

# A Meta-Analysis of Color Effectiveness in Designed Environments

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**Abstract:** *What constitutes “color effectiveness” in built environments? To address this question we developed a Meta Analysis of color in built environments reflective of color evolution across history intent and application. From early notions of color as enabler of navigating the physical and social environment, color has evolved into a conscious tool used to maximize diverse interests, including enhancing productivity, fostering healing and manipulating desire. Once culturally contextualized and geography dependent color now addresses cross-cultural needs and is influenced by technical advancements that dramatically alter its use and perception in what is becoming quasi-universal man-made environments in global markets. We examine color use in a cross-section of environments: work, education, healing, and retail and hospitality typifying the effectiveness goals that color attempts to support in each of these settings, and proposing a framework to assess color intent usability and efficacy.*

**Keywords:** *color, pattern, harmony*

## 1 Introduction

A comprehensive literature review was conducted to identify the state and strength of knowledge regarding the role of color in healing, learning, retail, hospitality and working environments (workplace and learning environment to be presented here)<sup>1</sup>. While the notion of color impact enjoys tremendous appeal, the limited empirical research on the subject portrays ill-supported and inconclusive evidence

that color actually *does* matter. This discrepancy between collective wisdom and scientific perspective on color effect is intriguing and begs questions regarding the conceptualization and methodologies employed for researching color. Interest in the topic of environmental design and specifically the effect that color might have in such context has grown steadily over the years in the field of environmental psychology. Environmental psychologists studied physical environments and their effect on human emotions and behaviors such as work performance or social interaction [73]. At its early days, environmental psychology was nothing more than an intuition-driven, small-scale research program. As [85] commented, as a field, environmental psychology suffered from no conceptual definition or adequate theory. Yet with the years, this area began to attract considerable research attention. For example, in studies of hospital environments, patient recovery rates, social behavior, and sense of well-being have been discussed as functions of special arrangement of patients, architecture, room decoration and furniture arrangement [50], [84]. Such works and many others [10] [13][20][55][58][60][81], Pritchett argued for psychical or social stimuli in the environment that directly impact the emotional state of a person, thereby influencing his responses to and behaviors in it [84].

Mehrabian [72] turned first to studies of perception identifying basic emotional responses to environments along three dimensions: pleasure-displeasure, degree of arousal, and dominance-submissiveness. Such a finding was powerful in that it presented emotions as the common denominator of response to environments relevant both to any aspect of environments and to most aspects of human behavior. This significant breakthrough gave researchers an anchor on which to build the argument for environmental impact; it legitimated the interface between design and psychology; and it brought to the fore the question of how to design for desired emotionality and, several decades later, the question of how to design for experience given that most experiences are (also and mostly) emotional. Within that context, the search for design levers led some to identify *color* as the most appropriate design lever to attract and affect emotions [73].

Our inquiry mapped considerable volumes of literature pertaining to working, healing, and learning environments for the possible role that color might play in these contexts. While reviewing the various works, it occurred to us that in order to understand the value color brings to these environments, we also must understand what constitutes “effectiveness” in these three different contexts—what effectiveness means for healing, learning, and working. We therefore also reviewed literatures that discussed the current state of knowledge pertaining to this question.

## 2 Working Environments

a. **Overview:** Most of the literature in this area begins with the presupposition that the world of business is changing and so is the way we work; yet most of the work environments in which we perform our jobs have not made the necessary adjustments to reflect these contextual changes [5][11][17][29][82][92]. Researchers discuss, and at times debate, the relative advantage and/or relevance of open versus private spaces [18][37][61][66][68][104]. It is believed that both open and private spaces are required and their usability is largely contingent on the type of task performed. The literature further discusses workplace elements identified as essential. These elements include accessibility to resources, knowledge and ideas; privacy for individual work; emergent interactions to foster exchange; the appropriate integration and use of technology; and, flexibility and configurability of furniture to support collaboration [3][5][6][7][8][15][64][98][105][106].

