

Implications

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Color in Office Environments

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Popular Beliefs About Color

In 1666, Sir Isaac Newton raised a triangular glass prism, intercepted a beam of sunlight, and proved that white light is composed of all visible colors of the spectrum. This event initiated a fascination with the qualities of color.

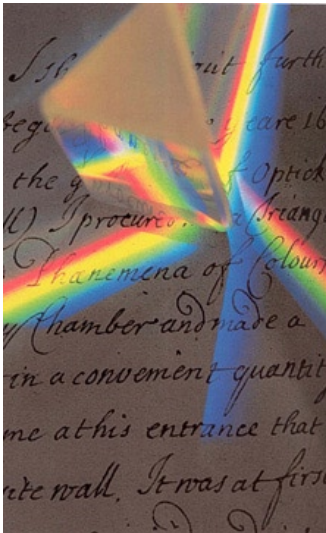
Writings on the effects and fleeting nature of color in art, culture, psychology, and religion are extensive. Just as it is difficult for most individuals to hum middle C without the aid of a piano, it is difficult for one to define an exact color from a few feet away due to the overall context, including surrounding surfaces and light conditions. Like the deep blue of an August sky or the warm glow of a fire, color can be impermanent. It is an element of design that is subject to change based on the natural and/or artificial light in an interior environment, as well as on the surface qualities of materials in the space.

There is extensive writing on the supposed psychological effects of color, such as that red is energetic and aggressive, blue is tranquil, and yellow is uplifting. But numerous myths and preconceptions exist about the effects of colors. Though empirical evidence in this area is limited,

the prevailing view is that warm colors are more arousing than cool colors, that red, and to a lesser extent the other warm hues of orange and yellow, speed up motor reactions and impair the efficiency of work performance. The experimental evidence to support these views is sparse, contradictory, and of limited usefulness in predicting the effect of color in the interior environment on office workers' productivity and mood.

Perhaps the most infamous study on how color can have a positive effect on one's psyche is the pink prison experiment from the late 1970s (Schauss, 1979). According to the study, when inmates in Seattle, Washington, were placed in bright pink prison cells, they exhibited less aggressive traits. The findings became so widely accepted that many prisons in Canada and the U.S. immediately painted their cells the same bright pink color. However, when the same experiment was repeated a couple of years later by a researcher at York University in Toronto, the same tranquilizing effects were not detected. The new conclusion was that the novelty of the color change generated the less aggressive effect.

Yet, the popular notion about the soothing effect of pink persists. In the 1990s, a major university sports team painted the visiting team's lockers pink believing that



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the color would inhibit the opposing players' aggressiveness. A few years ago, England jumped on the bandwagon by painting their prisons pink (Sample, 2003). And, as recently as October 2006, a popular news source described a sheriff of a small (five prisoner), 100-year-old, Texas jail who dyed or painted everything pink—uniforms, shoes, towels, interior walls—to humiliate his prisoners and discourage their return to the jail.

These findings are questionable; many of the notions about colors making people feel calm or depressed are outdated. Although color is an integral part of design, very little empirical evidence exists to support some of the popularly held ideas about the effects of color on task performance, worker productivity, and human psychology.



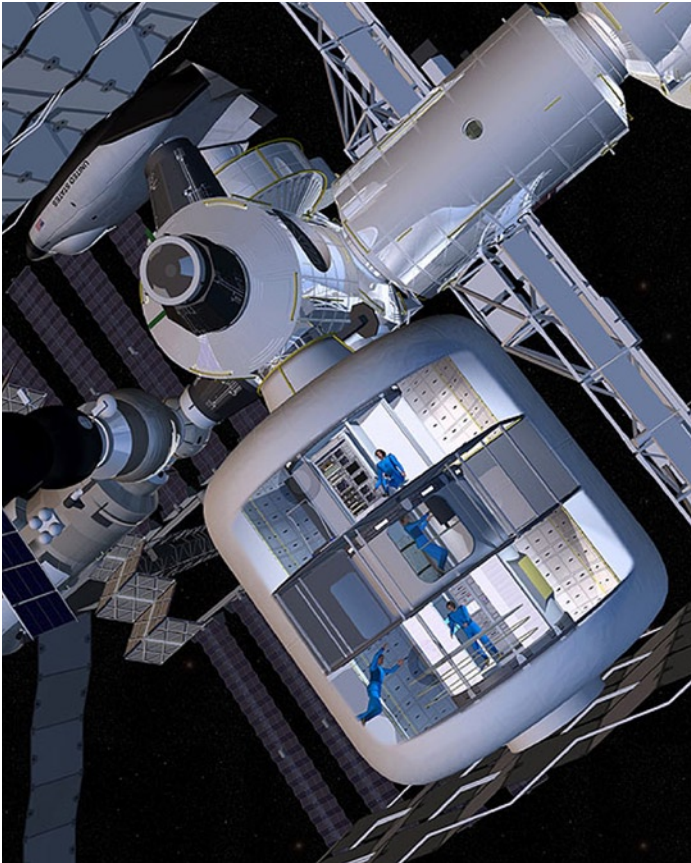
Does pink reduce aggression?

