells with their headers	Substantially Equivalent	Proposed standard is written broadly and is technology neutral, whereas existing standard is specific to HTML image maps and data tables.

Figure 5: *Comparison Table of WCAG 2.0 to Existing 508*

Other tools for testing accessibility are available on the official Section 508 website as well. These tools have been developed recently as technology and website design and development has become available to more and more consumers. Figure 6 is from the official Section 508 website where a "Test" page in the website's navigation bar is easily noticed ("Test for Accessibility").

Within these four sections, the "Learn About Testing Methods" clearly outlines to users the three methods in which users can evaluate their websites for compliance: automated, manual, and hybrid. Automated testing of a site relies on technology to scan and analyze a website for compliance in a variety of manners such as color contrast and text which can be identified by page scanners to name a few. Manual testing "uses a documented, consistent, repeated process" which is outlined by the Section 508 website ("Overview of Testing Methods for 508 Conformance"). Lastly, Hybrid testing is a combination of both manual methods and automated methods, and therefore, is arguably the most reliable form of compliance testing.

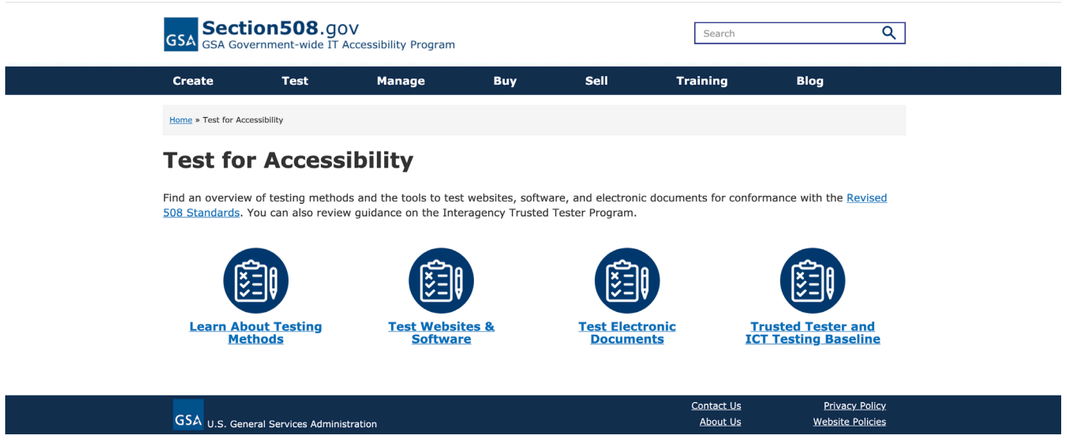


Figure 6: *Test for Accessibility (Section508.gov)*

Since the onset of the Americans with Disabilities Act in 1990 by former President George H.W. Bush, web accessibility standards have developed rapidly alongside the advancements of modern technology. The ADA Standards of Accessible Design' Section 508 are guidelines that are easily accessible by any user and provide access to tools and other guidelines which prove necessary in the development of universally accessible technology. As Section 508 continues to develop alongside technology, the harmonization with other standards should continue a primary goal within the U.S. Access Board and any agency which works towards web accessibility in order to advance into a society in which accessible technology is common practice.

ACCESSIBILITY PLUGINS

Various websites include an accessibility plugin that allows users to customize their individual experience based on the needs their disability presents. This plugin is described by the website as an "ADA compliance Plugin" ("ADA Compliance Plugin"). The OnTheMapMarketing plugin is based on these standards. The web page continues to explain how their widget works to meet various levels of the standards set by WCAG. There are three levels of WCAG compliance that websites can achieve through incorporating widgets based on Section 508 of the ADA. WebAim summarizes theses three levels of compliance as ("Web Content Accessibility Guidelines"):

- Level A is a basic requirement for some users with disabilities to be able to access and use web content.
- Level AA indicates overall accessibility and removal of significant barriers to accessing content.
- Level AAA provides improvements and enhancements to web accessibility for some users with disabilities.

The website describes their plugin that will "help you meet the standards in Section 508 as well as the most recent WCAG level A and level AA compliance guidelines ("ADA Compliance Plugin")." Finally, the OnTheMapMarketing explains that, "Most government websites, schools, universities and privately owned websites try to achieve a level AA conformance so that their website can be accessible to many individuals with disabilities." ("ADA Compliance Plugin").

ACCESSIBLY WIDGET

Bison Coolers is a website that is developed to include the accessibility plugin called "Accessibly" made by OnTheMapMarketing. This icon is easily noticeable by users and the widget in itself does open up to include a variety of options that the user can filter through to turn off and on such as contrast, a bigger cursor, inverting colors, and more ("Bison Coolers").

Figure 7 shows the widget icon as well as the popup that appears when the icon is clicked on to reveal various accessibility options to adjust elements such as contrast, inserting a reading line, and enlarging text. Figure 8 demonstrates the reading line and contrast features of the Accessibly settings in use.

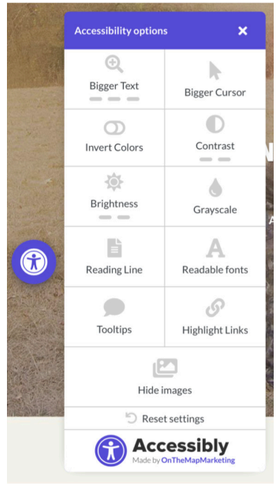


Figure 7: *(OnTheMapMarketing)*

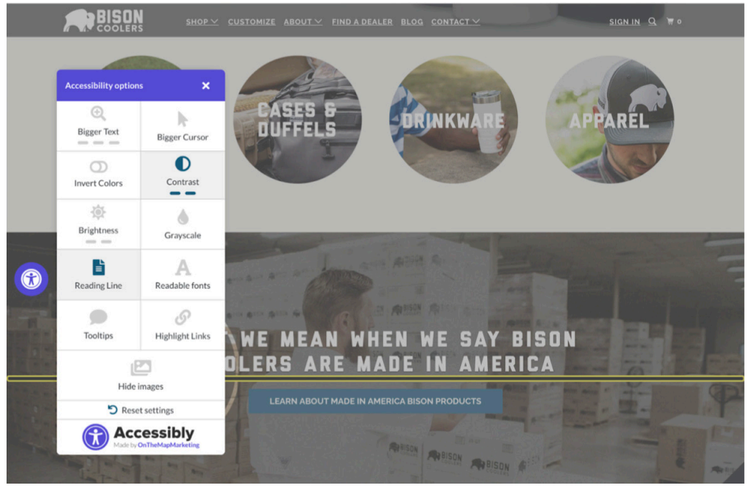


Figure 8: *Accessibility Settings in Use (OnTheMapMarketing)*

OTHER ACCESSIBILITY FEATURES

There are a variety of other features that websites have incorporated over time in attempt to comply with the WCAG guidelines that have been developed to create a more inclusive web experience for those with disabilities. Although websites do feature accessibility options, these options are often difficult to find, and also do not alter the user experience of the website based on the user interface changes that occur.

An example of these accessibility features is found on the footer of the Benefit Cosmetics website. Figure 9 is an image of the website's footer where the accessibility features can be found which proves the difficulties that users may have finding the features. Figure 10 and Figure 11 show the use of the "change contrast" option that is an accessibility feature on the website. The buttons and typography change from vibrant pink to a grayscale version for more contrast, however, the other features do not change in contrast which could be factors which can provoke symptoms of cognitive disorders such as sensory overload ("Benefit, Official Site and Online Store").

In Figure 9, Figure 10, and Figure 11 below, there are accessibility features that can be found currently on websites which will allow users to alter the user interface in order to better accommodate one's accessibility to a website. Although these current features can be viewed as a progressive step towards creating an accessible web experience for everyone, there are various obstacles which come alongside these features.

As noted, the ease of access to these features can be difficult such as finding them. Some of these features, such as on the Benefit Cosmetics website, are far too minimal. Other features, such as those found on the Bison Coolers website with the Accesibly plugin, can be extremely useful, but also overwhelming to those who are trying to use the features. Above all, the main problem that can be noted with these current accessibility features is that they remind the user that their cognitive function is different than that of neurotypical individuals. This is counterintuitive to creating and employing accessibility features because the significance of them is to create an all-inclusive user experience for everyone involved.

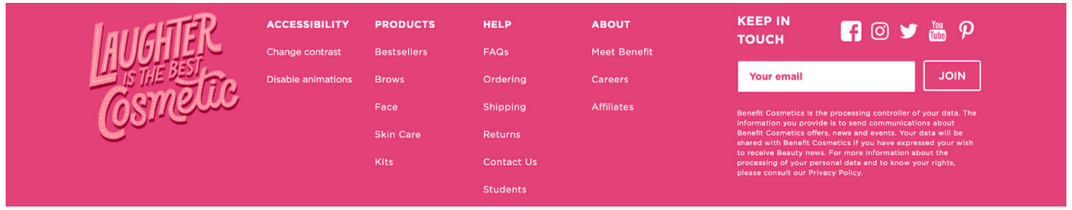


Figure 9: *Benefit Website Footer (Benefit Cosmetics)*

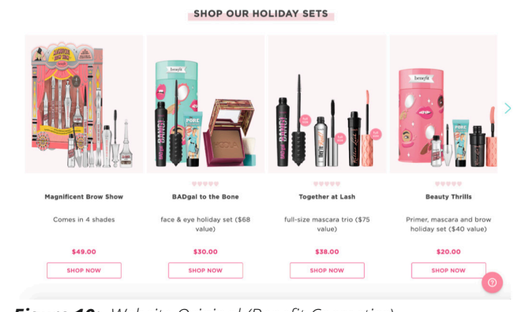


Figure 10: *Website Original (Benefit Cosmetics)*

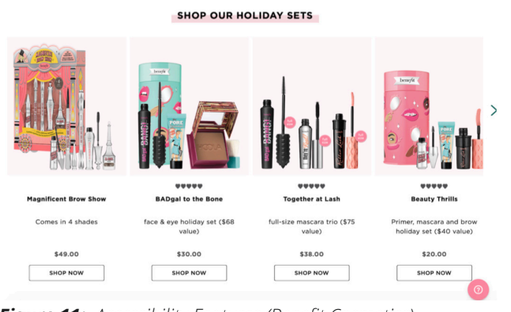


Figure 11: *Accessibility Features (Benefit Cosmetics)*

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Brand Identity

IDAC is an organization dedicated to creating inclusive web accessibility standards focused on promoting inclusivity, accessibility, and awareness of cognitive disabilities. Through IDAC, businesses or organizations and individuals can get IDAC certified, reference IDAC standards, and receive an IDAC accessibility audit simply by pasting their url into a box.