b. **Color:** Research on color in work environments is very limited in volume and contribution. For example, effectiveness was tested under different color conditions in three studies only to generate inconclusive and at times contradictory findings [36][62][63]. In another set of studies, subjects were surveyed to identify color impact opinions [2] [9] [96] again no conclusive results emerged as to the perceived impact of color. The literature describes in broad terms cases where companies redesigned their office environment using muted, bright and/or corporate colors but provides no further specification of color notation used and/or effectiveness measurements employed to trace the potential impact of certain color selections [4][56][70][94] [100][108]. These descriptive accounts provide only limited insight into the actual power of color. Furthermore, while the empirical research on color impact is limited, the majority of accounts reviewed were classified as "commentary" and lacking rigor (for example, [77][78][103][107][109]).

c. **Effectiveness:** Together with the empirically oriented literature, many commentaries were noted describing real-life cases, primarily throughout the 1990s, where companies redesigned the work environment (mainly their headquarters) to enable and/or support strategic change [18][22][23][31][37][54][56][66][74][76][89][94][102][108][114]. These accounts show a growing recognition of a workplace as a strategic lever yet no metrics were offered to evaluate effectiveness of such redesign efforts.

d. **Critical Analysis:** While the increasing awareness of workplace as an important enabler of strategic change and adaptation is evident by the growing number of studies and redesign efforts of companies' headquarters, most of the work attends to the functional and instrumental aspects of work; less attention is given to the symbolic and aesthetic of the workplace environment, and the roles color might play in achieving effective workplace design. Challenging issues, such as

measurements of effectiveness and design for experience, are largely neglected. Moreover, the research methodology itself is not growing in sophistication to enable studying more complex, intangible issues. Very few research works venture to fields outside of the design and architecture domains to integrate diverse knowledge bases into a comprehensive workplace design perspective. Rarely does research in this area leapfrog the present to deal with future challenges with the exception of ASID Workplace 2020 research program [5]. Furthermore, most of the research conducted is descriptive rather than prescriptive.

### 3 Learning Environments

a. **Overview:** The literature on learning environments is geared heavily towards discussing learning effectiveness concepts and methodologies [26][27][28][33][45]. Only a side stream within this literature is focusing on the physical environment (also referred to as visual environment) and the role it may play in supporting or inhibiting learning [30][34][47].

The term “design” is often used to describe structuring curriculum choices and learning experiences; that is, the conceptual arena for learning [99]. Researchers describe a shift away from traditional frontal instruction methods to collaborative methods of learning that are experiential, interactive, activity-based, peer-supported, and emotionally and cognitively engaging where immersion and exploration are promoted [33][35][51][59]. The literature is descriptive more so than prescriptive and speaks in a preliminary and tentative tone (for example, the works of [71][75]). Discussions of environmental design often center on issues such as the effects of size, shape and scope of learning spaces, acoustical and thermal qualities, illumination and view conditions, and the activity type that the environment enables, specifically as it pertains to collaboration, privacy, versatility, play, and exercise [79]. Most of the empirical work samples elementary school children with only few accounts using college students [91]. Little or no attention is given to adult learners in advanced age groups.

b. **Color:** Color is identified as a promising area for research even though only limited research has been conducted on the subject of color impact on learning [14][25][38][39][40][44][48][86][88][115]. Color in classroom environments is assumed to generate emotional experience, which may or may not support/enhance learning. Teachers believe that color enhances classroom learning [95] and facilitate memory [1]. Environments that generate approach-behavior are assumed to support learning. Such environments are positive also because of the way they were designed, hence the potential role of color. Other works focus on the functional role of color as embedded in the classroom walls suggesting that colors of these walls should complement the functional role walls serve to display various communications and students’ works. Children displayed emotional

associations to color with a tendency to associate positive emotions with bright colors, especially girls, and negative emotions with dull ones [87]. Girls also desired and were able to process a greater color variation than boys but this finding was refuted by another study [25][39]. In one instance, it was found that negative mood was affected by the task while positive mood was affected by environmental variables [40]. The limited volume of preliminary research on color's impact on learning and the different voices and conflicting findings leave much room for thorough investigation.

