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Literature Review and Annotated Bibliography

OFFICE SPACE, CHANGING WORKPLACES AND HUMAN PERFORMANCE

Prepared by:
John S. Andrew
Nellie Chang
Michelle Nicholson

School of Urban and Regional Planning
Queen's University

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This working paper summarizes the state of current research and literature on the interdisciplinary themes of the evolving and complex nature of "the workplace", and the role that specific characteristics of the office work environment have on the productivity and satisfaction of employees. A brief overview of the most relevant and current literature addressing these themes is followed (on pages 6-30) by an annotated bibliography of key sources. In each, the sources have been classified into six sub-themes. While each source appears under the sub-theme heading in which it best fits, several of the sources are appropriate to multiple sub-themes. The annotated bibliography is not intended as an exhaustive list; but rather as an up-to-date and comprehensive, yet concise introduction to these themes. The sources have been carefully selected based on their quality, relevance to these themes, applicability, and currency.

The abstracts included in the annotated bibliography have in approximately half of the cases been copied verbatim from the source itself. For the remaining readings, the authors of this review wrote their abstracts. Wherever possible, each abstract is followed by a web link, from which the full document may be either purchased or downloaded for free. The Forum office also has a complete set of the literature for research purposes.

OVERVIEW OF THE LITERATURE

The overall theme of the linkages between changing work patterns, specific features of office space design and human performance may be fragmented into six sub-themes (with some inevitable overlap). These are:

1. Changing Patterns of Work and Workplaces
2. Influence of Office Space on Human Performance and Productivity
3. Employee Communication, Collaboration and Interaction
4. Influence of Office Space on Employee Health and Comfort
5. Role of Space in Employee Recruitment, Satisfaction and Retention
6. Building Systems and Performance

In the face of rapidly rising energy costs, the commercial real estate sector has quite suddenly become preoccupied with building more efficient "green" structures, and rightfully so. This has been particularly true of the office property class, in both the private and public sectors.

However, those that practice and study facilities management have become aware that the financial benefits that accrue from making office buildings more energy efficient pale in comparison to the potential gains that may be realized if buildings are optimized to improve the productivity of their human, rather than built capital. This is due primarily to the high price of labour compared to other operating costs (Clements-Croome 2000). Specific features of office space, such as temperature, lighting, noise, privacy, physical comfort (*i.e*. furniture), and aesthetics such as the colour and texture of surfaces can affect the productivity, satisfaction and overall well-being of office workers. It may even affect their health or perceived health, as reflected in the number of sick days taken by an employee (further impacting productivity). There is considerable evidence (not reviewed in this paper) that the fiscal implications to an organization of designing office space to maximize employee productivity greatly exceed those associated with lowering a building's energy consumption. Fortunately there appear to be many recent examples of office buildings that are realizing both benefits simultaneously, and this is not limited to high-profile towers occupied by private sector users.

1. Changing Patterns of Work and Workplaces

The rapidly evolving nature of work, and the consequent changes in workspaces this is driving, are the subjects of a considerable body of literature. Much has been written (*e.g.* DYG 2001, Grantham 2004) about how telecommuting (working from home through the use of technology) and a shift in the economy toward a greater proportion of "knowledge workers" is affecting the space needs and expectations of organizations and their personnel. Although it does not address space issues, Lyons *et al.* (2006) is interesting in its testing for differences in general values, work values and organizational commitment among 549 private sector, public sector, and parapublic sector knowledge workers. It found only limited value differences among employees of the various sectors, but some work value differences between employees in the public and parapublic sectors. Future research on how these differences might translate into differing employee needs and wants with respect to office space would be worthwhile.

Myerson and Ross (2006) use 43 international case studies and a unique conceptual matrix (based on the four "realms" for knowledge work: the learning campus, the professional cluster, the public workplace, and the live-work setting) to carry out a comprehensive analysis of emerging office design practice that maximizes the contributions of knowledge workers.

The nature of the organization now has considerable influence on the character of the physical work environment. Moritz and Evans (2008) discuss the concept of "workplace strategy", in which human resources, real estate and information technology professionals work together to create innovatively designed workspace that better enables employees, maximizes space utilization, and reflects the organization's brand values.

van der Voordt (2004) empirically investigates the potential costs and benefits of an emerging pattern of non-territorial offices with desk sharing and rotation. It presents a framework for this cost-benefit analysis, and relies on data from cost analyses and post-occupancy evaluations of new offices to demonstrate it.

2. Influence of Office Space on Human Performance and Productivity

Several sources (*e.g.* Arnold 2004, Heerwagen *et al.* 2004, Sundstrom *et al.* 1994 and Vischer 2005) deal with the impact of specific office environmental factors (*e.g.* light, air quality, noise, *etc.*) and worker productivity. Arnold (2004) finds that improving air quality alone yields a 15 percent increase in productivity. Schneider (2007) surveyed office workers and reports that a better designed office environment could increase organizational productivity by 21 percent on average. Yet 46 percent of the respondents believed that creating a productive workplace was not a priority for their company. Mawson (2002) observes that as the knowledge-base of the economy has become more significant, it has become more difficult to measure worker productivity and the latter is often not considered when designing office space.

Clements-Croome (2000) critically appraises the factors that affect workplace productivity, and makes suggestions for making work environments more amenable to productivity. Brill and Weidemann (2001) examine two important design determinants of productivity and satisfaction: distraction-free workspace and opportunities for learning-laden informal interactions. They recommend new facility design concepts which have good potential to increase employee productivity and satisfaction, and enhance their learning. This study builds on earlier seminal work by Brill *et al.* (1994) that was based on an impressive 6-year nationwide (U.S.) study of over 10,000 employees in 100 companies.

Several studies, such as Bottom *et al.* (1997) make use of post-occupancy evaluation surveys of employees. Brennan *et al.* (2002) carried out a longitudinal study in a large private corporation to measure the effects of relocating employees from traditional offices to open offices. They found that open office design was associated with lower perceived productivity. There is no clear consensus on this issue in the literature. Vischer (1995) looks at how firms can reduce their occupancy costs by making more efficient use of space. She outlines strategies to achieve this, along with the many benefits that accrue.

Haynes (2007a) reviews the literature on the role that the behavioural environment plays in the productivity of employees, from their perspective. Haynes observes that the social context of an office is important, and employees make very personal interpretations of their surroundings. The article concludes that optimizing the productivity of office environments requires designers to pay heed to the role of the behavioural environment. Heerwagen (2000) answers the question: how do the physical attributes of green buildings affect the physiological, psychological, cognitive and social functioning of building occupants at the individual level?

3. Influence of Workspace on Employee Communication, Collaboration and Interaction

Heerwagen *et al.* (2004) investigate the question: How can the physical design of the workplace enhance collaborations without compromising an individual's productivity? Office space can be designed in order to facilitate interaction and collaboration between employees. However, the benefits must be balanced with noise distractions and work interruptions. Haynes (2007a) observes that office space needs to be designed with the goal of facilitating collaboration between employees, while also ensuring that disruptions and distractions to people engaged in individual tasks are minimized. Becker *et al.* (1983) compares the influence of open-private,

closed-shared, and closed-private offices on faculty work patterns and faculty-student interaction in a community college, based on 456 interviews with students and faculty. One hundred faculty and 356 students completed questionnaires. Faculty offices were observed throughout several days. Closed-private offices were found to be the most effective for faculty-student interactions. McLean (2004) analyzes key communication patterns between office workers in order to identify an office layout that will maximize communication, work flow and job performance.

4. Influence of Office Space on Employee Health and Comfort

Newsham *et al.* (2004) conducted an empirical study of the effect of office workers having individual control over light levels on their satisfaction, mood, comfort and self-assessed productivity. They found positive benefits from this allocation of control.

Fisk (2000) reports moderate to strong evidence that characteristics of buildings and indoor environments significantly influence rates of communicable respiratory illness, allergy and asthma symptoms, sick building symptoms, and worker performance. These translate into estimated cost savings to U.S. employers together of between US$1 billion and US$30 billion in lost worker time, per disease.