NAMING

IDAC stands for Inclusive Design for Autism and Cognition. It was chosen because it not only describes the function of the organization through its name, but it also is an acronym that is easily memorable as well as has corporate and professional attributes.

TYPOGRAPHY

To continue with creating an environment of inclusivity and welcomeness, typefaces were carefully selected. The rounded sans-serif typeface called Como was chosen for the logo because it contains characteristics that communicate a sense of friendliness and childlike curiosity. The typeface selected for secondary type is Raleway. The body copy typeface selected is Open Sans. Both Raleway and Open Sans were selected because they are web-safe fonts which are crucial for accessibility because they are easy to read and easily comprehended.

COMO HEAVY
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Raleway

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn
Oo Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

Open Sans

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo Pp Qq
Rr Ss Tt Uu Vv Ww Xx Yy Zz

COLORS

Color theory was referenced when deciding on brand colors. These four colors were selected because they each represent different individuals. Inclusivity is at the core of IDAC's mission, and these cheerful colors are welcoming to all. Blue is representative of the loyal and trustworthy characteristics that IDAC wants to communicate to users. Orange was chosen because it represents the welcomeness and determination of IDAC. Further, pink was chosen because it is representative of love and acceptance. Lastly, green represents the harmony and safety on the web that IDAC wants to create for individuals.

HEX	RGB	CMYK
#1C75BB	28 | 117 | 187	85 | 50 | 0 | 0
#F1650A	241 | 101 | 10	1 | 74 | 100 | 0
#DD327E	221 | 20 | 126	8 | 93 | 18 | 0
#009344	0 | 147 | 68	86 | 17 | 100 | 4

LOGO

The IDAC logo represents inclusivity and representation through the colors and typography. The logomark is an eye which is representative of the careful consideration that the IDAC takes in mitigating visual stimulants.

IDAC Inclusive Design for Autism & Cognition

IDAC STANDARDS

Use of Color

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Blue Light

Use bright, saturated colors sparingly to reduce Blue Light emission.

INTRODUCTION

The human body naturally controls its rhythms such as the production of the hormone melatonin based on the amount of light intake it is receiving. These rhythm shifts affect an individual not just physically, but also mentally and behaviorally. Research studies show direct correlations between behavioral problems and the deregulation of Circadian Rhythms in individuals with Autism Spectrum Disorder. Regulating and maintaining a typical Circadian Rhythm has the potential to improve health and behavior changes in individuals with Autism Spectrum Disorder. Maintaining a regular Circadian Rhythm is a difficult task specifically due to the development of artificial light through LED screens. It is crucial to take into consideration how User Interface Design can attempt to keep its contributions to a minimum.

The potential positive effects on those with Autism Spectrum Disorder include deescalating a potential sensory overload problem due to light sensitivity, as well as supporting Executive Function skills by assisting with time management by keeping to a schedule which helps regulate the circadian rhythm. By limiting the amount of blue light that an LED screen contains in its color wavelength composition, designers and developers can help mitigate potential adverse reactions that individuals with ASD may experience when interacting with websites or a mobile application.

THE KELVIN SCALE

The Kelvin Scale is a system which measures the composition of different lights. If a light composition projects more yellow, orange, or red, then it will measure on the lower end of the Kelvin scale. On the contrary, if a light composition projects more blue, than it will measure on the higher end of the Kelvin Scale of Color Temperature. Sunlight at 12pm or noon is averaged at 5500k on the Kelvin Scale. If LED screens or any other light sources are equal to or higher than 6500k on the Kelvin Scale, then the blue light composition will be actively disruptive to a user's Circadian Rhythm.

5600k
12pm Daylight

>6500k
Average LED Screen

<6500k
Ideal Screen Measure

Daylight standard on the Kelvin Scale is 5500k, but once it reaches 6500k, it is disruptive. That being said, keeping LED screecn measures at a measurement lower than 6500k will begin to reduce Blue Light emission.

ADDITIVE COLOR

Screens and anything digital use RGB which is also known as Additive Color. Therefore, the brighter a screen is, the more light is emitted.

Lower saturation by lowering the RGB numbers.

✓ DO

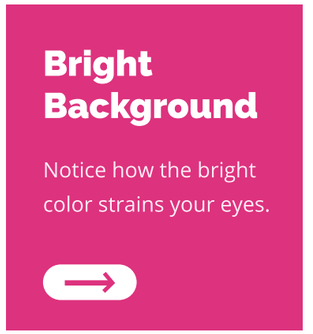
vs.

✗ DON'T

Brightness decreases the white within a color causes blue light emission to be more. Notice in the example on the left, the colors are much more difficult to look at and create a vibrating sensation the longer you look. The example on the right is much easier on the eyes even though the colors are only 15% lower in saturation. The IDAC suggests lowering RGB numbers to mitigate potential overstimulation and Sensory Overload, even if the numbers are lowered by only 5%.

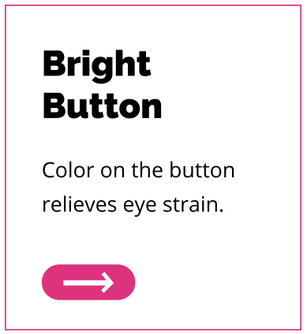
Use bright colors sparingly such as on a button rather than as an entire background.

✓ DO



vs.

✗ DON'T



Notice that the card with the bright pink background and white text creates an over-stimulating, vibration effect due to oversaturation. Although the same pink is used on the right, the minimal use of the pink directs user eyeflow towards the button, but since it is used on a graphic element rather than textual content that needs to be focused on, the pink causes less vibration and disruption.

OTHER RESOURCES

Below are three tools that are available for designers and developers to utilize to measure the blue-light composition of digital LED screens:

- www.Fluxometer.com is a software available to measure the overall light spectral output of screens. There is downloadable software available as well as physical devices that measure.
- Colorimeters are physical machines that developers and designers can purchase to measure blue light composition.
- Spectrometers are also physical machines that developers and designers can purchase to measure blue light composition.

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Contrast

> Provide ample contrast between foreground and background.

INTRODUCTION

Past research has proven that the perception of color variation including shades, hues, and other attributes are all results of light and the make-up of different wavelength frequencies of light. Knowing that sensory issues in Autism Spectrum Disorder can lead to sensitivity to light, it can be assumed that those with sensory perception issues as a symptom of Autism Spectrum Disorder have an atypical perception and preference of color.

Sensory issues may lead to hypersensitivity with light, and therefore color, an assumption can be made that individuals with ASD or related cognitive disabilities may have differing preferences to color than neurotypical individuals. Sensitivity to visual stimuli experienced by individuals with sensory perception issues proves that light and colors that are resulting from high frequency wavelengths can cause stress and sensory overload in individuals with ASD or other cognitive disabilities.

COLOR RATIO

Color ratio, also referred to as luminance, refers to the brightness between two colors. Luminance, or color ratio, is fundamental to the user's ability to perceive content that is on a website or mobile application. Below are the baseline ratios used as a refernce in calculating color ratios for User Interface design.

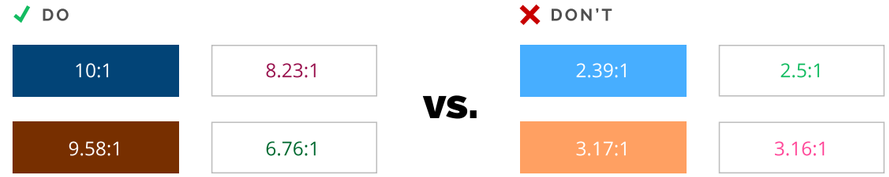
1:1
White on White

21:1
Black on White

1:21
White on Black

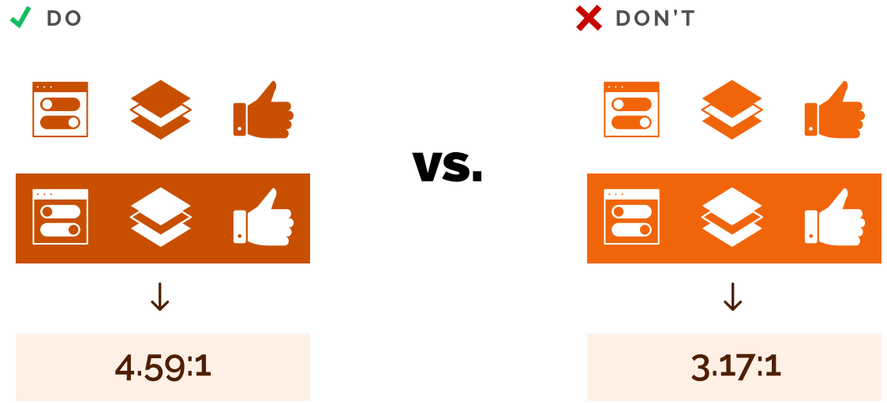
TYPOGRAPHY

To be in compliance with the WCAG standards, the minimum contrast ratio of text or images of text must have a contrast ratio of at least 4.5:1 (or 3:1 for large text). However, in order advance web accessibility to include individuals with cognitive disabilities, the IDAC suggests that all contrast ratios follow a minimum of 4.5:1



GRAPHIC ELEMENTS

The WCAG 1.4.11 states that non-text elements must have 3:1 contrast. These elements include social media icons, regular icons, and anything that does not include text content. Although overly saturated, bright colors may fall within the range of contrast equal to or greater than 3:1, these colors can be over-stimulating for individuals with Sensory Processing Issues.