c. *Effectiveness*: Researchers often reference the works of Piaget, Gardner and, more recently, Vygotsky's Constructionism approach as theoretical anchors [51][95]. These learning theories differ in their perspective on how learning occurs, whether by internal cognitive process or by social interaction. These two views have important implications for both teaching and environmental design considerations and effectiveness. For Piaget and Gardner, psychology of cognition and emotion serves a critical role: positive emotions that generate engagement, interest, and support creative thinking, secure states of mind that allow exploration with no fear of failure [14][75][79], order that foster cognitive processes of clarity and sense making [40][83], variety that stimulate thinking and innovativeness [87], and concentration and immersion that enable understanding [28]. Still Vygotsky's Constructionism approach presupposes that learning emerges through a sense-making dialogue between the learner and his environment [33]. As such, the social and visual contexts in which learning takes place become critical enablers or impediments of effective learning. Specifically, collaboration with others through teamwork, brainstorming, and peer-to-peer learning is regarded as essential [75].

d. *Critical Analysis*: Discussions regarding learning environment design are descriptive and, for the most part, express practitioners' experiences rather than evidence based insights. Similarly, the notion that color in classroom enhances students' learning performance is for the most part assumed but not substantiated in empirical research. There seems to be an inherent and interesting connection between designing environments for learning and designing for creativity. While learning literature does not differentiate between learning as acquiring existing knowledge and learning as generating new knowledge, the principles outlined as necessary for learning from social to psychological and physiological can inform design considerations of learning environments where innovation and creativity are sought.

## 4 Analysis and Future Direction

While color inquiries in general have been conducted for more than a century, the body of knowledge pertaining to color impact in the investigated environments is

relatively young and has emerged over the last four decades. Throughout this time, environmental psychologists were able to generate both interest and empirical support around the dynamic interface of environments and emotions. This aspect of the literature gave enhanced legitimacy to the investigation of color impact as color is considered a design lever most suitable to affect emotions. Yet, despite this conceptual evolution and the intuitive appeal that the “color impact” argument enjoys, research on color influence in environments is sparse, fragmented, often lacking rigor and empirical basis, and, as such, is limited in its explanatory power.

To further aggravate the challenge, two other factors add to the conceptual fog: First, the environments studied are undergoing significant transition. The working environment has shifted to become global, semi-virtual, collaborative, technologically enhanced, and innovation-driven; and, the learning environment has seen significant shift in teaching and learning methodologies away from curriculum and teacher-centric to collaborative, immersive, peer-oriented, and student-centric solutions. Second, and perhaps consequently, identifying effectiveness criteria in these environments has become a monumental challenge that researchers still sort out in what seems like a glacier-like pace, limited dedication, and with only limited success. As a result, the study of effective environmental design (in general) and the use of color in such environments (in specific) suffers and existing knowledge seems reactive, limited, obsolete at times, and overall narrow.

While the abovementioned changes experienced in the studied environments generate a considerable degree of complexity, the study of environmental design in general is still silo-oriented and does not seem interested in exploring white spaces that emerge naturally between disciplines such as architecture, psychology, medicine, education, and technology. Only limited efforts have made active attempts to pave roads into these complex interfaces. lastly, although the general question of how environmental design affects human response is inherently complex, and subsequent questions about the role of color in such contexts are equally challenging, often the methodologies used to study these issues are less sophisticated and unjustly simplistic. This discrepancy raises questions about the generalizability quality of findings and insights produced.