5. Role of Workspace Attributes in Employee Recruitment, Satisfaction and Retention

Monk (1997) reports that open-plan offices have lower levels of occupant performance and job satisfaction. They also increase employee stress and reduce their autonomy, task identity, supervisory feedback and privacy. They argue that ultimately, this compromises the productivity, motivation and well-being of the entire organization. In a longitudinal study conducted by Brennan *et al.* (2002) it was found that employee moves from traditional offices to open offices were associated with lower levels of occupant satisfaction with their physical environment. A similar, earlier study by Oldham (1988) found that employees who moved from an open-plan office to either a low-density open-plan office or to a partitioned office experienced significant improvements in task privacy, communication privacy, crowding, and office satisfaction. Cullen (2006) reports that as offices move toward more open workspaces such as cubicles, more employees are seeking privacy, fewer noise distractions (especially coworkers' phone conversations), flexible work hours and the ability to telecommute at least several days each week. These appear to be significant employee recruitment issues for organizations. It is also apparent that there a lack of consensus in the literature on the relative merits of open-plan *vs*. greater use of private offices and other office layouts, and the effects these may have on employee satisfaction, recruitment and retention. The key issues may be how to customize office space to the specific needs of the individual organization, and how to minimize disruptions and stress during the renovation and moving process. Questions such as how to determine the optimal office layout for an organization or unit, and how to implement these changes smoothly are deserving of research and discussion.

Vischer (2008) relies on extensive research on the use of space in office buildings to develop a user-centred theory in the context of one type of built environment. This theory "enables links to be made between knowledge accumulated both at the micro scale of the users' experience and at the macro perspective of how the built environment is produced and delivered."

Costello (2007) discusses how more companies are beginning to recognize that in today's knowledge economy, success depends on employers fostering a work environment that stimulates the intellectual growth of their people. This often includes innovative trends such as reduced demand for office space, improving employees' work-life choices by allowing them to work remotely, and increasing personnel retention by "going green." Venezia and Allee (2007) discuss the trend of technology enabling employees to work whenever and wherever they need, a flexibility which is theory improves their work-life balance. Yet, little is known about how these changes are affecting worker satisfaction, among other variables.

Brill and Weidemann (2001) found that office employee satisfaction is significantly raised by two factors: distraction-free workspace and opportunities for learning-laden informal interactions. An earlier study by Sundstrom *et al.* (1994) found that 54% of office employees surveyed indicated that they were bothered often by noise, especially by ringing telephones and nearby conversations. This type of disturbance correlated highly with employee job dissatisfaction.

Hays (1998) explains how Sears, Roebuck and Co. used new and modern office space as a powerful recruiting tool for software engineers. Haley (2004) discusses a biotechnology firm that lowered its employee turnover rate and increased productivity by allowing its employees to design their own work environment, and providing emergency child care and transportation, among other on-site services.

There is clearly a real need for empirical research based on a significant number of case studies to investigate the important question of how an organization's office accommodation policy can help to attract and retain employees. This is particularly relevant to public sector employers in the current job market of most regions in Canada, especially in their quest to hire young, well-educated employees.

6. Building Systems and Performance

Preiser and Vischer (2005) use several case studies to evaluate the use of an innovative building performance evaluation (BPE) framework in a variety of building types. The framework applies to all six phases of the building delivery and life cycle: (1) strategic planning/needs analysis; (2) program review; (3) design review; (4) post-construction evaluation/review; (5) post-occupancy evaluation; and (6) facilities management review/adaptive reuse. Sykes and Brennan (2006a) discuss new and emerging materials used in office building construction and interiors, and the positive impact that they are having on occupants. BOMA (2000) contributes further understanding of the role that integrated building operating systems play in increasing building and human performance.

Acknowledgement:

The authors wish to thank Professor David Gordon for the tremendous assistance he provided to this project.

ANNOTATED BIBLIOGRAPHY

1. CHANGING PATTERNS OF WORK AND WORKPLACES

Allen, Tim, Adryan Bell, Richard Graham, *et al.* (2004). *Working Without Walls: An insight into the transforming government workplace*. London: DEGW and Office of Government Commerce, UK.

DEGW and the Office of Government Commerce combined to produce this comprehensive publication which explores reform in the design of government workplaces in Britain. The first section of this publication examines the historical context of the factors that have led to changes in the government workplace. The second section explores current themes influencing workplace design. The third section discusses the practical aspects of understanding, achieving, and sustaining successful workplace change. The aim of the publication is to examine and explore current workplace developments of the UK government.
Link to Full-text

Aronoff, Stanley and Audrey Kaplan, eds. (1995). *Total Workplace Performance: Rethinking the Office Environment*. Ottawa: WDL Publications.

This book is about the office workplace - what it is, how it operates, and how it affects the people who work there. It examines the origins of the modern day offices we know today, the functions they perform for their organizations, the building systems of which they are comprised, and the way their interior settings affect human performance. Throughout, the discussion focuses on practical implications - the choices that can significantly enhance the value an organization realizes from its office facility.
Link to Purchase

Cullen, Lisa T. (2006). "Redrawing the CUBE." *Time*. July. 168(3): 28-30.

Even as workplaces move toward more open seating, privacy remains a top demand among employees. A Knoll study found that 45% say they do their best work in "their own personal space." The top privacy-related gripe: overheard conversation, particularly from cell-phone shouters. So architects are being exhorted to help muffle cubicle babble. Some advocate loft ceilings, others white noise; a desktop gadget called Babble can broadcast garbled recordings of the user's voice to mask real conversation. All of this is taking place just as many employers are encouraging a more nomadic work style. With 62% of U.S. office workers desiring flex time and 42% longing to telecommute, is the cubicle as we know it dead? "I don't think it should have ever been born, so I would love to say yes," says Alan Hedge, a Cornell professor who studies workplace design. "Technology already allows most of us to work from anywhere, but companies want to retain control."
Link to Full-text

DYG, Inc. (2001). *The New Workplace: Attitudes and Expectations of a New Generation*. Prepared for Knoll, Inc. and CB Richard Ellis, Inc.

This report presents the findings and insights emergent from a qualitative study conducted for Knoll, Inc. and CB Richard Ellis, Inc. in the winter of 2001. The study explores two hypotheses concerning workers, especially young knowledge workers today. First, that the physical and atmospheric work environment in fast moving, high growth, high talent companies represents a dramatic departure from the traditional workplace and work style of mature, established companies, with new needs and expectations on the part of employees. And, second that as young workers "return" to considering older, established industries as the so-called "new economy" softens, they will bring with them their new attitudes and expectations.
Link to Full-text

Freiman, Ziva (1994). "Hype vs. reality: The changing workplace: changes in the way Americans work offer architects opportunities of visionary proportions." *Progressive Architecture*. 75 (3): 48.

This article presents an overview of the changes in the American workplace and the implications of these changes for architects. This article describes major trends in the design of workplaces, the concept of non-territorial offices, challenges facing architects from the changes in the workplace, and new design concerns.

Grantham, Charles (2004). "Demographics and the changing nature of work." *Corporate Real Estate Leader*. 3 (4): 24-26.

The nature of the workforce is significantly impacted by demographic change. This article focuses on the demographic change of the workforce as the 'baby boomers' are retiring and the economy has become focused on the 'creative class', workers who produce and apply knowledge. The article provides an outline of the characteristics of this new creative class, stressing that this new class is different from the past employees that much of organizational life was centered around. With the 'baby boomers' retiring, the author warns that the developed world faces a major talent shortage. The author addresses how workplaces must adapt in an attempt to attract this new creative class.
Link to Full-text

Harrison, Andrew, Paul Wheeler and Carolyn Whitehead, eds. (2004), *The Distributed Workplace*. New York: Routledge.

The Distributed Workplace provides in one volume essential information on sustainable work environments which will be invaluable to those developing workplace strategies for end-user organizations, as well as suppliers of office buildings, information and communications technologies and building operation services. Municipal authorities and other organizations concerned with sustainable development and sustainable workplaces will also benefit from this book.
Link to Purchase

Heisler, Ted (2007). "Innovating the workplace through design: implementing trends that transcend." ***CoreNet Global's The Leader*****. 6 (6): 32-36.**

Through its study of real estate trends and experience working with national clients, this article observes how the workplace continues to evolve to meet the ever demanding needs of today's workers. The article discusses several of the key emergent office trends: technology transformation, collaboration exploration, the rise of branded environments, mainstream green, and changing management in the work environment. A case study of Ericcson, the Swedish telecommunications company, is provided to illustrate such trends.