Notice that although both sets of icons above technically have a minimum contrast ratio of 3:1, the icons on right compared to the set of icons on the left cause a vibrating effect. This is attributed to the saturation of the orange color used. In comparison, the icon set on the naturally are easier on the eyes even though the orange used is only 10% darker than that on the right. The IDAC states that the minimum color contrast ratio for all elements should be 4.5:1.

RESOURCES

For more information on the WCAG 2.0 Guidelines, visit www.w3.org

Below are links to various contrast checker websites that you can use to check contrast ratios between foreground and background colors.

- https://webaim.org/resources/contrastchecker/
- https://contrastchecker.com

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Application

Be intentional with the application of color as a design element.

INTRODUCTION

Due to hypersensitivity and overstimulation that can be attributed to color application in User Interface design, it is crucial to understand the importance of intentional application and utilization of color. Intentional use of color can help mitigate adverse reactions caused by deficiencies in Executive Function and Sensory Processing in individuals with cognitive disabilities. Color is a design element that can make a user's experience with an interface either a success or a failure because color can determine how users comprehend and process content.

COLOR TO CONVEY INFORMATION

Color should never be used alone to convey a message to users. Although color can be successful in communicating certain messages such as an alert or error, it is not a reliant design element by itself to convey a function or message to users. It is important to use color in this method as an enhancement alongside other forms of conveying a message rather than as the only signal of communicating as it cannot be assumed that this message will be clearly comprehended as intended.

✓ DO

Password ⊗

*Password does not meet requirements

The hyperlink is distinguished by color and the underline.

✗ DON'T

Password

The hyperlink is distinguished just by color.

PRACTICALITY FIRST

As mentioned, color as a design element can hinder or assist users in their experience with an interface. Using color for practicality first before aesthetic reasons will help user interaction with a website or mobile application. Limit the potential of disruptive color usage by concentrating on functional requirements (like status states or alerts) first. Then, use color for enhancement purposes to reinforce or balance the aesthetic of the content.

IDAC STANDARDS

Layout & Grouping

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Layout & Grouping

One of the most common impairments that those living with Autism Spectrum Disorder face is challenges with Executive Function. Executive Function is categorized as a self-regulation skill and is one of the key mental processes that enable individuals to plan, focus, remember and process instructions, and manage multiple tasks successfully. Another common impairment experienced by both neurotypical and neurodiverse individuals is called Sensory Overload, or Sensory Processing Deficits, which is most commonly described as hyperactivity to sensory input. Sensory processing deficits can lead to stress reactions which are typically manifested as social isolation and/or aggressive behavior based on low filtration capacity regarding stimuli and/or lack of coping resources within these individuals called Sensory Overload. Sensory overload refers not to the number of stimuli causing the reaction, but to the lack of coping strategies an individual may have.

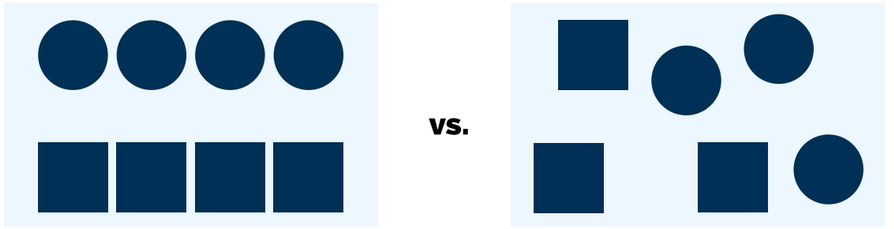
Gestalt Grouping Principles can assist with a user's ability to process information which is crucial in comprehending content. Utilizing Gestalt Grouping Principles while designing digital content can assist users with Autism or related cognitive disabilities by mitigating adverse effects and reactions related to deficits in processing information caused by Executive Function impairments and Sensory Processing Deficits.

Proximity

Create depth and promote function through proper use of figure-ground.

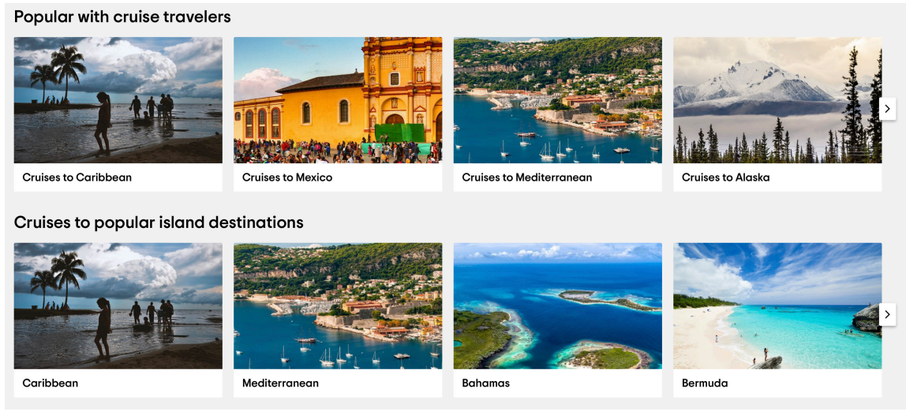
INTRODUCTION

The principle of proximity relies on the design element of space. The human brain naturally groups together objects that are closer together and separates those objects from other objects that are further away. In the left graphic, the circles are close to each other and the squares are close to the squares vs. on the right, the shapes are intermixed and there's no uniformity in proximity. This principle is easy to apply in design because it does not rely on any external force other than the arrangement and space used to arrange certain objects.



ORGANIZING CONTENT

In the screen below from Tripadvisor, the law of proximity works to help separate the two groups of different lists. Notice that the small amount of space in between the cards on the same rows is a much smaller space than that between the two rows. This helps users to visuals group the two lists together rather than just seeing an overwhelming amount of cards repeated. Grouping content into smaller groups such as the example below helps users to fully comprehend large amounts of content on their screen. This directly mitigates deficits in Executive Function as well as Sensory Processing.



TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

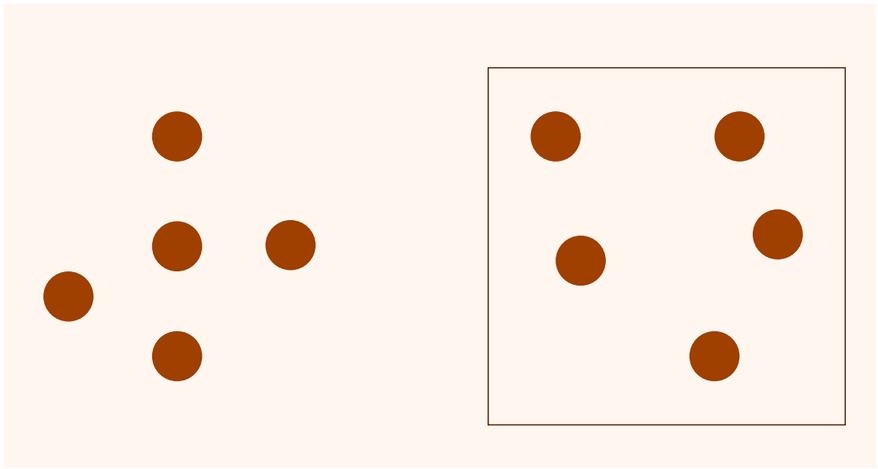
Common Region

Clarify that elements are grouped by creating enclosed regions.

INTRODUCTION

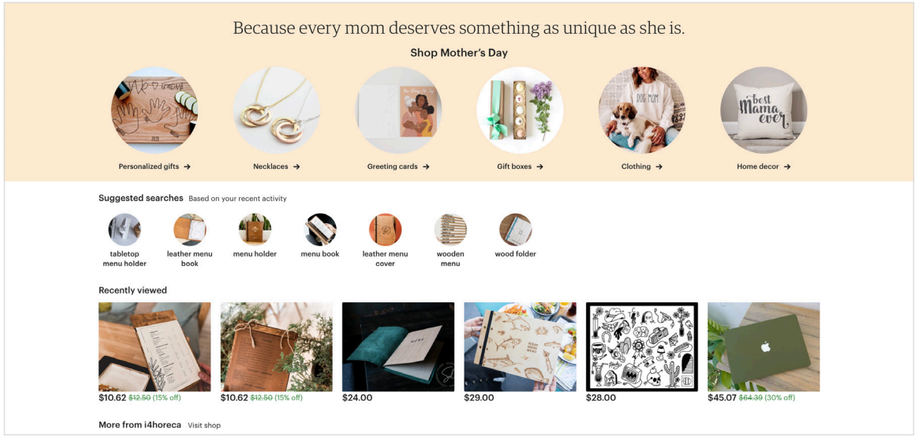
Closely related to the principle of proximity, the principle of common reason implies that individuals instinctively group together objects that are within the same closed region. Objects within these closed regions also appear to be separate from other objects. In other words, items or objects that share the same enclosed region on space, they are perceived as being related or connected to one another.

In the example below, the circles within the box are actually farther apart than those they are not in the box. However, due to the enclosed border around the circles, the circles within the box appear to be more of an obvious group than those that are outside of it.

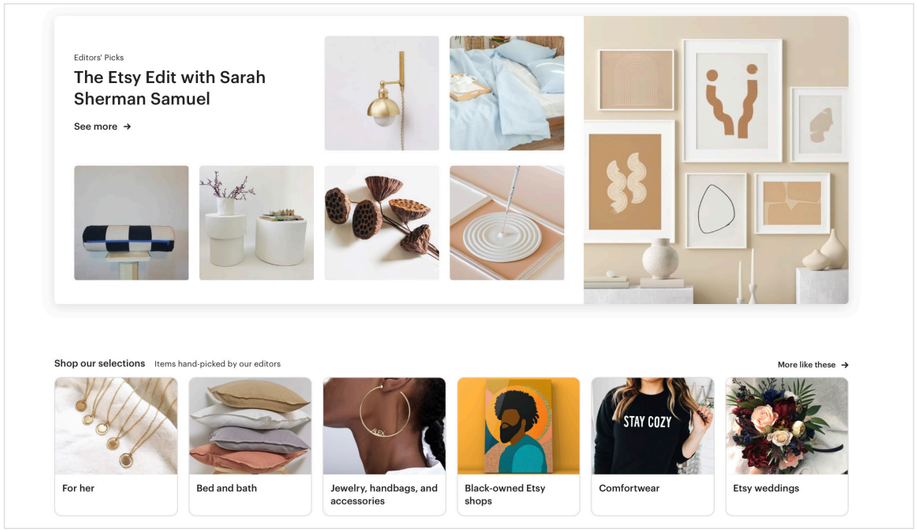


WITHIN DESIGN ELEMENTS

Creating an enclosed region of space around an object is one of the simplest ways to demonstrate grouping to users who may not have fully developed Executive Function skills. The images below from Etsy show three of the most common ways to employ the principle of common region: changing the background color, card with a drop shadow, and borders. Notice in the example below, how the section at the top is distinguishably a different group of content. This is made obvious by the light orange being the background of the section. The change of color as a background not only differentiates the objects as a group, but also directs the user's focus to this area establishing hierarchy.