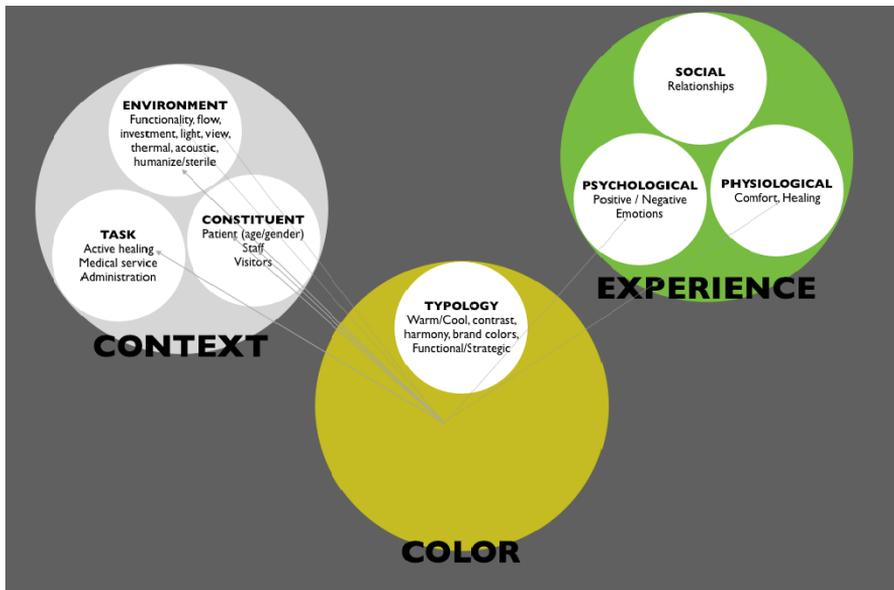


Fig. 1. Color Research Efforts Linked to Critical Contingencies in Healing Environments – Example

Future research on color in environment has a number of critical questions to explore:

1. “Within environments” color efficacy questions pertaining to color impact in specific environments taking into account variables identified as important by previous research such as audience type (including student, patient, teacher, guest, employee, team) and characteristics (age, gender); task type (creative, repetitive, service, peer-learning); effectiveness measurements (how is color impact measured and isolated from all other variables that co-act within an environment); and, color choices (hue, value, chroma, number of colors tested, color in artifacts, surfaces). (See Fig. 1 for schematic presentation of this research agenda applied to the Healing Environment).

2. “Between environments” color efficacy questions pertaining to broad “color lessons” relevant to different built environments (workplace, learning, healing, retail, hospitality and residential); identifying principles for the use of color to generate desired experience; examining the cross-cultural context of color use; mapping the contingency of color effectiveness when color is embedded in artifacts, vertical or horizontal surfaces; and, theorizing about the role of color as an enabler. Existing color knowledge allows us to approach many of the above questions with preliminary understandings and tested assumptions. Theories developed in other disciplines with regard to the psychology of emotions, change methodologies, performance measurement dashboards, learning and collaboration

frameworks, to name a few provide a rich context within which to examine the role of color. The opportunity to add color to existing white spaces across environments and disciplines is there to seize.