Horgen, Turid, Michael L. Joroff, William L. Porter, and Donald A. Schön (1999). ***Excellence By Design: Transforming Workplace and Work Practice*****. New York: Wiley.**

As office space is the second highest expense next to labor, the optimum use of office space has become critically important to companies looking to gain a competitive edge in business today. Based on a four year research project of the Space Organization Research Group at MIT's School of Architecture and Planning, this book explores how to impact work processes through workspace - processes that are already impacted by the company's culture, resources and technology. This book takes a strategic look at how people work - how organizations evolve organically, blending work style, process, and place.
Link to Purchase

Lyons, Sean T., Linda Duxbury, and Christopher Higgins (2006). "A comparison of the values and commitment of private-sector, public-sector and para-public-sector employees." ***Public Administration Review*****. 66 (4): 605-618.**

This study investigated differences in general values, work values and organizational commitment among 549 private sector, public sector, and parapublic sector knowledge workers. No differences in general values were observed across sectors, although five significant work value differences were revealed: parapublic employees value work that contributes to society more than public servants, who value it more than private sector employees; parapublic employees value opportunities for advancement less than both public and private sector employees; public servants value intellectually stimulating and challenging work more than parapublic employees; and private sector employees value prestigious work more than public servants. Private sector employees displayed greater organizational commitment than the employees in the other two sectors. Overall, the findings suggest only limited value differences among employees of the various sectors. The finding of some work value differences between employees in the public and parapublic sectors suggests that these two groups merit separate consideration in comparative studies such as this one.
Link to Purchase

Massey, Liz (2007). "Office space: 10 tips from the future." ***Office Solutions*****. 24 (3): 16-19.**

The article discusses the future of offices and gives some tips on improving existing ones. The nature of offices is changing as a younger generation is entering the workforce while businesses are becoming more competitive. However, despite changes it is apparent that offices will

continue to be a part of most businesses. The article gives tips on how to improve the work setting to keep people productive. These include: providing employees with different venues for working, using new technology such as videoconferences to connect with other people, and having areas where informal interaction is encouraged.
Link to Full-text via Gale Group

Moritz, Debra and Sarah Evans (2008). "Real-life work practices: Mapping global workplace strategy and measuring success." *CoreNet Global's The Leader*. 7 (1): 12-17.

During the past several decades, forward-thinking real estate, human resources and information technology professionals have explored innovative workplace concepts. These concepts, commonly bundled under the term "workplace strategy", tap into organizational and employee needs and create an environment that supports and enables employees, improves space utilization and efficiency, and reflects the organization's brand values. The need for a functionally suitable workspace is stressed as is the impact it has on increasing efficiency. Advice is also provided as to how to create the optimal work environment. To achieve success in office organization, the need for flexibility to accommodate the ever-changing demands of workspaces is emphasized.
Link to Purchase

Myerson, Jeremy and Philip Ross (2006). *Space To Work*. London: Laurence King Publishing.

This is the first comprehensive analysis of emerging office design practice to support and enhance the performance of knowledge workers. It explains how the office is being reinvented to respond to the imperatives of knowledge work, as well as the changing social imperatives and technology of the new millennium. A wide range of international workplace architecture and interior schemes that are leading the way in this important area are showcased. The book sets its 43 international case studies within a unique conceptual matrix that provides a framework for thinking about new strategies for reinventing office space. It identifies four "realms" for knowledge work: the learning campus (ACADEMY); the professional cluster (GUILD); the public workplace (AGORA) and the live-work setting (LODGE). The authors argue that only by finding an entirely new equilibrium at work between the opposing forces of family, colleagues, customers and professional peers, can knowledge workers in the 21st century achieve the same productivity gains as manual labourers in the 20th century.
Link to Preview

Myerson, Jeremy and Philip Ross (2003). *The 21st Century Office*. New York: Rizzoli.

This groundbreaking, comprehensive survey of workplace architecture of the new century captures emerging themes and ideas in office design from around the world. Rapid organizational, economic, and technological change has led to the creation of new workplace models that challenge designers to rework traditional theories. *The 21st Century Office* features forty-five case studies of offices planned or opened after January 2000 that showcase revolutionary designs in response to contemporary design challenges. The book begins by differentiating between today's workplace and the mechanistic, process-driven workplace model of twentieth-century modernism. This is followed by chapters focusing on four main thematic

directions in contemporary office: design-narrative, nodal, neighborly, and nomadic. Among the offices featured are Ogilvy & Mather, Los Angeles; Reebok, Canton, MA; TBWA/Chiat/ Day, Los Angeles; PricewaterhouseCoopers, Philadelphia; Oliver, IBM, Santa Monica, CA.
Link to Purchase

Ross, Andrew (2004). ***No-Collar: The Humane Workplace and Its Hidden Costs*****. Philadelphia, PA: Temple University Press.**

The author explores the new "no-collar" workplace - the most recent and radical step in our quest to create the perfect job - and finds important lessons about the future of work in an uncertain economy. Though urban knowledge workers enjoyed unprecedented autonomy and bargaining power, and their bohemian artisan style evoked a pre-industrial craft ethos, the volatile economy exposed even the rank-and-file to 24/7 schedules, emotional churning, and the kinds of pressure typically borne only by senior managers. How humane can, or should, a workplace be? Ross studied two Manhattan-based new media companies, Razorfish and 360hiphop.com, a multi-ethnic media site. As he conducted in-depth interviews and closely observed operations at these companies, he discovered the young enthusiasts loved their work so much they found themselves working 70-hour workweeks and had almost no outside lives.
Link to Purchase

van der Voordt, Theo J. M. (2004). "Costs and benefits of flexible workspaces: Work in progress in The Netherlands." ***Facilities*****. 22 (9/10): 240-246.**

The last decade has witnessed the introduction of non-territorial offices with desk sharing and desk rotation linked to different job functions and working processes. This paper discusses the motives behind the application of these new concepts, potential costs and benefits and data on accommodation costs. A framework of potential costs and benefits is presented and illustrated by data from cost analyses and post-occupancy evaluations of new offices. The author advocates the creation of an integral framework of (potential) costs and benefits, structured according to the principles of the balanced score card. This may help decision makers to set priorities in objectives and to anticipate on effects of interventions in office accommodation. Empirical data on costs and benefits of innovative workplace design are scarce. The framework according to the balanced score card should be explored further by interviewing experts from different organizations. The integral framework is new. The conceptual framework and data from empirical research may support decision making.
Link to Purchase

van der Voordt, Theo J. M. (2004a). "Productivity and employee satisfaction in flexible workplaces." ***Journal of Corporate Real Estate,*** **6(2): 133-148**.

In the early 1990's, a few organizations in the Netherlands began to experiment with flexible workspaces. Traditional cellular offices and open-plan offices or team-oriented bullpen spaces in which everyone had their own fixed workspace are no longer a matter of course. Making use of modern information and communication technology, the pioneers redirected their attention towards the sharing of activity related workplaces in a combi-office. Economic considerations (*e.g.* low occupancy of expensive workplaces), organizational developments (network

organizations, teamwork, fast exchange of knowledge, part-time work) and external developments (globalization, strong competition) are important drivers for change. The aim is to stimulate new was of working (dynamic, less closely linked to place and time), to improve labour productivity and to make major cost savings (fewer workplaces, fewer square metres), without reducing employee satisfaction. Twelve per cent of organizations that have moved recently use flexible workspaces for the most part or exclusively. An important question is whether the aims have been achieved. The Delft University of Technology in the Netherlands together with the Centre for People and Buildings and the Centre for Faculty Management are carrying out investigations into the costs and benefits of workplace innovation. This paper reports on progress thus far, with a focus on employee satisfaction and labour productivity.
Link to Full-text via ProQuest

Venezia, Camille and Verna Allee (2007). "Mobile workers: Practices, relationships and components for effective workplaces." ***CoreNet Global's The Leader*****, 6 (5): 18-22.**

Over the past decade, there has been a substantial increase in the number of workers who spend a significant portion of their time, and in many cases all of their time, away from traditional assigned office space. Mobile workers are now able to do their jobs without being tied to one desk for a fixed period of time. Today, technology allows employees to work flexibly and improve their work-life choices by working whenever and wherever they need. Yet, little is known about how the shift to greater mobility and the associated changes in workspace and technology usage are impacting diverse work roles, activities, interpersonal collaboration and worker satisfaction.
Link to Purchase

2. INFLUENCE OF OFFICE SPACE ON HUMAN PERFORMANCE AND PRODUCTIVITY

Arnold, Damian (2004). "Airy offices create 15% work boost." ***Building Design*****. 1634: 5.**