The image below contains two examples of common region as a means of grouping elements. The first one is the card with a drop shadow. Although the drop shadow is subtle, the card very clearly defines the "Editors' Picks" as a separate group of objects than the other groups of products on the page. Second in this image, the "Shop our selections" group of cards is an example of using a border as a means to group objects. The borders on these images allows for users to easily and quickly identify which image belongs to which category name.



TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Figure Ground

Create depth and promote function through proper use of figure-ground.

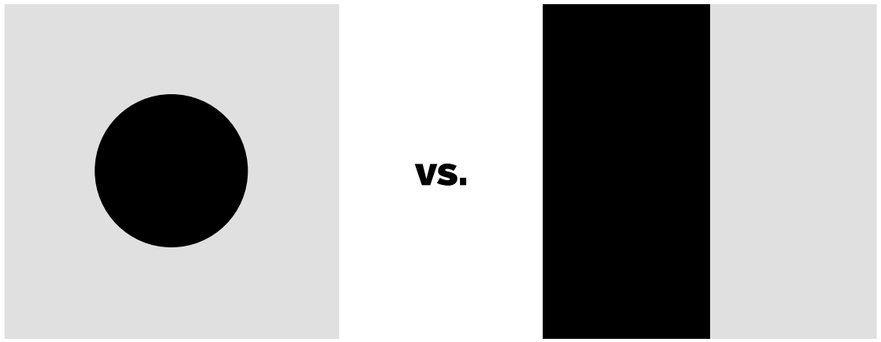
INTRODUCTION

The principle of figure-ground states that individuals instinctively identify an object as being either in the foreground or the background as an object either stands out in the front (the figure) or the object recedes to the back (the ground). Figure-ground can assist users in processing which objects should be focused on and which objects can be ignored. The principle of figure-ground in design can be thought of as the use of positive and negative space.

AMBIGUITY

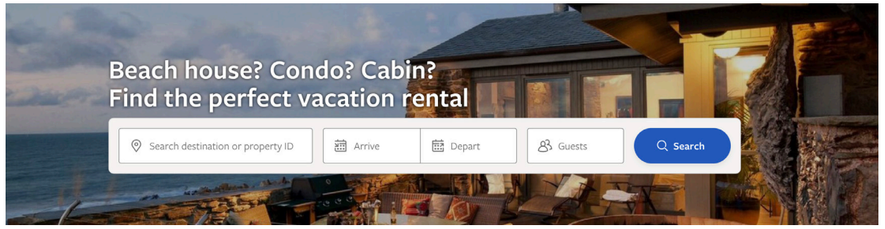
Ambiguous application of the principle of figure-ground versus stable figure-ground is an important concept to comprehend when designing an interface. Stable figure-ground leads users to direct one's attention to a specific element or object. In the example on the left below, the circle holds an individual's focus and attention and the background appears to be unnecessary to pay attention to. This is because of the stability of the full visibility of the circle in contrast to the shapeless background behind it.

In comparison, the example on the right demonstrates the potential for figure-ground to be ambiguous and confusing for users. In this example, the figure and the ground are both equal sizes and essentially reversible. Notice how this perceptual ambiguity causes your eyes to dart and alternate back and forth between the figure and ground. Although this concept of perceptual ambiguity can create interesting optical illusions, this ambiguous nature can create confusion for users.



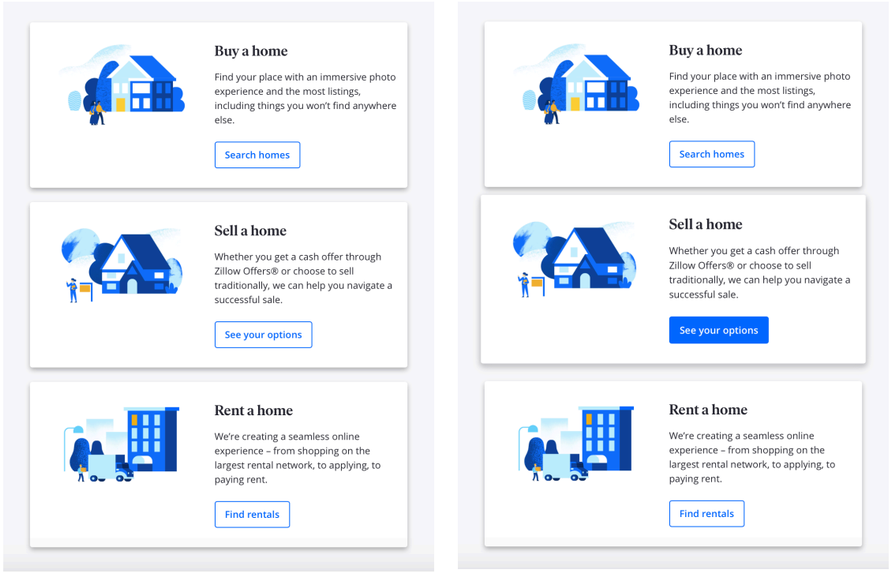
CREATING DEPTH

The figure-ground principle can be used to create the illusion of depth within web design. This implied depth created through the proper use of the principle can assist in directing the user's attention to specific elements on a page. Simply put, figure-ground helps direct, hold, and focus user attention. In this image below, the depth created by the contrast between the white quick search bar compared to the shadowed image in the background. This depth helps to promote the function in the header as well as direct the user's focus towards the focal point which helps create hierarchy.



PROMOTING FUNCTIONALITY

Figure-ground can be used as a means to help users understand the function of an object on a page. The two images below demonstrate the function of the button below. To create a fully comprehensible experience on a site, feedback to users is important. In this example from the Zillow website, when the user hovers over one of the boxes, the user gets feedback through the movement of the box that occurs. Notice that the button becomes inverted and the hovered box appears to move toward the user by increasing in slightly increasing in scale and a more noticeable drop shadow occurs creating a more in-depth figure-ground relationship with the content. This helps the user receive feedback knowing that a correct function is being performed.



TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Similarity

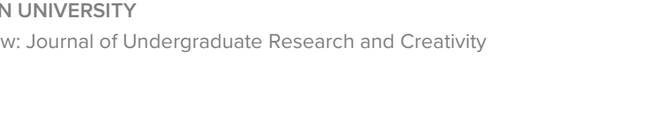
Similar elements help users comprehend functionality of objects.

INTRODUCTION

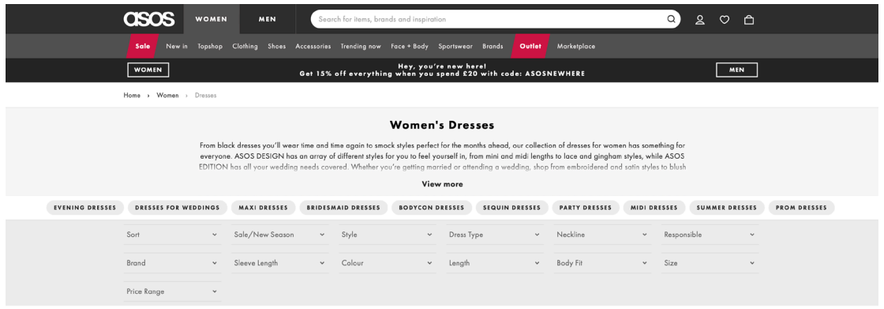
According to the principle of similarity, an individual naturally will group objects together when the individual objects appear to be similar to each other. The most common design elements used by designers to apply the principle of similarity are shape and color. Not only does the principle of similarity assist users in visually grouping together various elements, but also similarity suggests that specific objects perform the same or similar functions which proves helpful for processing digital content and the overall layout of a website or mobile application.

BASED ON SHAPE

In interface design, similar or the same shapes should be applied to elements of the UI design to increase the user's ability to comprehend and process various functionalities of certain objects. For example, buttons often follow a rectangular format or the pill format. When presented with various components or lots of content to process, the human brain naturally wants to group things together to make information easier to process especially when there is a lot of content on a screen. In this example, your brain naturally groups together the circles and the rectangles based on similarity shape since there are no other characteristics to identify groups.



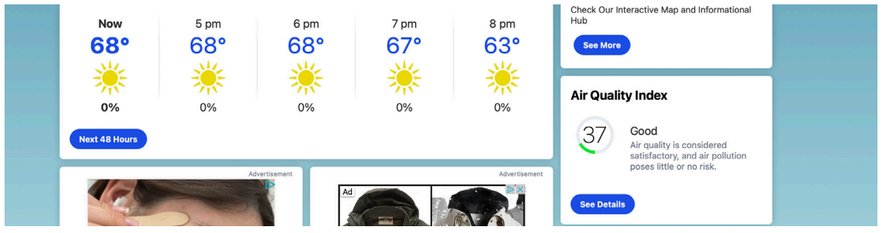
Notice in the image below from Asos that the sub-categories in the pages are noticeably grouped together because of the pill that is consistently used for each one.