## References

- [1] Anonymous, Expo classroom. PR News Wire US, 2006.
- [2] ASID, "The impact of interior design on the bottom-line", ASID, 1997.
- [3] ASID, "Productive workplaces: How design increases productivity expert insights", ASID, 1998.
- [4] ASID, "Recruiting qualified employees by design", ASID, 1999.
- [5] ASID, "Workplace values: How employees want to work", ASID, 2000.
- [6] ASID, "Designing better workplaces", ASID, 2005.
- [7] Asirvatham, S., "No more cubes", *Journal of Property Management*, Jul-Aug, 1999, p. 28-32.
- [8] Augustin, S., & Brand, J., "Impact of the physical environment on knowledge worker performance", 2001.
- [9] Avery-Office-Products, "Add some color to your working life", 2004.
- [10] Babin, B., Hardesty, D., & Suter, T., "Color and shopping intentions: The intervening effect of price, fairness and perceived affect", *Journal of Business Research*, 2003, pp. 56, 541-551.
- [11] Baier, S., "The view from bed number 10", *The Healthcare Forum Journal*, Vol. 39, No. 2, 1996, pp.60.
- [12] Barber, C., Laing, A., and Simeone, M., "Global workplace trends: A North American and European comparison", *Journal of Corporate Real Estate*, Vol.7, No.3, 2005, pp.210-221.
- [13] Basoglu, Z., "Color scheme preferences of elementary school children in their school environments," Paper AIC 2001, USA, 2001.
- [14] Basoglu, Z., "A comparative study on color scheme preferences of elementary school children for their school environments: Two private schools in Ankara", Paper presented at the Colour in Fashion and Color in Culture, South Africa, 2006.
- [15] Becker, F., Quinn, K., Rappaport, A., & Sims, W., "New Working Practices", Ithaca: Cornell U, 1993.
- [16] Becker, F., & Sims, W., "Office that work: Balancing communication, flexibility and cost", 2001.
- [17] Becker, F., Tennessen, C., Dahi, L.: *Managing workplace change*. Ithica: Cornell University, 1996.
- [18] Bencivenga, D: *The humanistic approach to space*. HR Magazine, March 1998.
- [19] Biehn, K. E.: *How does the use of color in pediatricians' offices affect children's perception of well-being?* Unpublished Master of Science, Lamar University, 2004.
- [20] Bitner, M.: *Service spaces: The impact of psychical surrounds on customers and employees*. *J of Marketing*, 56(2), 1992, 57-71.

- [21] Block, K., Block, P., Gyllenhaal, C.: The role of optimal healing environments in patients undergoing cancer treatment: Clinical research protocol guidelines, 2004.
- [22] Blum, A.: No Wallstreet stiff. *Interior Design*, 76(7), 2005, 109.
- [23] Boutelle, L.: Abercrombie & Fitch Headquarters. *Places*, 16(1), 2003,12-15.
- [24] Bower, S.: Dialysis facility design part IV: color, sound and materials. *Dialysis & Transplantation*, Nov, 1-5, 2006.
- [25] Boyatzis, C. J., & Varghese, R.: Children's emotional associations with colors. *The Journal of Genetic Psychology*, 155(1), 1994,77.
- [26] Bradley, S.: What's working? Briefing and evaluating workplace performance improvement. *J of Corporate Real-estate*, Oct. 2001.
- [27] Brooks, T., and Khandker: A collaborative learning lab: Does the form matter? *Contemporary Eco Policy*, 20(3), 2002, 330-338.
- [28] Brown, J.: New learning environments for the 21st century: Exploring the edge. *Change*, Sept/Oct, 18, 2006.
- [29] Budd, C.: *Workspheres*. In P. Antonelli (Ed.), *Workspheres*. New York: MOMA, 2001.
- [30] Burruss, W.: Adult learning environments: Requests upon and preferences of interior designers. *Oklahoma State U, Oklahoma*, 2004.
- [31] Cameron, K.: Organizational transformation through architecture and design: A project with Frank Gehry. *Journal of Management Inquiry*, 12(1), 2003, 88-92.
- [32] Carroll, R.: Applying design and color to healing. *Nursing Homes*, 54(2), 2005, 48
- [33] Cavallo, D.: Emergent design and learning environments. *IBM Systems Journal*, 2000, 39(6), 768-781.
- [34] Cherry, N.: Preparing for practice in the age of complexity. *Higher Education Research & Development*, 24(4), 2005, 309-320.
- [35] Chin, G., & Carroll, J.: Articulating collaboration in a learning community. *Behavior & Information Technology*, 19(4), 23345, 2000.
- [36] Chou, P., Gruteser, M., Lai, J., Levas, A., McFaddin, S., Pinhanez, C., et al.: *BlueSpace: Creating a personalized and context-aware workplace*, 2001.
- [37] Christian, N.: Not your fathers Chrysler: At new headquarters parking still a headache but culture improves. *WSJ*, 1997.
- [38] Cler, M., & Schindler, V.: Chromatic studies for urban space: Case study: High school campus, Lamentin (Guadeloupe, French West Indies. Paper presented at the *Colour in Fashion and Color in Culture*, South Africa, 2006.
- [39] Cockerill, I. M., & Miller, B. P.: Children's colour preferences and motor skill performance with variation in environmental colour. *Perceptual and Motor Skills*, 56, 1983,845-846.
- [40] Cohn, S., & Trotle, S.: Young children's preferences for school-related physical-environmental setting characteristics. *Environment and Behavior*, November, 1990,753-766.
- [41] Cooper, B.: A model for implementing color contrast in the environment for the elderly. *The American J of Occupational Therapy*, 39(4), 1985, 251.
- [42] Cooper, B.: The use of color in the environment of the elderly to enhance