This article reports on the effects on of more light, better air quality, and good acoustics in office design on staff productivity. It addresses the link between high productivity and good air. The initial findings of a study at the Royal Institute of British Architects (RIBA) Conference in Dublin are presented. The importance of investment in the environmental aspects of a building is discussed.
Link to Full-text

Becker, Franklin (1981). ***Workspace: Creating Environments in Organizations*****. New York: Praeger.**

This book looks at organizational ecology, physical setting, scientific management, organizational behavior, environmental psychology, productivity and space standards. Chapter 5 focuses on challenging the traditional ideas regarding productivity. Becker warns that unsatisfactory working conditions lead to hostile workers who contribute negatively to productivity. Becker emphasizes the importance of the physical environment in contributing to employee morale and productivity. While Becker acknowledges that this is not the only factor in

worker productivity, he claims it is often overlooked. Chapter 8 focuses on the construction of the office environment and the design process. Here Becker identifies and challenges common assumptions regarding planning methods and management practices.
Link to Purchase

Bottom, Connel, Stanley McGreal and George Heaney. (1997). "Evaluating office environments using tenant organization perceptions." ***Facilities,*** **15(7/8): 195.**

Operational property is increasingly recognized as an important asset capable of effective management. This article makes the case that premises can play a significant role by affecting organizational productivity and supporting corporate mission. It also reports the results of a post-occupancy evaluation survey carried out in the City of London.
Link to Full-text via ProQuest

Brill, Michael, Ellen Keable, Judy Fabiniak. (2000). "The myth of open-plan." ***Facilities Design & Management,*** **February. 19(2): 36-38.**

The authors challenge the desire for open offices, demonstrating research that open offices can prove detrimental to productivity. The article lists the top ten priorities with the strongest effects on employee performance and satisfaction from a research study conducted by BOSTI associates, an organization focused on research about the office. Acoustic privacy ranks highest in this list. The article emphasizes the need of private space for concentration, claiming that all employees require an opportunity for focused quiet work. Much work is spent doing noise generating activities, hurting the productivity of those who need to focus on undistracted solo work. The article advocates for small, private offices emphasizing the need for areas for distraction free work and interaction.
Link to Full-text via EBSCO

Brill, Michael, Stephen T. Marguilis, Ellen Konar, ***et al.*** **(1994).** ***Using Office Design to Increase Productivity*****. Buffalo, NY: Workplace Design and Productivity, Inc.**

Volume I contains the research results of BOSTI Associates' rigorous 6-year nationwide study of over 10,000 individuals across 100 companies. Volume II, based on Volume I's findings, presents research-based design guidelines, prototypical office designs and offers many practical applications for enhancing worker performance in any office.
Link to Purchase

Brill, Michael and Sue Weidemann (2001). ***Disproving Widespread Myths about Workplace Design*****. Buffalo, NY: BOSTI Associates.**

This booklet focuses on the two most powerful design determinants of productivity and satisfaction: the near-universal needs for distraction-free work and for learning-laden informal interactions. It translates these findings into new facility design concepts which have great capacity for dramatic and positive effects on critical organizational outcomes - increased performance, more satisfied employees, more productive teams, and enhanced learning.
Link to Purchase

Clements-Croome, Derek, ed. (2000). *Creating the Productive Workplace*. London: E & FN Spon.

In an increasingly competitive environment, companies are being forced to think harder than ever about the way they work and how they can improve profitability. *Creating the Productive Workplace* provides a critical, multidisciplinary review of the factors affecting workplace productivity. Productivity is a key issue for individual companies as well as the national economy as a whole. With 70-90 per cent of the costs of running an organisation consisting of the salaries of the workforce, small increases in worker productivity can reap high financial returns. Many studies have shown that productivity at work bears a close relationship to the work environment. This book sets out the most important factors and evidence behind this phenomenon, and offers solutions to providing a work environment conducive to productivity. This book is essential reading for facilities and estates office managers, interior designers, architects and building environmental engineers. It is also a text for undergraduates and postgraduates studying these disciplines and related subjects. Of particular value are Clements-Croome's chapter on indoor environment and productivity, and the chapter on productivity in buildings by Leaman and Bordass.
Link to Purchase

Haynes, Barry P. (2007). "An evaluation of office productivity measurement." *Journal of Corporate Real Estate.* 9 (3): 144- 155.

The aim of this paper is to evaluate approaches to the measurement of office productivity. The author presents a historical context to office design and reviews appropriate literature. The review aims to establish the limitations in defining office productivity and the range of approaches to its measurement. The review of the literature reveals that there is no universally accepted means of measuring office productivity, but the researches that have produced the most research evidence have tended to adopt a self-assessment approach. This paper establishes that the "people centred" approach to office evaluation is most appropriate for office workers with varying job tasks that allows the end-user or occupier perspective to be established.
Link to Full-text via ProQuest

Heerwagen, Judith (2000). "Green buildings, organizational success, and occupant productivity." *Building Research and Information*. 28 (5): 353-367.

Can 'green' buildings positively contribute to business performance and organizational effectiveness? Can 'green' buildings affect high-level organizational outcomes, such as profitability, customer satisfaction and innovation? How do the physical attributes of green buildings affect the physiological, psychological, cognitive and social functioning of building occupants at the individual level? This paper explores the wider context of sustainable design, integrating work form organizational effectiveness and human factors to suggest that 'green' buildings provide economic and organizational benefits for business.
Link to Full-text via InformaWorld

Marans, Robert W. and Kent Spreckelmeyer (1981). *Evaluating Built Environments*. Ann Arbor, Michigan: The University of Michigan.

The authors present a conceptual model of how the physical environment and organizational setting of the workspace can influence the perceptions and behaviors of workers. The model is illustrated throughout the text with a single case study that examines an office building in terms of the impact it has had on the people who work there, other building users, and the surrounding community and whether the building's spaces actually enhance or inhibit the successful completion of work activities. Chapter 8 provides a focus on the effects of the environment on worker performance and provides recommendations to enhance worker productivity.
Link to Purchase

Mawson, A (2002). "The workplace and its impact on productivity." A*dvanced Workplace Association*. 4 (8).
This paper by the Advanced Workplace Associates examines the effect that workplaces have on professional productivity. As the economy has shifted to a knowledge-base, productivity has become more difficult to quantify, thus professional productivity is often not considered when designing an office space. This paper discusses the workplace mismatch, acknowledging that workers are individuals and have different needs to enhance productivity. The Advanced Workplace Associates advocate 'unchaining' workers from their desks to allow workers to choose from a variety of settings and find one that best meets their needs.
Link to Full-text

O'Riley, Mary Kate (2004). "Make space for work." *Director*. 58 (2): 46-46.

O'Riley offers a report on the importance of the design of the office in workforce productivity; aspects of interior design that should be considered in designing an office. Employers are cautioned to spend wisely when designing a working environment for happy and healthier staff. O'Riley advocates for investment in a good working environment as while it may be more expensive in the short-term, it pays off in the future.
Link to Full-text via EBSCO

Resnick, M L, Zanotti, A. (1997). "Using ergonomics to target productivity improvements." *Computers & Industrial Engineering*. 33(1,2): 185-188.

Ergonomics have traditionally been used to decrease the number of occupational injuries by discovering those postures and tasks that create significant musculoskeletal stresses. However, the principles which underlie ergonomics can potentially be used to improve productivity as well. Ergonomic guidelines may allow prediction of those postures and workplace layouts that maximize the speed at which employees can work. In this study, fifteen subjects performed a typical industrial task in a variety of layouts designed within an ergonomically acceptable work envelope. The effects of tool mass, work height, and movement distance on performance time were measured. All three variables had significant effects on performance time, even within the ergonomic work envelope, however the magnitudes of the effects varied considerably. The results indicate that workstations can be designed to maximize performance and reduce costs by considering both ergonomics and productivity together.

Link to Full-text via Science Direct

Roulac, Stephen E. (2002). "Interview with Gerald de Kerchove." ***Journal of Corporate Real Estate*****. 4(4): 390-398.**

Gerald de Kerchove worked as CFO and Executive Vice President at Fair, Isaac and Company for 25 years. In an interview, he discusses how he hoped to increase his company's productivity through researching the link between productivity and the physical environment. Unable to find a conclusive measure of productivity, Gerald de Kerchove decided to create a measure using mathematical statistics to predict future behavior. He found no specific method to measure productivity, finding productivity to be dependent on a range of hundreds of variables, and instead chose to measure productivity based on four principle elements. In the interview, he discusses how he analyzes firms to determine ways to improve. The interview also provides a list of key concepts for analyzing workplace productivity.