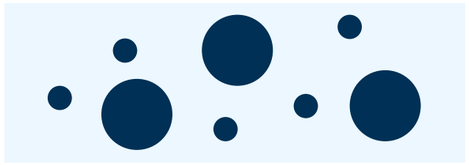
BASED ON COLOR

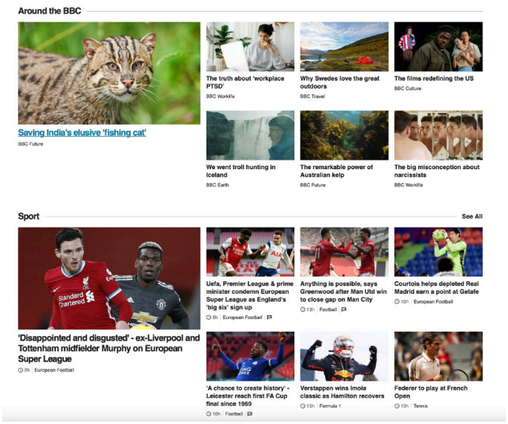
As mentioned, color as a design element can hinder or assist users in their experience with an interface. Using color for practicality first before aesthetic reasons will help user interaction with a website or mobile application. Limit the potential of disruptive color usage by concentrating on functional requirements (like status states or alerts) first. Then, use color for enhancement purposes to reinforce or balance the aesthetic of the content. In this abstract example, color is used strategically alongside using shapes to differentiate based on similarity to assist in the emphasis of the two groups. Color is used to clarify and is not used by itself for aesthetic purposes.

In the example below, the blue buttons are used to highlight the functionality of the buttons. Notice that the same button style and color is continued throughout the web page allowing users to associate the bright blue with buttons. This consistency in the use of color helps users to group together all of the buttons and comprehend the function of a singular element.



BASED ON SIZE





Using similarity in size is another useful tool when using the rule of similarity. In the example below on the left, similarity in size causes the larger circles to stand out and form a group even though they are separated by other smaller circles. This same idea can be applied in User Interface design to create organization through layout.

Each category in the BBC News headlines follows this same format. Notice how your eye is directed to the larger headlines on the right. The larger stories are similar in size to each other which allows users to recognize these as featured headlines standing out amongst other stories.

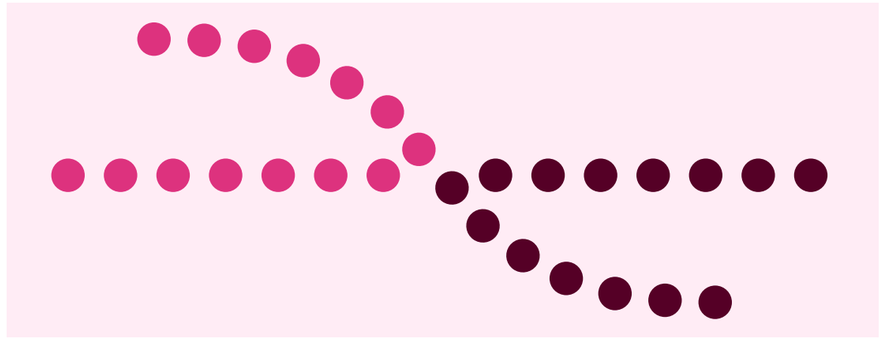
TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Continuity

> Use consistency between elements on a line to direct eyeflow.

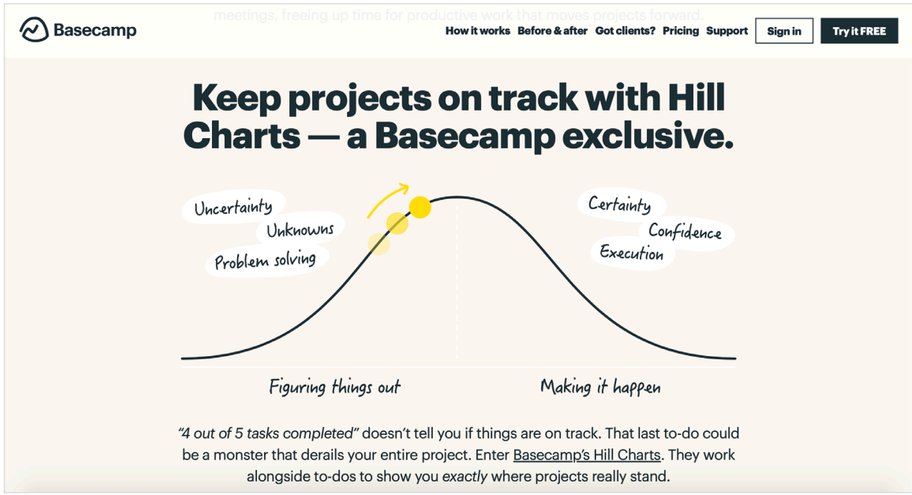
INTRODUCTION

The principle of continuity applies to user eye-flow and refers to the concept that once the human eye begins to follow an object in a direction, the eye-flow will continue until it reaches another object. In other words, objects that are arranged in a continued curve or line are perceived to be related more than those objects that are not arranged in a line or curve. Notice in the example below that your eye naturally follows the curved line even though the colors alternate between the two lines of dots. This is proof that the continuation of the curved line is a stronger visual stimulant of relatedness than the similarity in colors.



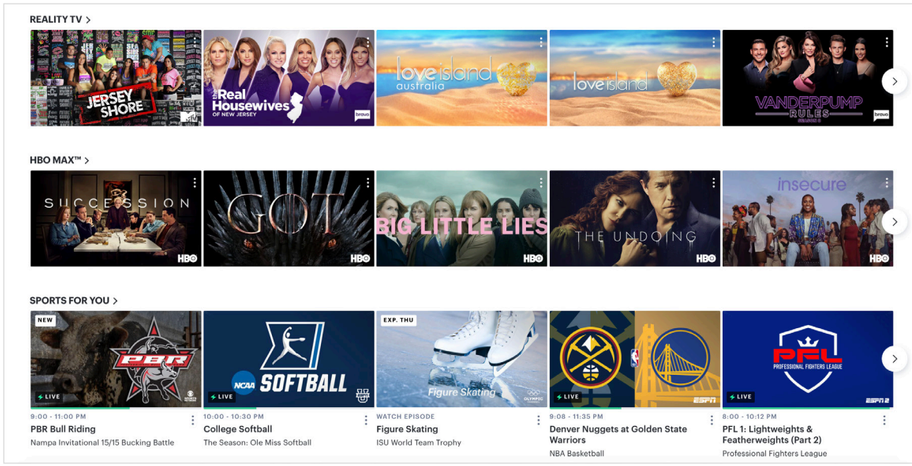
COMMUNICATING INFORMATION

The principle of continuity helps with communicating information to users. In the image below from Basecamp, the graphic is utilized as a tool to communicate the features of the product in a simplified manner. Notice that the description of the features follows the arrow, line, and circles which creates easy eyeflow and comprehension for users.



DIRECTING EYEFLOW

The principle of continuity is fundamental in directing user eyeflow and promoting functionality. In order to properly employ and utilize this principle, it is important to use it as a means to keep consistency of space and alignment between elements to avoid disruptions. It is also suggested that this principle is used to suggest direction and that there is more content to follow if there is. In the example below from Hulu, the consistency of spacing and alignment help to create a horizontal eyeflow for users. Further, the arrow at the "end" of the line assists users in knowing that there is clearly more content within these groups following those on the screen.



TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Focal Point

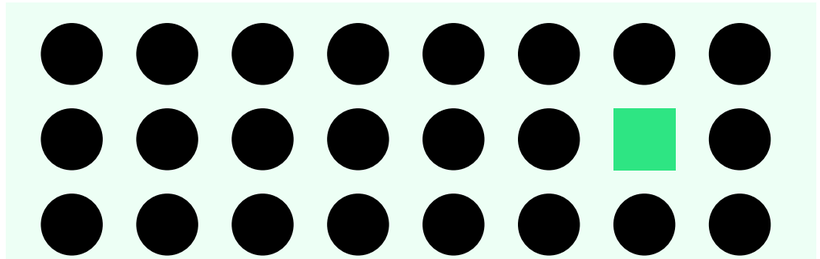
Minimum of 1 and maximum of 3 focal points per screen view.

INTRODUCTION

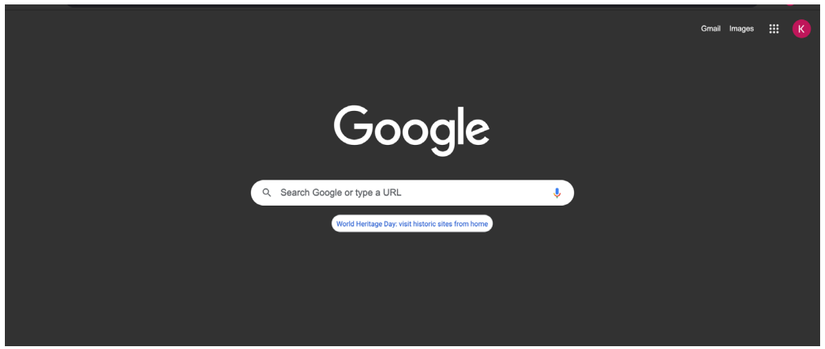
The principle of focal point suggests that when one object stands out from a group of objects as different or the object stands out visually, the human eye will be attracted to this object first and this object will hold a user's attention. When the principle of focal point is employed in website design, this principle can help the users understand what is important on the page and can mitigate sensory over by allowing users to focus on one thing at a time as well as help with Executive Function by visually prioritizing information on a web page..

GOOD USE OF FOCAL POINT

Notice in the image below, your eye is directed to the single green square first. After looking at the green square, your brain continues to process the rest of the information in the composition. This is proper use of the focal point principle.

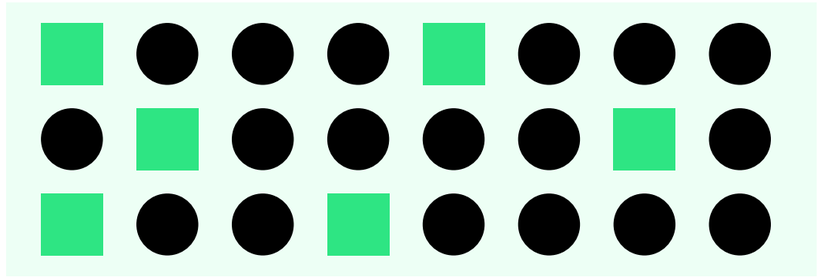


In the image below of the Google search engine, the focal point is clearly the search bar. This example employs multiple Gestalt Principles such as focal point and figure-ground. However, all principles work together to direct the user's attention to the main function of the page. The contrast of the white against the dark background creates a very distinct contrast between the background and the search bar.

