COLORFULNESS AND REFLECTIVITY IN DAYLIT SPACES

This research paper focuses on the connection between daylight and color reflectivity in understanding how to optimize reflectance in indoor spaces to improve lighting efficiency and visual comfort. Buildings consume 70% of all U.S. electrical energy production, most of it for electrical light. Therefore daylighting is an important strategy both to save energy and reduce greenhouse gases that cause global warming.

Reflectivity is also important architecturally in the experience of a space.
Given the benefits of reflectivity, why are rooms not typically designed with reflective surfaces? There are several anecdotal reasons that designers tend to use interior surfaces of low reflectivity. Colors that are perceived to be richer such as deep reds and blues; for instance, dark wood finishes like mahogany low reflectivity. Floor coverings that have lower reflectivity are also seen as easier to keep clean. Our aesthetic valuing of deep colors thus conflicts with the high reflectivity that is more effective for daylighting.

Hypothesis: The average reflectivity of an interior space can be increased without changing people's perceptions of the color in the space. This can be tested empirically. Three experiments were designed to answer the question:
"Can we achieve the perception of deep colors while also providing reflectivity?"

The first experiment: Out of twenty-four colors, each group on average correctly evaluated only three colors. All the other colors were perceived to have a higher LRV than they actually had. Most colors in the range of 40%-50% were perceived as having a 20% higher reflectivity than they actually had. This shows that designers tend to overestimate the reflectivity of colors. Colors in the LRV ranges of 0-9% and 90-99% were usually correctly perceived. Obviously these colors are easier to evaluate.

The second experiment: Both 'skilled' and 'naïve' observers perceived a room to be the most colorful room when it was in the reflectivity range of 30%

The third experiment: Despite the actual performance of the Light Reflectivity Value in the color range of seven shades of red, the box with the "Flamingo Dream Pink" was perceived by all the observers to be the most colorful chroma. This result contradicts the assumption that colors with the lowest reflectivity values are the most colorful.

The eye is capable of making separate judgments about color reflectivity. Daylighting is well documented, as is the architectural role of reflectivity, but the connection between daylighting and reflectivity needs to be further explored. Although these are preliminary experiments and results, the implications were felt to be of sufficient interest to continue the work. Multiple personal tests are being conducted, and I will increase the number of human subjects. These results will be evaluated to find a rule for the perception of color, which will lead to design applications for the use of color in interior spaces.

These experiments will aid in the designing of color schemes for building interiors. It is of value for the designer to know approximately the colorfulness and the reflectivity of the space and to be able to anticipate an effect that may be critical to his aesthetic conception.