Schneider, Jay W. (2007). "Focus on workplace design." ***Building Design & Construction*****, March. 48(3): 33-37.**

According to the US Workplace Survey, commissioned by architecture giant Gensler, U.S. corporations often underestimate the impact of workplace design and layout on their employees, and as a result productivity - and profits – suffer. Respondents said that, on average, they could increase their work output by 21% if their office environment were better designed. Surprisingly, a great workplace environment can even be enough to make employees agree to an extra hour of work each day. But nearly half of the respondents (46%) believe that creating a productive workplace is not a priority for their company, with 40% of employees citing corporate belt tightening as the main reason. Some survey results, however, indicate that employers understand the connection between office environments and company performance better than employees give them credit for.
Link to Full-text via EBSCO

Smith, Anna (1997, September). "Musical chairs and the flexible office." ***Management.*** **44(8): 65-73.**

Do flexible open office plans provide a competitive advantage? The author provides various case studies of businesses that have had their office environments physically restructured and the effects such restructuring has had on employees. The office environments addressed include the Ministerial office of the Government of Canada, Phillips Fox law firm in New Zealand, Telia Handel a Swedish telecom company, and the telecom company Ericcson. The article discusses the physical restructuring done by these corporations and the benefits associated with such changes in design.

Sundstrom, Eric and Irwin Altman (1989). "Physical environments and work-group effectiveness." ***Research in Organizational Behavior*****. 11: 175-209.**

Using an ecological approach, this chapter proposes a framework for analyzing the role of the physical environment in work groups. Group effectiveness, defined in terms of output and

viability, is conceived as a function of the fit among the group-organization boundaries, territorial control, and environmental features of the group territory that support boundary management. Research and theory from environmental psychology provide some examples of physical features that support boundary management in work-group territories. Territorial features are discussed for the four categories of work groups representing different combinations of integration vs. differentiation. The framework raises questions for future research on group effectiveness and points to some practical issues in the design of facilities for work groups.

Sundstrom, Eric, Jerri P. Town, Robert W. Rice, *et al.* (1994). "Office noise, satisfaction, and performance." *Environment and Behavior*. 26 (2): 195.

A field study assessed disturbance by office noise in relation to environmental satisfaction, job satisfaction, and job performance ratings among 2,391 employees at 58 sites before and/or after office renovation. In all, 54% said they were bothered often by noise, especially by people talking and telephones ringing. Disturbance by noise correlated with dissatisfaction with the environment and job but not with self or supervisor-rated performance. Quasi-experimental analysis of groups reporting increased, decreased, or unchanged disturbance by noise revealed a drop in satisfaction concurrent with increasing noise. Disturbance by office noise may reflect a variety of environmental and job characteristics and may have a role in job satisfaction through both environmental satisfaction and job characteristics. Implications are discussed.
Link to Full-text

Vischer, Jacqueline C. (1995). "Strategic work-space planning." *Sloan Management Review*. 37(1): 33.

Companies are examining their use of space more carefully to reduce occupancy costs. Misconceptions about the role of accommodation on organizations have led to costly inefficiencies in space planning and building use. Reducing square footage provides a company with a 2-stage opportunity for improvement. First, space "right-sizing" and redesign can lead to a better "fit" between work-space design and users' tasks; employees' work space can more effectively support the work performance and improve productivity. Second, the process of making space cuts and changes is an opportunity for initiating broader-based corporate change in companies seeking to reduce overhead, empower employees, and reengineer work processes. One company that has taken advantage of right-sizing work space opportunity is the Bank of Boston.
Link to Purchase

Vischer, Jacqueline C. (1996). *Workspace Strategies: Environment as a Tool for Work*. New York: Chapman and Hall.

This book examines the issues and concepts that influence the planning and designing of work spaces. It shows managers, property owners, educators and building professionals how people use their workspace and how office planning can be improved to help make people more effective at their jobs. The book also provides advice on how to implement such improvements to office space. Vischer stresses the role of the work environment as a tool for work.
Link to Purchase

Vischer, Jacqueline C. (1999). "Will this open space work?" ***Harvard Business Review*****. May.**

This article provides a case study of workplace design followed by expert opinions. Northern Oil built its new downtown offices to foster off-the-cuff conversations and casual meetings, but manager Sasha Pasternak pushed for some private spaces. She also worked to standardize workstation size and set up special arrangements for mobile workers. Donald J. Chiarofaro of Chiarofaro Co. notes that office space itself seldom makes a significant difference in productivity, teamwork or efficiency, and challenges the claim that open-space office plans save money. Paul O'Neill of Alcoa, whose recent office-design experience was similar to Northern Oil's, urges designing new space around 'natural work groups'. Carnegie Mellon University professor Vivian Loftness argues that open offices do not cost less than traditional ones. David Lathrop of Steelcase North America warns that getting employees to accept new designs is difficult.
Link to Purchase

Wah, Louisa (1998). "The power office." ***Management Review*****. 87(5): 10-14.**

The article attempts to provide justification of how an open office environment can increase productivity. While many employees claim that they feel they have increased productivity, the author claims that CEOs require hard numbers before making decisions to invest in restructuring office environments. There is no simple method to measure productivity, thus it is difficult to provide concrete proof. The author attempts to justify the benefits of the open office environment by discussing the importance of the intangible effects of an open office environment, emphasizing the gains from proximity to team members and benefits of informal contact.
Link to Full-text via EBSCO

Zeisel, John (2006). ***Inquiry by Design: Environment/Behavior/Neuroscience in Architecture, Interiors, Landscape, and Planning.*** **New York: W.W. Norton & Company.**

Inquiry by Design lays out fundamental theoretical approaches to design and research as well as practical research methods applicable to planning, programming, and evaluating physical environments. It systematically describes basic methods of research and how to apply them and shows how collaboration between designers and researchers leads to greater design creativity.
Link to Purchase

3. INFLUENCE OF WORKSPACE ON EMPLOYEE COMMUNICATION, COLLABORATION AND INTERACTION

Asirvatham, Sandy (1999). "No more cubes." ***Journal of Property Management.*** **July. 64(4): 28-32.**

This article discusses how the traditional manufacturing model of the workplace is becoming increasingly outdated as emphasis has been placed on promoting innovation and creativity among workers. The focus of the work environment has shifted from productivity to the effectiveness of the production process. The article claims that tomorrow's workspaces will be

open and flexible. The inside of offices will be restructured to encourage employee interaction and establish a more creative environment. This will challenge traditional perceptions of real estate and the office environment. This article further discusses the ways that flexible workspaces can be implemented.
Link to Full-text via ProQuest

Baldry, Christopher (1997). "The social construction of office space." ***International Labour Review*****. 136(3): 365-378.**

The "office" has always taken on a specific connotation. Through this article, Baldry attempts to demonstrate how social and architectural structures interact and the symbolism that they can represent. Buildings provide specific meanings through symbolism. Baldry discusses historic developments in office structure from the "bull-pen" offices of the 1930's to the present "post-Fordist" office structure. The discussion of the evolution of office structure is an attempt to demonstrate the interconnectedness between structure and social relations in the office environment. Baldry's article presents a plea for consideration of the built environment when analyzing work.
Link to Full-text via ProQuest

Becker, Franklin, Beverly Gield, Kenneth Gaylen ***et al.*** **(1983). "Office design in a community-college: Effect on work and communication patterns."** ***Environment and Behavior*****. November. 15: 699-726.**

Few studies have assessed how characteristics of the physical setting affect specific organizationally-valued behaviors. The present study compares the effects of open-private, closed-shared, and closed-private offices on faculty work patterns and faculty-student interaction. One hundred faculty and 356 students completed questionnaires. In addition, systematic observations of faculty offices over a several day period were conducted to assess occupancy rates as a measure of adaptation to unsupportive physical surroundings. Faculty in open-private offices reported significantly more difficulty working efficiently and concentrating. Both faculty and students reported that faculty were less available in open-private as compared to closed-private offices, and both groups reported that the quality of performance feedback either given or received suffered in the open plan compared to traditional shared or single-occupancy offices. The implications of the design and use of the physical setting for individual and organizational effectiveness in college and other client-centered settings are discussed.
Link to Full-text via Sage

Brill, Michael (1992). "Workspace design and productivity." ***The Healthcare Forum Journal*****. September. 35(5): 51.**

