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Evolving the WCAG3 Accessible Contrast Perceptibility Standard for Maps

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Abstract:

The W3C WCAG2 web accessibility contrast ratio standard has long served as a way for cartographers, web map developers and designers to systematically conform and improve design for an accessible online audience (World Wide Web Consortium, 2008). It is widely used by independent designers and large industry players such as Apple alike (Apple Inc., n.d.; Tickner, 2022). However, map and web designers often misunderstand the purpose and limitations of the standard, believing it as being all-purpose. In actuality, the WCAG2 contrast checker was meant for only one purpose: to evaluate the lightness difference between the coloured text of a certain font size and style against the coloured background (World Wide Web Consortium, 2008). Nonetheless, an overreliance on the WCAG2 contrast ratio standard seemingly took hold as the shortcut to achieve a supposed high accessibility rating. This overreliance highlights the incomplete understanding of perceptual accessibility and the lack of better-tailored tools and resources for achieving higher visual accessibility in design. However, this overreliance also highlights the fundamental importance of inclusive design and accessibility itself as well as the well-intentioned pursuit for a high accessibility rating.

Simply put, inclusive design and accessibility is a fundamental right and a pursuit that benefits all users and is worthy of attention and understanding. Accordingly, the W3C is in the process of developing and drafting the next version of its web accessibility standard (WCAG3) (World Wide Web Consortium, n.d.-b). In WCAG3, the basic contrast ratio check is replaced with a more progressive and advanced Accessible Perceptual Contrast Algorithm (APCA) score (World Wide Web Consortium, n.d.-a). The APCA uses a more progressive lightness contrast (Lc) compliance reference table that considers typeface geometry, colour value (lightness) and other contextual factors (Somers, n.d.; Ulitin, 2023). This shift represents a much-needed evolution in how design accessibility is evaluated.

This exploratory project attempts to develop a custom-tailored expansive perceptibility model meant for evaluating map colour perceptibility. We do so by building on the proposed APCA and coupling it with the CIE CAM02 Uniform Colour Space (CAM02-UCS) colour appearance model. The CAM02-UCS is a colour appearance model that attempts to accurately model human colour perception (Fairchild, 2001). The initial model was introduced by the International Commission on Illumination as an update to the CAM97s model. The model's main focus on perceptual uniformity helps to ensure that colour differences are better consistently perceived by the human eye, regardless of the actual hue, providing a more reliable approximation of colour uniformity compared to other models like CIELAB (Lou et al., 2006). It is especially beneficial for designers who require a colour space that closely matches natural human colour discrimination, making it an invaluable tool for inclusive digital visualizations and other applications where precise colour representation is crucial. In that vein, the integration of CAM02-UCS enables us to directly evaluate map colour perceptibility derived not just from luminance contrast ratios but from a baseline model of human colour perception. Further, with the inclusion of CAM02-UCS, this expansive perceptibility model attempts to incorporate axes of colourblindness as well as primary factors that contribute to the simultaneous contrast illusion problem (Luo & Li, 2013).

Accordingly, we developed this expansive colour perceptibility model into a proof-of-concept Python tool that performs automated semi-randomized spot checks to grade maps' WCAG3 APCA compliance and progressive perceptibility. Users can input a single (or multiple) map image and have the tool calculate an estimated progressive perceptibility index score for the map. The tool works by taking 5 semi-randomized pixel cluster samples from each map and then calculating the progressive perceptibility model score for colours used in each pixel cluster, finally averaging the score into a progressive perceptibility index value for the input map. This progressive perceptibility index value replaces the overutilized and misleading traditional contrast ratios.

This project lays the framework that helps to evolve how cartographers and web developers can think about design accessibility. However, it is important to emphasize that the goal of this project is not an all-encompassing solution to

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achieve universal visual perceptibility and inclusive design. Rather this project marks an important step and evolution towards expanding the avenues towards inclusive design – the particular avenue explored here being visual perceptibility. As we continue to evolve our understanding of accessibility and inclusive design, this framework encourages a thoughtful approach to design that prioritizes inclusivity.

In summary, our project bridges the gap between theory and practical implementation, empowering cartographers to build more accessible and visually engaging maps. We hope that the cartographic community and industry will embrace this evolution and collectively shape a more inclusive digital future.

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