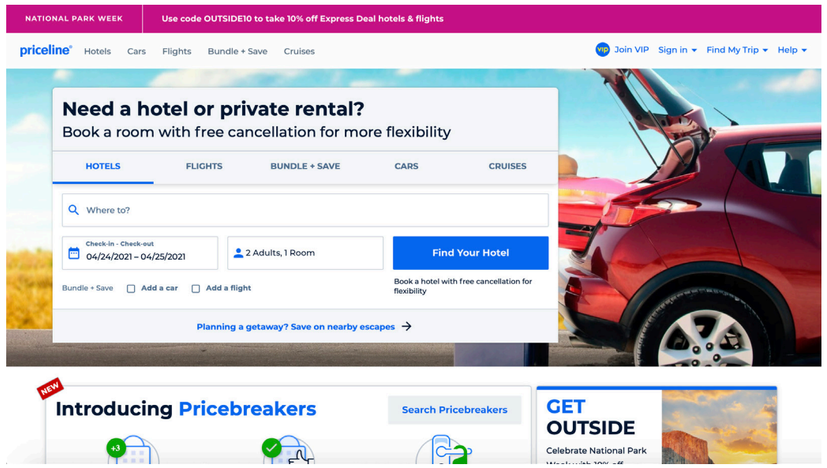


OVERUSE OF FOCAL POINTS

The principle of focal point can be very beneficial to individuals with Sensory Processing issues because it directs the user focus towards one particular thing when applied properly. It is crucial to avoid overusing focal points or this will do more harm than help. Notice in the image below how multiple green squares cause your eyes to dart all over the graphic which is over stimulating even to neurotypical individuals.



Here is an example of a web page with too many focal points. Notice how your eyes dart around the page and never find a resting place. This is due to the overly saturated header image, the lack of negative space on the page, and the multitude of elements with the bright blue color. Further, the addition of the saturated pink banner at the top of the web page is adding another focal point. This is confusing to the users which can lead to sensory overload through making it difficult to identify where to look. Overuse of focal points can also lead to lack of user eye-flow ability which is disruptive for individuals with Executive Dysfunction.



TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Closure

Add additional elements alongside the principle of closure for clarification.

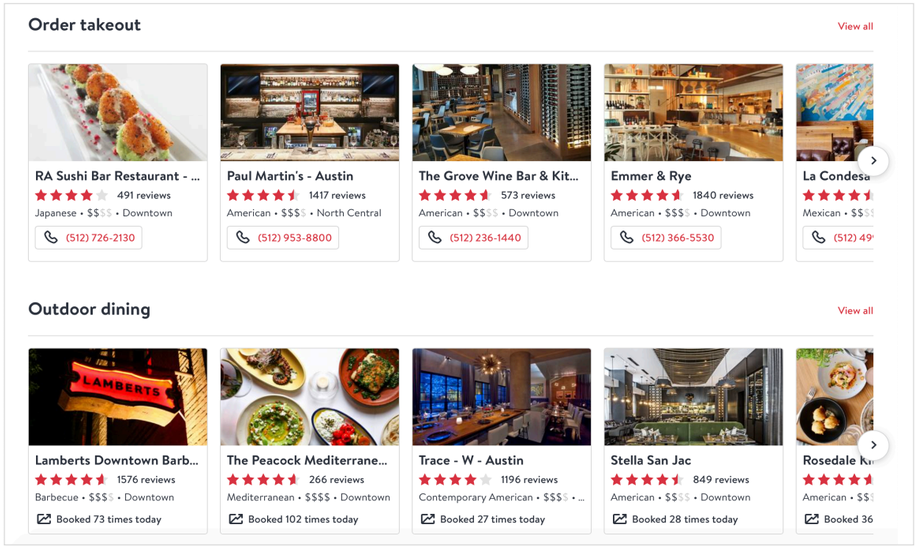
INTRODUCTION

According to the principle of closure, when the human brain identifies a collection of complex objects, it will search out a pattern in an attempt to make sense of the objects. When an individual sees an object or image with incomplete or missing parts, the individual's brain will fill in the blanks in order to complete the image and recognize a pattern.

The WWF logo seen below is a great example to comprehend the fundamentals of the principle of closure. The human brain automatically connects to the fact that the image is a panda even though the image is not complete.

CLARIFICATION

Notice that the card at the right of the screen is incomplete and appears to be cutoff. This is an example of using closure to promote functionality. Users will understand that there is more content following these restaurants in the group. The human brain makes this assumption because the content is abruptly cut off. Common sense tells that there is more content. To make this more obvious to users, it is necessary to add another element to fully communicate the continuation of information. In this instance, the arrow acts as clarification to communicate this.



IDAC STANDARDS

Content Comprehension

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Content Comprehension

Individuals with ASD and other cognitive disabilities tend to have difficulty with comprehending content and visual processing due to impairments in Sensory Processing and Executive Function. Cognitive Load and Working Memory are two components of Executive Function which are reduced functions when an individual has difficulties with Executive Function. Cognitive Load is described as the mental resources that an individual has available to problem solve or complete a task. Working Memory relies on Cognitive Function and is similar to short term memory. Less working memory can affect the user's ability to navigate a website and users with this impairment tend to forget how they got to a certain touchpoint on a website and how to return to other touch-points. Deficits in Executive Function also affects other aspects of mental processing such as: challenges problem-solving which would lead users to abandon a site/task, trouble focusing one's attention on main content or functionality, and challenges with reading comprehension.

Typography

> Use typefaces with simple letterforms to increase legibility.

INTRODUCTION

Typography is a crucial design element that is fundamental in making digital content accessible and comprehendible. Web safe fonts and point sizes of fonts can assist not only those with reduced reading comprehension deficits related to Autism Spectrum Disorder, but also can improve the user experience for individuals with other cognitive disabilities such as dyslexia and other learning disabilities specifically to name a few.

TYPEFACES

Typefaces, also referred to as fonts, are an important design element that can create an accessible and inclusive user experience for individuals with cognitive disabilities. Typefaces with simple characteristics allow an individual's brain to comprehend content easier because the brain recognizes the familiar shapes and patterns created by the text. Complex and fonts that are too decorative create a confusing user experience for both neurotypical individuals and neurodiverse individuals because the complex characteristics of the letterforms require more energy, focus, and overall cognitive function to comprehend.

Avoid typefaces with ambiguous letterforms.

✓ DO

This typeface is easy to read because it is simple.

vs.

✗ DON'T

This typeface is difficult to read because it is complex.

Limit the number of typefaces used across the website or digital experience to promote consistency.

All of these typefaces decrease legibility *and* make it *difficult* to comprehend.

Use appropriate letter-spacing through consistent and clear tracking and kerning.

FONT SIZING

The size of the text and content can drastically improve or hinder the user's ability to understand and process. The smallest copy on a page is typically the body copy. According to the WCAG guidelines, the suggested minimum font size is 9 points. However, to promote full user accessibility, the IDAC suggests that the minimum should be 12 points.

1px = 1/96th"
Pixel compared to inch

1pt = 1/72th"
Point compared to inch

12pt = 16px
Minimum font size

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Hierarchy

Direct user eye-flow by creating defined hierarchy within content.

INTRODUCTION

Individuals with Sensory Overload or Executive Function deficiencies have a difficult time with content comprehension. When a website or mobile application has too much content like text and media, it can provoke adverse reactions in an individual with Sensory Processing deficits. These reactions can lead the user to abandon and leave the website, become frustrated, etc. which creates an experience that is not accessible to those with these cognitive disabilities. Various considerations can be taken to mitigate these adverse reactions and also create an inclusive experience for neurotypical and neurodiverse individuals. Creating hierarchy within a page layout can assist in directing user eye-flow in the intended direction of the page content.

TYPOGRAPHIC HIERARCHY

Typographic hierarchy is a fundamental design element that ensures a user's ability to easily navigate a website, understand what is important, and quickly find specific information. Distinguishable headings, subtitles, and bullet points can assist in a user's ability to discern what is important at a glance. There are four main attributes that can be used to help create typographic hierarchy:

Size can assist in creating hierarchy. Essentially, anything noticeably larger than the body copy establishes hierarchy. However, it is important to ensure that the difference in point sizes is large enough to ensure that hierarchy is established.

✓ DO

Larger Title

Notice how the larger text in this box demands your attention before this paragraph of body copy. This is because the larger font size establishes hierarchy.

vs.

✗ DON'T

Larger Title

Keep in mind how this box does not create strong as strong of hierarchy as the box to the left becuase there is not enough difference in point size.

Weight within font families can also assist in helping establish visual hierarchy. It is important to select weights that have distinguishable differences when using it as the only source of hierarchy in content.

✓ DO

In **this body of text**, the bold text directs your attention to it since it has a noticeable difference in weight styles.

vs.

✗ DON'T

In this body of text, the difference in weights between the fonts lacks the ability to direct your focus because it is too similar.

Contrast in typefaces can establish typographic hierarchy.

✓ DO

Different Typeface

The typeface in the heading helps establish hierarchy because it is noticeably different than the one used on the body copy.

vs.

✗ DON'T

Different Typeface

The typeface in the heading does not establish hierarchy because it is not different enough than the one used on the body copy.

Color can help to establish hierarchy and direct user eyeflow. Keep in mind that the color should be noticeable and due to disabilities that obstruct an individual's ability to perceive color, it should not be the only method used to establish hierarchy.

✓ DO

Different Typeface

This is an accessible way to use color as a way to create hierarchy because it the text is also significantly larger than the body.

vs.

✗ DON'T

Different Typeface

This is not an accessible way to establish hierarchy because it relies on color only to direct the user eyeflow.

TEXAS CHRISTIAN UNIVERSITY
2022 Boller Review: Journal of Undergraduate Research and Creativity

Readability

> Create content that is concise and simplified in style.