The effects of the physical environment on job performance, satisfaction, ease and quality of communication are discussed in this article. Brill challenges many of the traditional theories regarding office design and office management, including a criticism of open office environments. Brill concludes that the aspects of the office that affect job performance and satisfaction act relatively independent of each other. Brill also advocates that to improve

performance one does not necessarily need to spend more money on the physical environment, but simply spend money more wisely.
Link to Full-text via ProQuest

Caddy, Edmund III (2006). "Scandinavian innovation." ***Corporate Real Estate Leader*****. July/August: 18-22.**

The Norwegian telecommunication company Telenor attempted to construct a leading workplace to foster innovation. According to Jon Fredrik Baksaas, the President and CEO of Telenor, when the company was attempting to restructure its workplace it, "sought a highly aesthetic environment, even at this vast scale, that would stimulate creativity, the processing of ideas, and the exchange of information and knowledge." Telenor decided to amalgamate its forty sites into a single site. It sought to create an environment where employees were able to work anywhere and anytime though the technology of mobile connectivity. It also hoped that this environment would increase employee interaction. An outline of the project's business plan is provided in the article. The benefits of Telenor's restructuring to a flexible workplace are provided in an attempt to justify the importance of workplace flexibility.
Link to Full-text via CoreNet

Haynes, Barry P. (2007a). "The impact of the behavioral environment on office productivity." ***Journal of Facilities Management*****. 5 (3): 158-171.**

The aim of this paper is to demonstrate the role that the behavioral environment plays in office productivity. The paper reviews the literature from the occupier perspective. This approach enables a greater appreciation of the social context of offices. The review establishes the need to link work process with the office environment. It identifies the need to understand how occupiers make sense of space through personalism. The balance between the positive interactions in the office and the negative distractions are explored. The review of the literature reveals that by adopting the occupier perspective potential tensions can be identified between individual, private, and team-based collaborative work areas. These tensions can have an impact on the office occupier's productivity. This paper establishes that to ensure office environments are designed for optimum productivity considerations must be given to the role of the behavioral environment. Office environments need to be designed to enhance collaboration, whilst at the same time ensure individual private work is not compromised.
Link to Full-text via ProQuest

Heerwagen, Judith, Kevin Kampschroer, Kevin Powell, ***et al.*** **(2004). "Collaborative knowledge work environments."** ***Building Research & Information*****. 32 (6): 510-528.**

How can the physical design of the workplace enhance collaborations without compromising an individual's productivity? The body of research on the links between physical space and collaboration in knowledge work settings is reviewed. Collaboration is viewed as a system of behaviours that includes both social and solitary work. The social aspects of collaboration are discussed in terms of three dimensions: awareness, brief interaction and collaboration (working together). Current knowledge on the links between space and the social as well as individual aspects of collaborative work are reviewed. The central conflict of collaboration is considered:

how to design effectively to provide a balance between the need to interact and the need to work effectively by oneself. The body of literature shows that features and attributes of space can be manipulated to increase awareness, interaction and collaboration. However, doing so frequently has negative impacts on individual work as a result of increases in noise distractions and interruptions to on-going work. The effects are most harmful for individual tasks requiring complex and focused mental work. The negative effects are compounded by a workplace that increasingly suffers from cognitive overload brought on by time stress, increased workload and multitasking.
Link to Full-text via InformaWorld

McLean, Jennifer Tallman (2004). "Forward-thinking planning and design." ***Corporate Real Estate Leader*****. 3 (4): 18-20.**

Most tenants don't need more space, they need "smarter space." This article looks at key communication patterns between individuals in an office before any changes are made in order to identify an office layout that will maximize communication, work flow and job performance.

Oldham, Greg (1988). "Effects of change in workplace partitions and spatial density of employee reactions." ***Journal of Applied Psychology*****. 73 (2): 253-258.**

This study examined the effects of moving from an open-plan office to one of two alternative office designs: (a) an office with partitions surrounding employee work areas or (b) a low-density open-plan office with more usable space per employee. A total of 65 claims adjusters from three offices of a large insurance organization provided data at two points in time: three months before the office changes and three months after the changes. Hierarchical regression analyses and paired t tests showed that, relative to employees in a control office, employees who moved from an open-plan office to either a low-density open-plan office or to a partitioned office experienced significant improvements ($p < .01$) in task privacy, communication privacy, crowding, and office satisfaction. Moreover, two individual difference measures influenced significantly ($p < .05$) the effects of the office changes on the crowding responses. Employees who had low levels of stimulus screening or high privacy needs reported the largest decreases in perceived crowding after the office changes. The implications of these findings for future research on office design are discussed.
Link to Full-text via EBSCO

Sundstrom, Eric and Mary Graehl Sundstrom. (1986). ***Work Places: The Psychology of the Physical Environment in Offices and Factories*****. New York: Cambridge University Press.**

How do the physical surroundings affect people who work in offices and factories? *Work Places* attempts to answer this question by summarizing what is known about the psychological and social influences of work settings. The authors discuss research and theory concerning individual satisfaction and performance, interpersonal relationships, group cohesion, and organizational effectiveness. Separate chapters address the physical aspects of the environment (temperature and air quality, lighting and windows, noise, music, colour, and work-stations), the symbolic aspects of the work environment (status and self-identity), and issues of communication, privacy, small groups, and the organization as a whole.

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4. INFLUENCE OF OFFICE SPACE ON EMPLOYEE HEALTH AND COMFORT

Becker, Franklin and Fritz Steele (1995). *Workplace by Design: Mapping the High-Performance Workscape*. Jossey-Bass Business and Management Series.

Despite all of the literature devoted to change in the workplace, discussing either the role of technology or the need to restructure organizations, little attention has been paid to the physical workplace and how space can limit or shape both work itself and the application of technology. The authors target managers and organizational leaders with this consideration of the consequences of space planning and design. Issues addressed include: work-flow patterns, the status and identity aspects of space and location, the need for flexibility, the growing role of teams, health factors, and the unique characteristics and technological requirements of remote or off-site workers.
Link to Purchase

Carsia, Tiernan (2002). "Designing workspaces for higher productivity." *Occupational Health & Safety*. September. 71(9): 192-194.

The concept of an open office space has become quite popular as employers seek to maximize the number of employees and minimize the amount of space. Tiernan identifies one of the major problems of the open office environment by addressing the additional office noise that such a set up generates. Open office spaces risk decreasing success in an effort to save money as office noise has proven a primary inhibitor to productivity. Office noise has also been linked to health and safety concerns. The open office environment causes acoustic issues as it increases the level of conversations. Other office components can also be large generators of noise, harming the acoustic environment. This article discusses the problems with office noise and the importance of all of the components of the office working in sync to generate the ideal acoustic environment.
Link to Full-text via ProQuest

Fisk, William (2000). "Health and productivity gains from better indoor environments and their relationship with building energy efficiency." *Annual Review of Energy and the Environment*. 25: 537–66.

Theoretical considerations and empirical data suggest that existing technologies and procedures can improve indoor environments in a manner that significantly increases productivity and health. The existing literature contains moderate to strong evidence that characteristics of buildings and indoor environments significantly influence rates of communicable respiratory illness, allergy and asthma symptoms, sick building symptoms, and worker performance. Whereas there is considerable uncertainty in the estimates of the magnitudes of productivity gains that may be obtained by providing better indoor environments, the projected gains are very large. For the United States, the estimated potential annual savings and productivity gains are $6 to $14 billion from reduced respiratory disease, $1 to $4 billion from reduced allergies and asthma, $10 to $30 billion from reduced sick building syndrome symptoms, and $20 to $160 billion from direct improvements in worker performance that are unrelated to health.

Productivity gains that are quantified and demonstrated could serve as a strong stimulus for energy efficiency measures that simultaneously improve the indoor environment.
Link to Full-text via EBSCO

Hamilton, Kathryn (1998, May). "Welcome to the neighborhood." *Buildings: Interiors*. 12-16.

The shift to a knowledge economy has led to new requirements to enhance productivity. The workspaces of the knowledge economy must be flexible and responsive to the work being done; a 'one-size-fits-all' approach is not effective. The workspace design should be based on both the present and future goals. There are different types of employees and teams which have different needs, thus workspaces should be designed to accommodate such differences. It is also essential that employees have a comfortable environment to enhance productivity. According to this paper, creating an effective work environment in the knowledge based economy is based upon technology, human resources, and facility design.

Newsham, G., J. Veitch , C. Arsenault, and C. Duval (2004). *Effect of dimming control on office worker satisfaction and performance.* (NRCC-47069). Ottawa: National Research Council of Canada.