- function. *Geriatric Medicine and Social Policy*, 2(1), 1986, 151.
- [43] Coryell, J.: The therapeutic use of color in a clinical environment. Unpublished Doctor of Psychology, Wright Institute, 2003.
- [44] Cunningham, R.: Learning and recognizing patterns of visual motion, color and form. Unpublished Ph.D, Boston, U, Boston, 1998.
- [45] Dickey, M.: Engaging by design: How engagement strategies in popular computer and video games can inform instructional design. *ETR&D*, 53(2), 2006, 67-83.
- [46] Dillenbourg, P., Baker, M., Blaye, A. & O'Malley, C.: The evolution of research on collaborative learning. In E. S. P. R. (Eds) (Ed.), *Learning in Humans and Machine: Towards an interdisciplinary learning science*. Oxford: Elsevier, 1996, pp. 189-211.
- [47] Drew, C. J.: Research on the Psychological-Behavioral effects of the physical environment. *Review of Education Research*, 41(5), 1971, 447-465.
- [48] Eroglu, S.: An empirical study of retail crowding: Antecedents and consequences. *Journal of Retailing*, 66(2), 1990, 201.
- [49] Evans, G.: *The built environment and mental health*, 2003.
- [50] Goffman, E.: *Asylums: Essays on the social situation of mental patients and other inmates*. Chicago: Aldine Publishing Company, 1960.
- [51] Gokhale, A.: *Collaborative Learning Enhances*, 1995.
- [52] Critical Thinking. *Journal of Technology Education*, 7(1), 21-30.
- [53] Gross, R., Sasson, Y., Zarhy, M., & Zohar, J.: *Healing environment in psychiatric hospital design*, 1998.
- [54] Hamilton, O., Baker, S., & Vlastic, B.: Walls are falling as the "office of the future" finally take shape. *Business Week*, April 29, 1996.
- [55] Harleman, M., Werner, I., & Billger, M.: Significance of color on room character: Study on dominantly reddish and greenish colors in north-respectively south-facing rooms. Paper presented at the *Design & Emotion 2006*, Sweden, 2006.
- [56] Henderson, J.: Auto motives. *Interiors*, 152(6), 1993, 78-81.
- [57] Izumi, K.: Psychosocial phenomena and building design. *Building Research*, July-Aug(9-11), 1965.
- [58] Kezar, A.: Re-designing for collaboration in learning initiatives: An examination of four highly collaborative campuses. *The Journal of Higher Education*, 77(5), 2006, 804.
- [59] Kotler, P.: Atmospherics as a Marketing Tool. *Journal of Retailing*, 49(4), 1973,48.
- [60] Kupritz, V.: Privacy in the workplace: The impact of building design. *Journal of Environmental Psychology*, 18, 1998, 341-356.
- [61] Kwallek, N., Lewis, C., Lyn-Ahsiao, J., & Woodson, H.: Effects of nine monochromatic office interior colors on clerical tasks and worker mood. *Color Research and Application*, 21(6), 1996, 448-458.
- [62] Kwallek, N., Woodson, H., Lewis, C., & Sales, C.: The impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity. *Color Research and Application*, 22(2), 1997, 121-132.

