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# Many People, Many Eyes: Aggregating Influences of Visual Perception on User Interface Design

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**Abstract**

Many factors influence a user's visual perception of an interface (e.g., culture, gender, visual impairment). In general, interface researchers and designers have considered these factors in isolation, without considering the combined effect of every factor influencing the visual perception of the user. As a result, interfaces have been optimized for single factors (e.g., improving accessibility for individuals with low vision), at the expense of optimizing for the individual's visual perception experience (e.g., considering cultural preferences and lighting conditions while assisting users with low vision). In this workshop, we will begin the process of combining the broad range of visual perception knowledge to create a holistic approach to understanding users' visual perception. The resulting knowledge pool will be used for generating interfaces better suited to the full range of users' visual perception abilities.

**Keywords**

Visual perception research, interfaces, design guidelines

**ACM Classification Keywords**

H5.m. Information interfaces and presentation

## Introduction

There are many differences in how we see the world. Native Welsh speakers, for example, lose their ability to differentiate between green and blue as they acquire the language (4-month old babies can visually differentiate, adults cannot) [6]. Colorblindness affects around 8% of men and 0.4% of women [2]. Gender modulates which designs we perceive as appealing and trustworthy [14]. North Americans are relatively better at ignoring the context surrounding a focal object, whereas East Asians perceive such contextual information first [8].

These differences affect our perception of interface designs and other visualizations, yet two substantial questions remain: (1) How can we provide visual designs that are *equally* usable by everyone? (2) How can we create *personalized* designs that cater to an individual's perceptual abilities and preferences?

Visual perception and HCI researchers have established a large knowledge base about what a user interface should look like in order to cater for the visual perception abilities of specific user groups. Most prior work addressed one factor only (e.g., colorblindness [4], visual acuity [1], artifact size [7], memory [10], depth perception [5], visual search [11], saliency [15], perceptual grouping [13], gender [3], culture [12]). Some work resulted in perceptual models that can be used to adapt interfaces to a user's abilities and preferences [9][1]. However, a person's visual perception is not just influenced by a single aspect of their body or culture or environment or expectations. For example, a female user in East Asia can have different abilities, preferences, and expectations than another female user in the US, even though they

possibly share a similar visual impairment. Likewise, an elderly person might share low spatial visual acuity with a teenager, even though the reason might be age for one of them, and a visual impairment for the other. Our visual perception is influenced by a broad number of factors ranging from variations in our ability to see information (e.g., due to visual impairments), to variations in how we interpret such information (e.g. due to cultural exposure, age, or gender). Because of this, people rarely "see" the same user interface. Instead, they perceive their very own interpretation of a user interface, and this might be quite different from what the designer intended to express, or what conventional usability guidelines would suggest.

This workshop is aimed at defining common ground between the different strands of visual perception research in order to promote synergy and a shared understanding of *how* people perceive today's designs, and how their perception might differ. To accomplish this, we will begin the process of combining the broad range of visual perception knowledge to create a holistic approach to understanding users' visual perception. Our long-term plan is that the resulting combined pool of knowledge will be used to provide design guidelines for generating interfaces better suited to the individual visual perception abilities of the users.

## Workshop Goals

This workshop aims to aggregate knowledge on visual perception research. Specifically, the goals are to:

- Provide a platform to promote a shared understanding of the factors influencing our perception of visual information. After the workshop, each participant should be aware of

other factors, and their respective influence on user interface design.

- Create a network of visual perception that visualizes our understanding. Network nodes will represent factors, and edges will represent dependencies/relationships between factors (e.g., age affects spatial acuity, but also color discrimination).
- Provide a forum for collaboration, and to exchange and discuss information on this topic.

### **Workshop Submissions**

Some of the areas that workshop participants may have experience with include the following:

Factors that influence the visual perception of designs:

- Visual impairments and its effect on design
- Situational impairments (e.g., lighting conditions)
- Influences of cultural exposure on perception
- Elderly users and the effect of age on perception

Effects of these factors on HCI:

- Aesthetic preferences as a decisive factor for user engagement
- Visual cues that lead to more trust
- Usability issues arising because of visual perception difficulties

Adapting to perception abilities and visual preferences:

- Measuring and modeling perception abilities

- Automatic adaptation of designs to perception abilities and/or visual preferences

For this workshop, we invite two types of submissions: technical contributions and position papers.

*Technical contributions* should focus on the influence of one or more factor(s) of visual perception, such as age, culture, gender, impairments, situational conditions, or other influences that change expectations on design. They should discuss (1) the influence of the factor(s) on general information uptake, our understanding of visualizations, or interface design, and (2) how interfaces can be designed to cater for specific user groups. Ideally, authors submitting technical contributions should have worked at the intersection of visual perception research and HCI, but we also invite authors of other research fields that can contribute to our understanding of how people see and interact with information.

*Position papers* should focus on a discussion of possible interactions between different factors, and how user interfaces can cater to users' holistic visual perception. We also invite designers to show examples of their work and discuss where knowledge and improvement is needed, or how their designs have previously catered for a certain user group.

### **Workshop Format**

We will begin this one-day workshop with a networking activity in which we become a human tag cloud of visual perception research. We will tag each other with keywords describing each other's work, and find those of us that have similar tags to form an expert group. In a brief poster session organized by expert group,

each participant will later present his or her work to all workshop participants. After a cluster of poster presentations for an expert group are completed, we will have a short brainstorming session to initiate the process of aggregating the relevant information for all participants.

Information from these brainstorming sessions will then be used to construct a network visualization of the factors that influence human perception of interfaces. Factors will be joined by edges when two factors interact (e.g., age and eye disease both effect visual acuity [1]). This exercise will provide the opportunity to identify interactions between different factors that influence visual perception, helping build common knowledge among workshop participants.

Once this network is created, we will pursue an open-ended discussion about the feasibility of creating user interfaces that consider the user's visual perception abilities holistically, associated challenges and their potential resolutions. We will also discuss how interface design guidelines can be distilled from this collective knowledge.

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