This experiment was conducted in a mock-up office-space laboratory. One hundred and eighteen participants worked for a single day under one of four lighting designs. They had no control over the lighting until the latter half of the afternoon, when all participants were offered some form of individual dimming lighting control. During the working day participants performed a variety of simulated office tasks, as well as completing a number of questionnaires on topics such as mood, satisfaction, and discomfort. Results related to questionnaire outcomes were consistent and convincing. After lighting control was offered there were significant improvements in mood, room appraisal, lighting satisfaction, glare dissatisfaction, environmental satisfaction, satisfaction with performance, self-assessed productivity, and visual discomfort. Further, our results suggest that it is not control in itself that is important, but exercising control to achieve preferred conditions. Participants who made the biggest changes to lighting conditions after they were given control tended to register the biggest improvements in mood, satisfaction and discomfort outcomes; those who made little change registered no improvements in outcomes. Task performance results were more equivocal. On many tasks, performance did significantly improve after control was introduced, but we attribute these improvements primarily to known practice effects. We recommend field studies over the longer term to test whether mood and satisfaction effects persist, and whether performance effects emerge.
Link to Full-text

Sykes, David and R. J. Brennan (2006a). "High-performance workplaces II: A revolution in building materials will transform your workplace." *Corporate Real Estate Leader*. March: 42-44.

Office buildings can be cleaner, brighter, healthier, more efficient, safer, stronger, lighter weight, smarter, less expensive and truly sustainable thanks to a revolution in technologies called "nano-

materials." In this article, the author discusses new technologies that impact the materials used in office buildings and interiors.

5. ROLE OF WORKSPACE ATTRIBUTES IN EMPLOYEE RECRUITMENT, SATISFACTION AND RETENTION

Becker, Franklin (1980). "Employees need role in design of work space." *Hospitals*. November 16. 54 (22): 97, 101.

Becker provides a case study of employee participation in facility planning using a medium-sized hospital in upstate New York. In the study, employees filled out questionnaires and were involved in group workshops to address their concerns with their office environment and potential solutions. All levels of staff were involved in planning the changes of the work environment. Input from employees of all levels helped to address existing workplace problems and increase efficiency. Participation of the entire staff also provide beneficial to employee morale.

Becker, Franklin (1990). *The Total Workplace: Facilities Management and the Elastic Organization*. New York: Van Nostrand Reinhold.

The author claims that a new focus on facility management has been fostered by changes in the structure of organizations. Facilities management is becoming increasingly important in a competition to attract highly qualified workers. The book outlines historical changes that have led to advancement in facility management. It also provides anecdotal evidence for the effects of facility management policies and procedures on organizations. The elastic organization has also been linked to increased performance, with a focus on the process and a renewed importance in facility management. The book claims that quality offices must be diverse to accommodate individual differences and change. Also stressed is that what is perceived as a quality office is subject to individual preferences and thus to have a quality office it is important to find common ground among all players. The author stresses the advantages that can be gained by analyzing facility management internationally to find ways to improve. The book focuses on how facility management can help to provide a total workplace that can be competitive by attracting high quality staff and providing them with an environment to reach their full potential.
Link to Purchase

Brennan, Aoife, Jasdeep Chugh and Theresa Kline (2002). "Traditional versus open office design: a longitudinal field study." *Environment and Behavior*. 34 (3): 279-299.

Research in open office design has shown that it is negatively related to workers' satisfaction with their physical environment and perceived productivity. A longitudinal study was conducted within a large private organization to investigate the effects of relocating employees from traditional offices to open offices. A measure was constructed to assess employees' satisfaction with the physical environment, physical stress, coworker relations, perceived job performance, and use of open office protocols. The sample consisted of 21 employees who completed the surveys at all three measurement intervals: prior to the move, four weeks after the move, and six months after the move. Results indicated decreased employee satisfaction with all of the

dependent measures following the relocation. Moreover, the employees' dissatisfaction did not abate, even after an adjustment period. Reasons for these findings are discussed and recommendations are presented.
Full Text via Sage

Costello, Mark (2007). "Staying on: Employee retention by design." ***CoreNet Global's The Leader*****. 6 (Sept/Oct):18-22.**

Leading employers recognize the need to create a work environment that will stimulate the intellectual growth of their collective work force, which is imperative for success in today's 'knowledge economy.' The article deals with: work/life balance and working remotely, how going "green" helps retain employees, and the declining demand for office space.
Link to Full-text via CoreNet

DYG, Inc. (1998). ***The Second Bottom Line: Competing For Talent Using Innovative Workplace Design*****. On-line report.**

Large employers will have increasing needs to attract computer programmers and software engineers, while facing greater difficulties holding onto these workers. The overall goal of this research is to learn about the value of the physical environment to high-tech workers in the late 1990's.
Link to Full-text

Fischer, Gustave Nicolas, Cyril Tarquinio and Jacqueline C. Vischer (2004). "Effects of the self-schema on perception of space at work." ***Journal of Environmental Psychology*****. 24 (1): 131-140.**

The purpose of this research is to show that a person's self-schema can affect his or her perception of reality at work. Results show that significant differences in environmental perception and workspace evaluation exist between people with a self-schema of professional failure and those with a self-schema of professional success. The findings suggest that the self-schema filters information about the environment in two directions, affecting how people assess their work environment, and also how they see themselves on the basis of the attributes and functioning of their work environment. The study has interesting implications for a better understanding of the complexity of the person–environment relationship in the workplace.
Link to Full-text via Science Direct

Haley, Fiona (2004). "Mutual benefit." ***Fast Company*****. 87 (October): 98.**

Genencor, a biotech company, took a radical initiative allowing its employees the opportunity to design their own work environment. This has led to a lower employee turnover rate and increased employee productivity. Genencor also provides employees with a variety of onsite services to aid employees in completing errands without having to leave work. Other services provided by Genencor include emergency child care, and transportation. These additional services help to please workers and are a minimal expense per employee compared to the cost of

recruiting and retraining new workers. Genencor provides an example of how the transformation to a flexible work environment can prove beneficial to employers.
Link to Full-text

Hays, Scott (1998). "Sears turns office space into a recruiting tool." ***Workforce Management*****. 77 (12): 117-120.**

When Sears, Roebuck and Co. found itself struggling to find information technology (IT) professionals, it decided it was time for change. In an attempt to recruit new workers, Sears transformed its traditional office design to create a unique and cutting-edge work environment. This transformation of workspace proved successful at increasing their staff of IT professionals from 25 to 145. An interview is provided with Gael Hanauer, the senior director of human resources and information systems at Sears. In the interview, Hanauer discusses the changes made to the workspace in an effort to be competitive at attracting IT workers.
Link to subscription

Monk, Roger (1997). "The impact of open-plan offices on organizational performance." ***International Journal of Management*****: Part 1, 14(3): 345-349.**

Research into open-plan office usage has found that some advantages are more assumptions than reality. In an open office, improved communications are not necessarily those to do with work, there is less interaction, much more distracting noise, co-worker movement and overheard conversation interfering with information exchange and concentration. Work performance standards and job satisfaction are threatened as there is an increase in stress and a decline in autonomy, task identity, supervisory feedback and privacy. The emphasis appears to be on architectural and financial rationalism and not on the needs of incumbent employees, which needs eventually affect the productivity, motivation and well-being of the whole organization.

Oldham, Greg and Nancy Rotchford (1983). "Relationships between office characteristics and employee reactions: A study of the physical environment." ***Administrative Science Quarterly*****. December. 28 (4): 542-556.**

This research examined the relationships between objective office characteristics (openness, office density, workspace density, accessibility, and office darkness) and several measures of employee reactions (satisfaction, behavior during discretionary periods, and spatial markers). In addition, the research examined the extent to which three sets of intervening variables examined these relationships. The intervening variables were interpersonal experiences (conflict, friendship opportunities, agent feedback), job experiences (task significance, autonomy, task identity) and environmental experiences (crowding, concentration, privacy). Data was collected from 114 clerical employees of 19 offices. Each of the office characteristics related significantly to one or more of the employee reaction measures. Moreover, office characteristics affected several employees' reactions through their impact on the intervening variables.
Link to Full-text via ProQuest

Vischer, Jacqueline C. (2008). "Towards a user-centred theory of the built environment." *Building Research & Information*. May. 36 (3): 231 – 240.

