

Colour Design for Crisis Maps

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Abstract:

The importance of maps in disaster management phases has already been well recognised. Timely response and accurate communication are crucial in emergencies; hence, crisis map design needs to be tailored to the purpose (Altan et al., 2010; Kuvezdic and Lapaine, 2014). Crisis events often demand immediate action. Under such conditions, acute external stressors like time pressure can limit users' ability to interpret and accurately process map information, as stress negatively affects cognitive functions and impairs selective attention (Svatonova and Kolejka, 2017; Braunstein-Bercovitz, 2003). One essential aspect of the visual presentation of crisis maps is the strategic design of colour schemes. Colours significantly impact human perception, cognition, and stress levels (Elliot and Maier, 2014; Lubos, 2008), thus affecting the effective encoding and retrieval of map information.

This study explores the impact of colour on user perceptions of crisis maps under stress conditions in a controlled laboratory setting. Conducted in Serbia, the experiment required participants to be physically present. The participant group was predominantly from the Balkans, including Serbian, Croatian, Slovenian, Bosnian, and Bulgarian nationals. Despite their similar cultural backgrounds, participants ranged in education and age from 18 to 56 years. The interpretation of colour symbology highly depends on the cultural background (Adams and Osgood, 1973; Alnasuan, 2016). Given the cultural similarity of the participants, this research exclusively examines colour symbology within the context of Western culture.

Over 40 participants were exposed to mild or high-stress levels through time pressure and negative feedback (Dickerson and Kemeny, 2004). The stress levels were induced using various sources, including audio and visual stimuli and situational procedures (Bushman and Baumeister, 1998; Siedlecka and Denson, 2019). Participants in the mild-stress group were limited by time, with a ticking clock displayed on the screen. The high-stress group faced an additional stressor in the form of standardised false feedback provided by the experiment conductor. A control group without these stressors was included to assess baseline responses.

Six maps were created and organised into three subgroups. Each subgroup contained two maps that shared the same content complexity but were designed with different colour palettes, following best practices from the literature. Since every map element affects the reader's efficiency and accuracy, colour is the only variable in the subgroups, while the remaining map elements are constants (Jiang et al., 2007). The colour palettes used for designing the maps consist of calming (blues, greens, purples) and alarming colours (oranges, reds, yellows).

The impact of the different colour palettes is examined by analysing and comparing participants' response times and accuracy when solving tasks represented in the maps under different levels of stress exposure. In addition to response time and accuracy, a qualitative survey has been conducted with each participant, providing broader insights into colour's impact on an individual's perception. It has been established that specific colours can either reduce or increase blood pressure and heart rate. Understanding whether these effects can benefit users' perception in stressful situations is crucial. The results of this study are intended to serve as a foundation for developing standardised guidelines for crisis map design, ultimately aiding authorities in enhancing community resilience against disasters.

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