INTRODUCTION

Readability of digital content is an important foundational element which will improve the user experience for people with cognitive disabilities. Implementing various guidelines regarding the stylization of text can improve an individual's ability to process content -- specifically those with reduced Executive Function. Another important factor in improving readability is the content itself and how it is written.

STYLIZATION OF TEXT

Things to keep in mind:

- **Left justified text is the easiest to read because it provides a consistent starting place to each line.**
- **Rivers created through fully justified text decrease legibility significantly.**
- **Do not indent paragraphs to signal a start. White space and Gestalt Grouping Principles to separate paragraphs increase readability and comprehension.**

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat. Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur. Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

- **Line length should stay between 50 characters and 120 characters for ideal readability and user eye-flow. If you have lengthier lines or paragraphs, increase line spacing.**

CONTENT

It is important that copywriters, designers, developers, and anyone else involved in the content creating process of a digital experience acknowledge that clear and concise content is a crucial element for inclusive digital design. No two individuals comprehend and understand content in the same manner. It is difficult to set a rule or guideline for how complex or simple text and content should or should not be. However, here are some guidelines to keep in mind while creating content:

- **Be direct and avoid the use of fluff words.**
- **Short phrases and paragraphs are easier for all individuals to process.**
- **Write in a manner that accepts that the audience is intelligent, but do not write in a manner that assumes the user is an expert on the subject matter.**

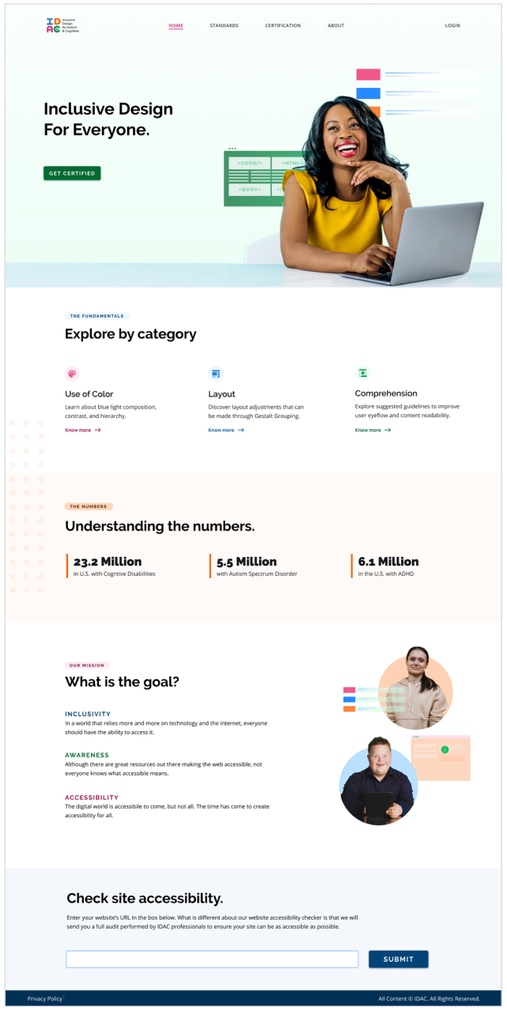
ACTIONS TAKEN

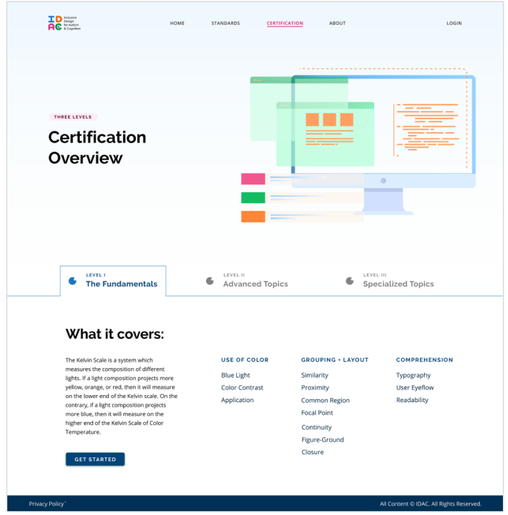
Other Deliverables

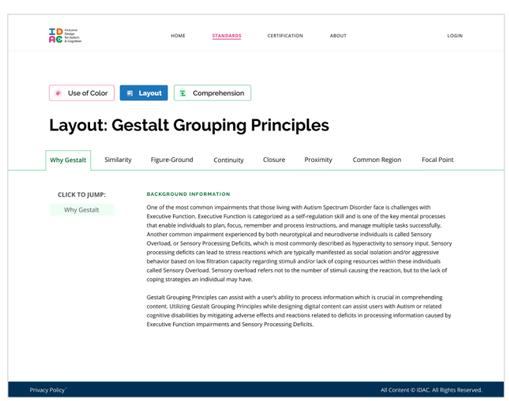
WEBSITE

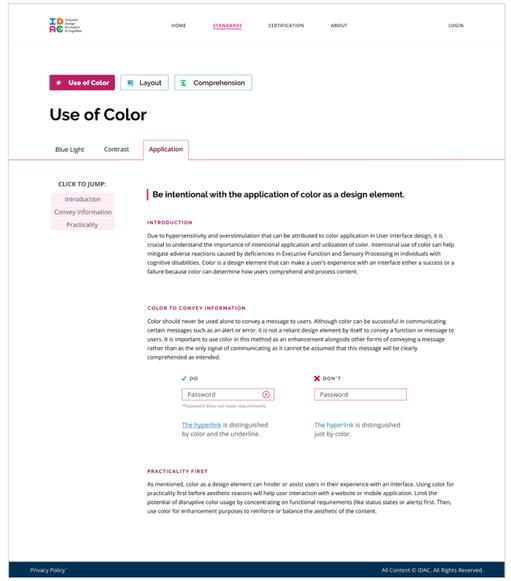
The IDAC website is designed to function as an all encompassing tool for inclusivity and web design. Through the website, businesses, organizations, and individuals can get certified on three levels of the IDAC standards: The Fundamentals, which covers common visual stimulants, Advanced Topics, and Specialties. The specialties certification will allow businesses, organizations, or individuals to craft a course that is crafted specifically to their company or industry needs. Users will also be able to receive an IDAC accessibility audit simply by pasting their website url into a box on the website.

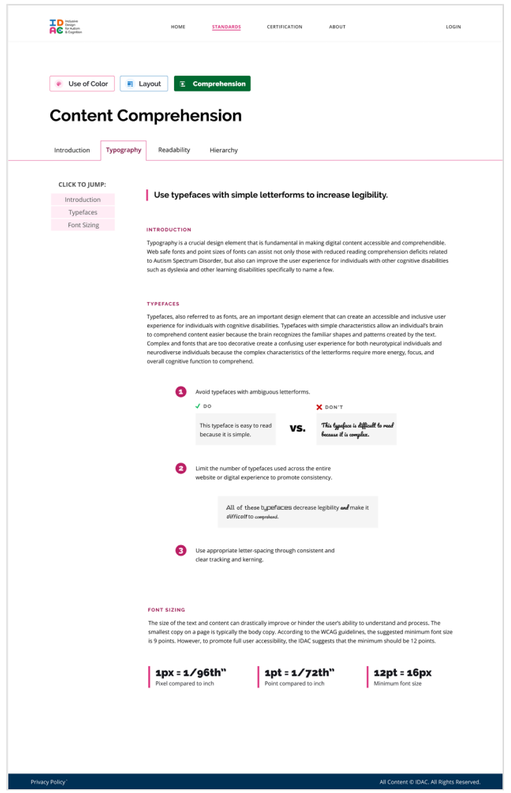
The most important function of the website is to act as a reference guide for the IDAC standards. Users will be able to view the thirteen topics of the fundamental IDAC standards with examples so that designers, developers, and other individuals can ensure they are creating websites that are universally inclusive and accessible for individuals with cognitive disabilities.