- [64] Lane, B.: Changing spaces. *Metro West Business Journal*, 1993.
- [65] Linton, P.: Healing environments: Creating a total healing environment. *Journal of Healthcare Design*, V, 1993, 187..
- [66] Lohr, S.: Hey who took the office doors. *The New York Times*, 1997.
- [67] MacStravic, S.: Better facility design leads to better health care outcomes. *Health Care Strategic Management*, 23(2), 11, 2005.
- [68] Maher, A., & Vonhippel, C.: Individual differences in employee reactions to open plan offices. *Journal of Environmental Psychology*, 25(5), 219-229, 2005.
- [69] McCluskey-Shepley, M., & Wilson, P.: Designing for persons with AIDS: A post-occupancy study at the Bailey-Boushay House, 1999.
- [70] McGuire, P.: Public Image. *Architectural Review*, April, 2003, 70.
- [71] McLoughlin, C.: Learner support in distance and networked learning environments: Ten dimensions for successful design. *Distance Learning*, 23(2), 2002, 149.
- [72] Mehrabian, A.: Public places and private spaces: The psychology of work, play and living environments. New York, NY: Basic Books, 1976.
- [73] Mehrabian, A., & Russell, J.: An approach to environmental psychology. Boston, MA: MIT, 1974.
- [74] Millford, M.: Dupont shuts the door on its private offices. *The New York Times*, 1997.
- [75] Mishra, P., & Girod, M.: Designing learning through learning to design. *The High School Journal*, Oct/Nov, 44, 2006.
- [76] Morris, L.: Social design: The link between facility design, organizational design and corporate strategy: Knowledge Management Lab, 1999.
- [77] Nayar, J. G.: What color is your workspace: Steelcase, 2003.
- [78] Nebenzahi, D.: Feng Shui helps redefine the workplace, 2005.
- [79] Neilsen, E., Winter, M., and Saatcioglu, A.: Building a learning community by aligning cognition and affect within and across members. *Journal of Management Education*, 29(2), 2005, 301-318.
- [80] Peck, R.: Recent trends in Alzheimer's facility design. *Nursing Homes*, 47(6), 1998, 17.
- [81] Pelgrim, P. H., Hoonhout, H. C. M., Lashina, T. A., Engel, J., Ijsselsteijn, W. A., & deKort, Y. A. W.: Creating atmospheres: The effects of ambient scent and colored lighting on environmental assessment. Paper presented at the Design & Emotion 2006, Sweden, 2006.
- [82] Pollack, R.: Interior design support the "knowledge age", 2000.
- [83] Price, H.: The emotional context of classroom learning: a psychoanalytic perspective. *European Journal of Psychotherapy, Counseling & Health*, 5(3), 2002, 305-320.
- [84] Pritchett, T. K.: An experimental test of the impact of color environment on the effectiveness of colors an attention producing device in magazine advertising. Florida State University, Florida, 1982.
- [85] Proshansky, H., Ittelson, W., & Rivlin, L.: Environmental psychology: Man and his physical setting. New York, NY: Holt, Rinehart & Winston, Inc. 1970.