A Body of Color Research

The realization that individuals exist within enclosed structures for most of their lives has become increasingly important. Creating office work spaces that are inviting, uplifting, and energetic is a worthy design goal. Designers need to understand how spaces affect individuals so they can design spaces that counterbalance the chaos and stress of everyday life and create environments of personal well-being.

The research presented here was undertaken with the goal of understanding more fully how color within the work environment affects occupants. Over the last 15 years, in a series of experiments, a body of work has been developed from a number of studies in closed office spaces to determine the possible effects of color on worker well-being, productivity, performance, and satisfaction (Kwallek, 1988; 1990; 1996). Several phases have involved workers performing various office tasks (e.g., typing, proofreading, answering the telephone, filing) and then methodically testing the effects of various office colors and color schemes on the workers.

One objective has been to predict which colors or combination of colors enhance worker performance and well-being in confined office spaces. Lessons about confined spaces, which are part of daily work on earth, are also relevant for astronauts on long-term space flights in the habitation module of the International Space Station (ISS), as well as for the projected inflatable habitation module used when NASA travels to the Moon and/or Mars. Traditionally, NASA has only used white for the interior of any of its habitation modules. With significant findings about color, NASA may be more amenable to greater variation in the color palette within its confined habitation module.



Interior view of proposed Moon and Mars Transfer Habitation Space Module ISS, NASA.

A Groundwork Study

Impact of Three Color Schemes on Worker Performance and Mood Relative to Individual Environmental Sensitivity

Background

This following research, supported by Interface Flooring Systems, Inc., BASF Corporation, and the International Interior Design Association (formerly the Institute of Business Designers), took a broader approach than previous research to the question of color in the work environment.

Most color research has studied single, bright, monochromatic colors with subjects having only limited exposure to color in an actual environment. Because the effects of interior colors on workers would have differed substantially if office workers had been tested for longer periods of time, it was decided to investigate workers over a full eight hour workday for four consecutive days (Kwallek, 1997). Since a combination of colors forming a color scheme within the office might generate different results than what a single vivid color might generate, it was decided to use more realistic variation in color to represent what might be found in actual offices. Furthermore, contrast of value, saturation, and the interrelationship of adjacent colors are what office workers perceive. Such color dimensions and their relationships within the environment may be more important than the color itself.

In addition, few researchers have considered differences in individual responses to color and light. Individual differences in the ability to screen out irrelevant stimuli may interact with how different colors affect an individual's mood and performance. Researchers suggest individual differences in arousal response (i.e., an activated response to the environment that causes physiological changes) may be the central reason why individuals respond to the environment in a particular way (Mehrabian, 1976). Studies have found that some individuals are more easily distracted by irrelevant stimuli, leading to decrement in performance. Other individuals actually improved their performance on task when irrelevant stimuli were introduced. These differences may be associated with an inability to automatically screen out less important stimulation. Individuals who are most adept at screening out the less relevant stimuli of their environments are referred to as high screeners, while individuals who typically cannot screen out incoming stimuli are referred to as low screeners.



The three office color schemes employed.

Color Selection

Several years ago, NASA funded an extensive review of literature on color to determine which colors and color combinations would create the most seemingly spacious, pleasant, and productive environment for the habitation module. NASA's research findings informed the selection of the office colors we tested.

The quintessential office color is white and in a prior study the workers were less productive in a white office than in any other office color; therefore monochromatic white was selected as one of three office color schemes to be examined. Also, a monochromatic white office was of interest for the additional reason of informing NASA of the effects of white on worker productivity and mood over a long period of time in a relatively confined space.

