# A Binned-Profile Approach to the Color Blending Problem in Optical See-Through Displays

Author 1*

Organization or School

## ABSTRACT

Optical see-through displays allow users to view both digital content and physical objects at once. In such displays, light coming from background objects mixes with the light originating in the display, causing what is known as the color blending problem. Understanding color blending is important for the broader adoption and the design of digital content on see-through displays. Color blending affects the legibility and color encodings of content and can negatively impact the general usability of AR optical see-through displays. We investigate color blending for improving color preservation, the ability to maintain the original intended color even after color blending takes place. At the heart of color preservation is the capacity to predict how digital and background colors blend for a given display.

In this paper we propose the binned-profile model (BPM) for color prediction and preservation in optical see-through displays. BPM is based on the observation that each display renders colors differently and that background colors are influenced by the display medium before blending occurs. For a given display BPM uses a colorimetric profile of how the display shows colors; with colors binned to a small set of "noticeably different" colors. We validate our model by measuring the accuracy of the predictions against other prediction models (direct model and chromatic adaptation transformations). We then introduce a color correction algorithm and measure its accuracy. We examined our methods using an extensive set of digital and background color pairs, and on different optical see-through hardware configurations. Finally, we elaborate on the usability and design implications of our approach for color preservation.

**Keywords**: Color Blending, Optical See-through Displays, Color Binning, Color Correction, Color Perception.

**Index Terms**: H.5 [Information Interfaces and Presentation]: H.5.1: Multimedia Information Systems — Artificial, Augmented, and Virtual Realities; H.5.2: User Interfaces — Ergonomics, Evaluation / Methodology, Screen Design, Style Guides