- [86] Read, M.: The impact of space and color in the physical environment on children's cooperative behavior. Oregon State University, 1996.
- [87] Read, M.: Use of color in childcare environments: Application of color for way finding and space definition in Alabama child care environments. *Early Childhood Education Journal*, 30(4), 2003, 233,.
- [88] Rice, J., & Mitchell-Ketzes, S.: Success stories from the new workplace. *Building Operating Management*, Aug, 20-28, 2002.
- [89] Russell, B.: Hasboro Corporate offices. *Interiors*, 154(2), 1995, 36-37.
- [90] Saba, J.: Calming environments within healthcare facilities. Paper presented at the Neuroscience and Healthcare Facilities Workshop, Woods Hole, MA, 2002.
- [91] Schaal, S., Bogner, F.: Human visual perception: Learning at workstations. *JBE*, 40(1), 2005, 32.
- [92] Schweitzer, M., Gilpin, L., Frampton, S.: *Healing spaces: Elements of environmental design that makes an impact on health*, 2004.
- [93] Searles, H.: *The non-human environment in normal development and in schizophrenia*. New York, NY: International University Press, 1960.
- [94] Southerst, J.: NCR in Scotland rethinks workplace design, 2003.
- [95] Stone, N.: Designing effective study environments. *J of Environmental Psychology*, 21, 2001, 179-190.
- [96] Stone, N.: Environmental view and color for a simulated telemarketing task. *Environmental Psychology*, 23, 2003, 63-78.
- [97] Stouffer, J.: Patient-centered healing. *Facilities Design Management*, 19(3), 2000, 32.
- [98] Sunstrom, E., Burt, R., Kamp, D.: Privacy at work: Architectural correlates to job satisfaction and job performance. *Academy of Management*, 23(1), 1980.
- [99] Tanner, K., Jago, E.: *Influence of the school facility on student achievement*, 1999.
- [100] Tetlow, K.: Best large office: McCann Ericsson Worldwide 16th flr renovations. *Interiors*, 158(1), 1999, 36-39.
- [101] Tivorsak, T. L., Britto, M. T., Klostermann, B. K., Nebrig, D. M., Slap, G. B.: Are pediatric practice settings adolescent friendly? And exploration of attitudes and preferences. *Clinical Pediatrics*, Jan/Feb, 55-61, 2004.
- [102] Tofle, R., Schwarz, B., Yoon, S., Max-Royale, A.: *Color in healthcare environments: Coalition for health Environments Research*, 2004.
- [103] Trent, L. The shape of color. *Facilities Design Management*, 21(3), 10, 2002.
- [104] Vanecko, A.: *Integrated workplace*, 2001.
- [105] Veitch, J.: *Satisfaction and performance in office environments (seminar): National Research Council – Canada*, 1996.
- [106] Veitch, J., Gifford, R.: Choice perceived control and performance decrements in the physical environment. *Journal of Environmental Psychology*, 16, 1996, 269-276.
- [107] Ward, G.: Colors and employees stress reduction. *Supervision*, 56,1995, 3-5.
- [108] Webb, M.: Nickelodeon Animation Studio. *Interiors*, 157(9), 1998, 76-79.

- [109] Weder, A.: Rhapsody in blue. *Interiors*, 160(5), 2001, 116-119.
- [110] Wells, M.: Office clutter or meaningful personal space: The role of office personalization in employee and organizational well being. *Environmental Psychology*, 20, 2000, 239-255.
- [111] Wheeler, G.: Work pattern emerging in the 21st century, 2000.
- [112] Wilson, K., and Fowler, J.: Assessing the impact of learning environments on students' approaches to learning: comparing conventional and action learning designs. *Assessment Evaluation in Higher Education*, 30(1), 2005, 87-101.
- [113] Wilson, K., Fowler, J.: Assessing the impact of learning requirements on students' approaches to learning: Comparing conventional and action learning design. *Assessment Evaluation in Higher Learning*, 30(1), 2005, 87-101.
- [114] Wright, G.: After wild ride, office choose muted tone, style. *Building Design and Construction*, 2002.
- [115] Yazici, J.: A study of collaborative learning style and team learning performance. *Education Training*, 47(2(3)), 2005, 216-229.

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<sup>i</sup> Discussion and findings re the healing, retail and hospitality environments were omitted from this submission due to scope constraints. A complete version of the paper can be obtained directly from the authors