For a second office, a predominantly bright red color scheme (contrasted with medium blue-green) was selected as a color scheme because it has frequently been associated with negative effects. From summaries drawn from NASA's report, it was predicted that an office color scheme with the largest surface area of a vivid color would create an environment which would seem more confined, unpleasant, and less conducive to productivity.

Conversely, a third office employed a predominately light pastel color scheme for the room. The intention was to test NASA's prediction that productivity would

be enhanced and the worker would believe the room to be pleasant (in contrast to the red office). The colors were selected based on NASA's conjecture that the largest surface area should be high in value (light), low in saturation (dull), that the second largest area should be medium in value and saturation, and, finally, that the trim and accents should be high in saturation (bright) and either high or low in value (light or dark). Thus, a light blue-green office was chosen for comparison of a predominantly cool color scheme with a predominantly warm color scheme. Also, literature citations on color preference indicate that office workers prefer a light blue-green office color (Brill, 1984, 1985).

The purpose was to determine the effects of these three color schemes on mood, speed in performance of clerical tasks, and accuracy on proofreading clerical tasks administered to office workers. The effects of the color schemes were examined for 90 workers taking into account individual differences in environmental sensitivity (high screeners vs. low screeners).

Findings

Workers in the red office reported higher negative mood characteristics compared with workers in the blue-green office. However, when considering screening ability, greater negative mood aspects were reported for low screeners compared with high screeners in the red and white offices. Possibly the starkness of the white office (lacking contrast) was more

disturbing for low screeners than high screeners who could more easily ignore the starkness of that office.

Low screeners were less productive in the red office than in the blue-green office. On the other hand, high screeners were more productive in the red office than in the blue-green office. An explanation for this may be that as an individual's level of arousal increases, so does performance. If red is inherently arousing, then high screeners may perform better than low screeners in the red office while low screeners may feel overwhelmed and their performance may subsequently deteriorate. By contrast, if the blue-green office environment is inherently more relaxing, then high screeners may not experience enough arousal to reach a high level of productivity.

In examining the effects on productivity of the three different color schemes, the results suggest that color scheme alone may not have a discernible impact on productivity. By themselves, the three different color schemes did not impact productivity differently. Only when individual differences in the ability to screen irrelevant environmental stimuli were taken into account did the color schemes exhibit a differential impact on productivity.

Future

This groundwork study helps determine how color might affect people's mood in the workplace and if mood affects their productivity. The findings suggest that color scheme alone may impact mood. Surprisingly, though, mood and productivity were not related to each other, suggesting that the impact of colors and stimulus screening on both mood and productivity are independent. No link was found between worker mood and worker performance. Positive mood characteristics did not lead to higher productivity. A prevalent assumption in studying employee performance is that the employee's mood is related to productivity. However, the results did not support this notion, which could have implications for workplace design.

The impact of color on a given individual's mood may not be relevant in maximizing performance.

Furthermore, individual screening ability may influence how people experience the color of a particular interior. These results may indicate that individual characteristics should be examined more closely to understand the impact of various colors on an individual's experience. An important implication for the future is that employers may need to be more concerned with screening employees for similar relevant characteristics. Creating a one-size-fits-all ideal interior environment for individuals with differing characteristics may be impossible. Alternatively, interiors could be designed with maximum flexibility to allow for variations within the same general space according to each individual's characteristics. Each study is a short step toward finding answers, and each might lead, in some small way, to protecting the long-term well-being of office workers.

About the Author



Nancy Kwallek, Ph.D., is professor and director of the interior design program in the School of Architecture at the University of Texas at Austin. She holds the Gene Edward Mikeska Endowed Professorship in interior design and received her doctorate from Purdue University. Dr. Kwallek has been studying the psychological effects of color in the interior environment and the effects of color on office workers' health, well-being, performance, and job satisfaction for over 15 years.

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Related Research Summaries

“Color Appearances in Rooms”

—*Color Research and Application*

“Color and Scenic Images in Workspaces”

—*Journal of Environmental Psychology*

“Color Aids Wayfinding for Young Children”

—*Early Childhood Education Journal*

“Effects of Office Color Scheme on Workers”

—*Color Research and Application*

“Impact of Office Workers Having Environmental Control”—*Journal of Environmental Psychology*

“Mood and Performance Associated with Office Color”—*Color Research and Application*

“Color, Meaning, Culture, and Design”

—*Journal of Interior Design*

“Improved Productivity Through Office Design”

—*Building Research & Information*

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