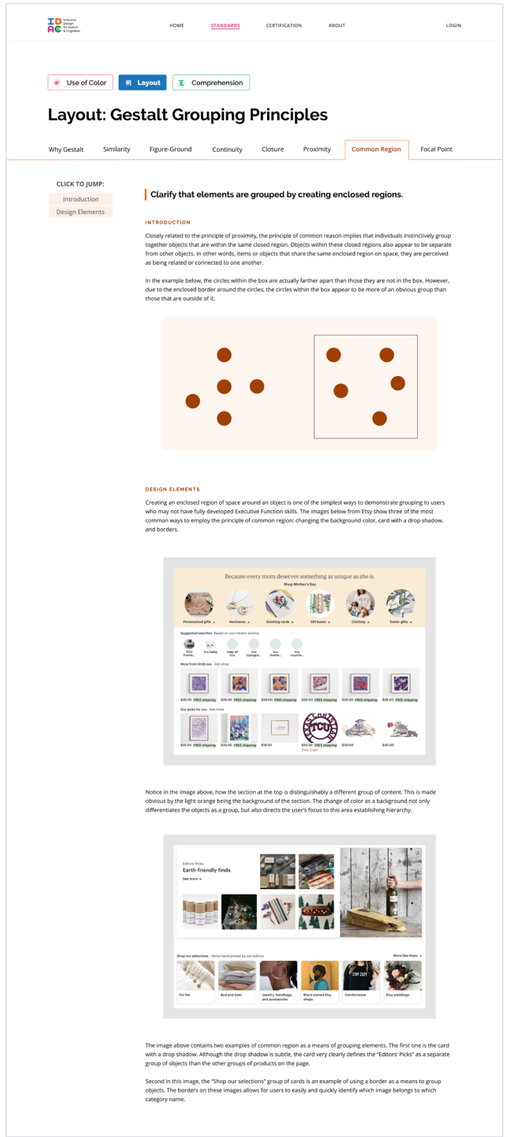






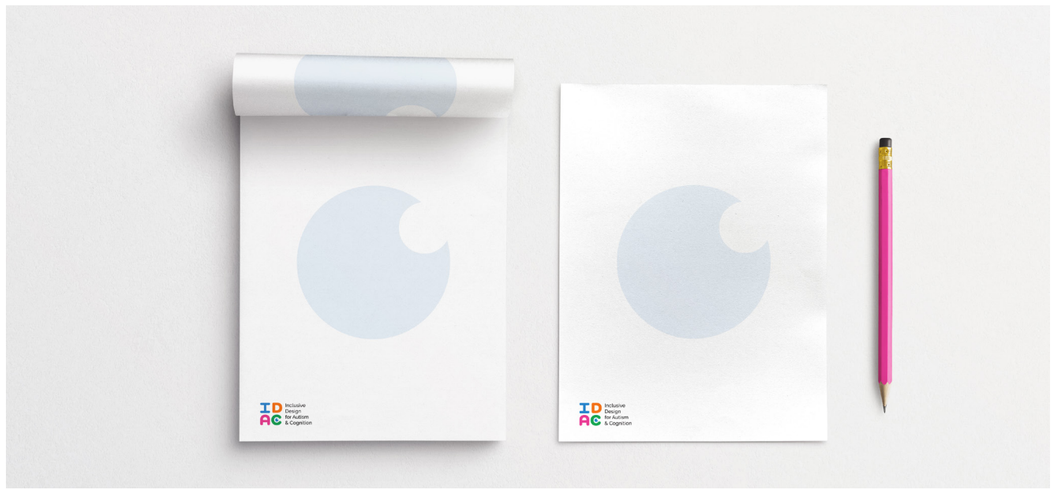






COLLATERAL

To further promote awareness of IDAC, various collateral was developed for promotional uses which will help in spreading awareness of IDAC's mission in creating web accessibility guidelines that are inclusive of all disabilities including cognitive disabilities. Collateral can also build recognition of IDAC as a legitimate organization by creating awareness of the company as well. Pieces of collateral for IDAC includes hats, notepads, and desk calendars.



EDUCATIONAL SPACES

To promote the IDAC mission of awareness and inclusivity, IDAC professionals will present to leaders in the UX and web design industry as well as the organizations which currently enforce ADA Section 508 guidelines such as the W3C and the U.S. Access Board to communicate the need to adopt IDAC standards into current web Accessibility standards. The IDAC organization will provide on-site trainings business and organizations interested in company-wide training sessions on the IDAC standards.

Conclusion

Although current web accessibility standards are robust and encompass a wide range of topics which help with disabilities, there is a gap in web accessibility standards for individuals with cognitive disabilities. IDAC was created to bridge this gap in web accessibility standards. In order to identify these opportunities to improve, common symptoms of Autism Spectrum Disorder and Cognitive Disabilities were identified through extensive research. The branding, collateral, and marketing of IDAC as an organization and the design standards covering thirteen topics were all developed to help close this gap and promote awareness of creating a web accessibility experience that is inclusive to everyone. Regardless of an individual's entry point, everyone deserves to have the same opportunities.

Sources

"About WebAIM." WebAIM: Web Accessibility in Mind, webaim.org/about/.

"About Us." *About Us | Section508.Gov*, U.S. General Services Administration, May 2018, www.section508.gov/about-us.

"Accessibility Training." *WebAIM: Web Accessibility in Mind*, webaim.org/services/training/.

"ADA Compliance Plugin: The #1 ADA Website Compliance Widget: On the Map Inc." *On The Map, Inc.*, 27 Oct. 2020, www.onthemapmarketing.com/accessibly/.

"Autism Spectrum Disorder: Overview." *American Speech-Language-Hearing Association*, ASHA, www.asha.org/practice-portal/clinical-topics/autism/.

"Best Coolers: USA Made Roto-Molded Ice Chests Coolers." Bison Coolers, www.bisoncoolers.com/.

Bölte, Sven et al. "Gestalt perception and local-global processing in high-functioning autism." *Journal of autism and developmental disorders* vol. 37,8 (2007): 1493-504. doi:10.1007/s10803-006-0231-x

Brosnan, Mark J et al. "Gestalt processing in autism: failure to process perceptual relationships and the implications for contextual understanding." *Journal of child psychology and psychiatry, and allied disciplines* vol. 45,3 (2004): 459-69. doi:10.1111/j.1469-7610.2004.00237.x

"Circadian Rhythms Promote Wakefulness." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 1 Apr. 2020, www.cdc.gov/niosh/emres/longhourstraining/wakefulness.html.

"Circadian Rhythms." *National Institute of General Medical Sciences*, U.S. Department of Health and Human Services, 13 July 2020, www.nigms.nih.gov/education/fact-sheets/Pages/circadian-rhythms.aspx.

"Cognitive Introduction." *WebAIM*, Center for Persons with Disabilities, webaim.org/articles/cognitive/.

"Color and Mood." *Products | ENERGY STAR*, Energy Star, www.energystar.gov/products/lighting_fans/light_bulbs/color_mood.

Crane, Laura, et al. "Sensory Processing in Adults with Autism Spectrum Disorders." Autism, vol. 13, no. 3, May 2009, pp. 215–228, doi:10.1177/1362361309103794.

Davis, Robert G., and Andrea Wilkerson. "Tuning the Light in Classrooms." *Energy.gov*, U.S. Department of Energy, 2017, www.energy.gov/eere/ssl/downloads/tuning-light-classrooms.

Diagnostic and statistical manual of mental disorders: DSM-5 (5th ed.). (2017). Arlington, VA: American Psychiatric Association.

Dietz, Patricia M., et al. "National and State Estimates of Adults with Autism Spectrum Disorder." *Journal of Autism and Developmental Disorders*, vol. 50, no. 12, 10 May 2020, pp. 4258–4266., doi:10.1007/s10803-020-04494-4.

"Executive Function & Self-Regulation." *Center on the Developing Child at Harvard University*. (24 Mar. 2020). developingchild.harvard.edu/science/key-concepts/executive- function/.

Franklin, Anna, et al. "Color Perception in Children with Autism." *Journal of Autism and Developmental Disorders*, vol. 38, no. 10, 2008, pp. 1837–1847., doi:10.1007/s10803-008-0574-6.

"Gestalt psychology." *Britannica Academic,* Encyclopædia Britannica, 26 May. 2020. academic-eb-com.ezproxy.tcu.edu/levels/collegiate/article/Gestalt-psychology/36624.

Grandgeorge and Masataka. "Atypical Color Preference in Children with Autism Spectrum Disorder." *Frontiers in psychology* vol. 7 1976. 23 Dec. 2016, doi:10.3389/fpsyg.2016.01976

"Information and Communication Technology (ICT) Standards and Guidelines." *Federal Register*, National Archives, 18 Jan. 2017, www.federalregister.gov/d/2017-00395.

Lai, Meng-Chuan et al. "Autism." *Lancet (London, England)* vol. 383,9920 (2014): 896-910. doi:10.1016/S0140-6736(13)61539-1

"Lighting Color Temperature - Warm & Cool Lights: TCP Lighting Solutions." *TCP Lighting*, 13 Nov. 2020, www.tcpi.com/what-is-lighting-color-temperature/.

McKay, Ashlea. "The Autistic UXer: Designing with and for a Different Kind of Mind." *Medium*, Medium, 9 Aug. 2018, medium.com/@AshleaMcKay/the- autistic-uxer-designing-with-and-for-a-different-kind-of-mind-4fc1ccaf327b.

Mejía-Figueroa, Andrés et al. "Developing Usable Software Applications for Users with Autism: User Analysis, User Interface Design Patterns and Interface Components." 2016 4*th International Conference in Software Engineering Research and Innovatio*n, CONISOFT (2016): 195-203.

"Official Site and Online Store." benefitcosmetics.com/en-us/.

Overview of Testing Methods for 508 Conformance. May 2018, www.section508.gov/test/testing-overview.

Robertson, Caroline E, and Simon Baron-Cohen. "Sensory perception in autism." *Nature reviews. Neuroscience* vol. 18,11 (2017): 671-684. doi:10.1038/nrn.2017.1122

Scheydt, Stefan et al. "Sensory overload: A concept analysis." *International journal of mental health nursing* vol. 26,2 (2017): 110-120. doi:10.1111/inm.12303

"Sensory Issues." *Autism Speaks*, www.autismspeaks.org/sensory-issues.

Taylor, Danielle M. "Americans with Disabilities: 2014." *United States Census Bureau*, U.S. Department of Commerce, 28 Nov. 2018, www.census.gov/library/publications/2018/demo/p70-152.html.

"Test for Accessibility", U.S. General Services Administration, www.section508.gov/test.

"The Color of the Light Affects the Circadian Rhythms." *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 1 Apr. 2020, www.cdc.gov/ niosh/emres/longhourstraining/color.html.

"WebAIM's WCAG 2 Checklist." *WebAIM,* webaim.org/standards/wcag/checklist.

"Web Content Accessibility Guidelines." *WebAIM*, webaim.org/standards/wcag/.

"What Are Gestalt Principles?" *The Interaction Design Foundation*, The Interaction Design Foundation, www.interaction-design.org/literature/topics/gestalt-principle.

"What Is Autism Spectrum Disorder?" *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 25 Mar. 2020, www.cdc.gov/ncbddd/autism/facts.html.

"What Is Executive Function? How Executive Functioning Skills Affect Early Development." *Center on the Developing Child at Harvard University*, Harvard University, 30 Oct. 2020, developingchild.harvard.edu/resources/what-is-executive-function-and-how-does-it-relate-to-child-development/.

Wong, B. "Gestalt principles (Part 1)". *Nat Methods 7*, 863 (2010). https://doi-org.ezproxy.tcu.edu/10.1038/nmeth1110-863

"Virtual Web Accessibility Training." *WebAIM*: Web Accessibility in Mind, 2021, webaim.org/training/virtual/.

"U.S. Access Board - Comparison Table of WCAG 2.0 to Existing 508 Standards." *Home - United States Access Board*, U.S. Access Board, www.access-board.gov/ict/wcag2ict.html.

"1991 ADA Standards for Accessible Design." *ADA.gov*, ADA, www.ada.gov/1991ADAstandards_index.htm.

"2010 ADA Standards for Accessible Design." *ADA.gov*, ADA, www.ada.gov/2010ADAstandards_index.htm.