The building user's experience is explored as the basis for constructing a theory of the built environment. The first postulate of a user-centred theory is that the built environment exists to support the activities of the users that it shelters. This theory, therefore, indicates ways in which we might learn more about this complex relationship; it also provides tools for measuring the degree to which the built environment in use is successful. Ways of approaching the users' experience of built space, and ways of measuring it to ensure that knowledge of the user-environment relationship grows, are described. Challenges to implementing such an exploration include defining users, agreeing on the meaning of experience, and organizing if not delimiting what is included in the notion of built environment. The temporal dimension of space use is also a consideration. Drawing on extensive research on space-use in office buildings, a viable user-centred theory is developed in the context of one type of built environment. The user-centred theory enables links to be made between knowledge accumulated both at the micro scale of the users' experience and at the macro perspective of how the built environment is produced and delivered.
Link to Full-text via Informaworld

6. BUILDING SYSTEMS AND PERFORMANCE

BOMA International Foundation (2000). *Integrated Systems: Increasing Building and Workplace Performance*. Washington, DC.

Research conducted by the Building Owners and Managers Association (BOMA) International has proven that meeting many of the needs of tenants can be accomplished through HVAC and other building operating systems. Much of this research is found in the chapter entitled, "What Office Tenants Want and BOMA's Strategic Mapping Project." The underlying principle as to why building owners and management professionals should consider integrated systems is based on a measurement of building performance. This paper summarizes the key findings of an industry-based partnership that was formed with the goal of understanding the role integrated systems play in terms of increasing building and workplace performance.
Link to Full-text

Bottom, Connel, Stanley McGreal and George Heaney (1998). "The suitability of premises for business use: An evaluation of supply/demand variations." *Property Management*. 16 (3): 134-144.

Office buildings in the City of London accommodate a wide variety of tenant organizations whose business characteristics and property requirements differ. Physical design/quality attributes also differ between buildings and, therefore, either constrain or support specific business activities. The results of a survey carried out using a sample of investment properties and their tenants within the City illustrate the existence of these variations. In particular, the difference between tenant organizations' perceived supply and demand for individual building design/quality factors is highlighted showing areas of general under-performance. The owners of City of London office buildings, typically the financial institutions, are concerned with the

functionality of their properties which influence the short- and long-term returns of this particular type of asset. Information originating from the utilization of building appraisal techniques is of considerable use within any property management decision-making process and in particular the identification of potential problems associated with building obsolescence.
Link to Full-text

Bradley, Stephen and Christopher Hood. (2003). "Delivering minimalist workplaces that improve corporate agility." ***Journal of Facilities Management.*** **June. 2(1): 68.**

Unwarranted allocation of personal space and accumulation of personal 'stuff' can become impediments to business agility, turning conventional offices into 'millstones' which suppress an organization's ability to change direction smartly in the face of new competition and other business forces. Workplace design needs to cater to perpetual change of occupancy, organization, work processes and messages about the business. Tangible assets should be dynamic, adaptable and even portable. Setting aside arguments in favour of 'showpiece' corporate headquarters, this paper advocates that what is needed to help business units to stay competitive in a 'minimalist workspace' – kept free of 'stuff' that clutters and impedes quick and inexpensive adaptation of local needs, every few months rather than every few years. The minimalist workplace does not need to be bland or impersonal. Imaginative design and minute attention to detail of the physical environment and the tools, technology, and support services can produce attractive and 'livable' environments which can successfully accommodate personal preference and promote a sense of belonging as well as mobility. This paper outlines four 'golden rules' for best practice in the minimalist workplace, demanding more proactive space management and more intelligent real estate design and specification to cater to greater utilization of facilities.
Link to Full-text via ProQuest

Cairns, George (2003). "Seeking a facilities management philosophy for the changing workplace." ***Facilities*****. 21(5): 95-105.**

This article promotes the notion that the emergent field of facilities/facilities management (FM) requires a philosophical basis, where philosophy refers not to an esoteric, academic abstraction, but to the basic theory and general principles of knowledge that underpin everyday activity. It argues specifically for generation of a philosophy of "the workplace"; the separate but related social, physical, technological and organization contexts of work. This philosophy of "the workplace", the centre stage of FM activity, is important in order to: first, provide a knowledge base that critically engages with the complexities and ambiguities of these diverse but interconnected contexts of work; second, engage with some of the failings of FM knowledge to date, where idealistic best practice is presented as if it were theory, and simplistic research presents universal solutions based upon limited engagement from a simple context; and third, provide a knowledge base that can stand up to critical analysis from other fields of knowledge, some of which overlap with that of FM.
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Duffy, Francis (2000). "Design and facilities management in a time of change." *Facilities*. 18 (10/11/12): 371-375.

This article reviews the development of facilities management over the last 20 years. A parallel and similarly retrospective view is taken of developments in office design. There is some reason to believe that both movements have been a failure for the same reason – an exaggerated notion of the importance of cost cutting leading to the predominance of supplying side values rather than serving the real interests of increasingly demanding views. More optimistically, it is agreed that, if both facilities managers and designers (including architects) were to give proper attention, in a period of particularly rapid change, to user interests, then considerable and beneficial innovation would become possible.
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Office of Government of Commerce (2006). *High Performance Property: The Route Map to Asset Management Excellence*. Office of Government of Commerce, Norwich.

High Performance Property provides the framework and direction for improving strategic property asset planning in central government over a defined period with the key actions required by the centre and departments clearly defined. The "route map" challenges government: both at the centre and in departments together with their arms length bodies to deliver a step change in performance. The "route map" examines four components of property asset management in central government: leadership and integration, benchmarking and standards, skills and capability, and review and challenge.
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Preiser, Wolfgang and Jacqueline Vischer (2005). *Assessing Building Performance.* Oxford, MA: Elsevier.

The building performance evaluation (BPE) framework emphasizes an evaluative stance throughout the six phases of the building delivery and life cycle: (1) strategic planning/needs analysis; (2) program review; (3) design review; (4) post-construction evaluation/review; (5) post-occupancy evaluation; and, (6) facilities management review/adaptive reuse. The lessons learned from positive and negative building performance are fed into future building delivery cycles. The case studies illustrate how this basic methodology has been adapted to a range of cultural contexts, and indicate the positive results of building performance assessment in a wide range of situations.
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Preiser, Wolfgang, Jacqueline Vischer, and Edward White (1991). *Design Intervention: Toward A More Humane Architecture*. New York: Van Nostrand Reinhold.

In this book, Chapters 15 and 17 are case studies of innovative office-building architecture in Europe, designed with explicitly humanistic goals as well as desire for efficient and innovative technology. Chapter 16 takes a less architectural and more environmental look at human needs in the work spaces. The author challenges the basis for many existing engineering and architectural standards that guide office building design, especially where ambient interior conditions are

concerned. This chapter poses the question of whether or not minimal environmental standards really contribute to human comfort, and to what extent the basis for these standards should be reconsidered.
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Rowh, Mark (1999). "The high-performance workplace." *Office Systems*. February. 16(2): 18-24.

This article provides tips on how to provide the most effective office environment. One of the key components of a productive office environment is flexibility. This flexibility includes the ability of the office structure to adapt to meet changing needs. Flexible office furniture is also important to establish this as it can be adapted to meet the various demands of individuals. The importance of proper ergonomics, light, temperature, and air quality are also discusses as playing an influential role in productivity and safety and must be considered when designing an office environment. Much advice is provided on how to establish an office environment to optimize employee performance.
Link to Full-text via ProQuest

Sykes, David and R. J. Brennan (2006). "High-performance workplaces: innovations in workplace strategy." *Corporate Real Estate Leader*. March: 34-37.

The article provides information on what a high-performance workplace is and how to achieve it. Companies attempt to attract knowledge workers and increase their productivity in an effort to become high-performance workplaces. The article provides seven habits of highly effective workplaces. The article emphasizes that CEOs need fast research on the increases in productivity from changing the office environment to justify such a change. Methods for attaining such instant feedback are provided and encourage the changing of the office environment to accommodate increases in productivity. An example is provided through the construction of the Herman Miller Marketplace.

Vischer, Jacqueline C. (2005). *Space Meets Status: Designing Workplace Performance*. New York: Routledge.

This book was authored by an environmental psychologist and deals with the problems that are created when employers try to decrease the size of individual offices and workstations in order to increase work efficiency. Employees often regard their workspace as a "home away from home", a retreat and a space that symbolizes their status and marks their territory. They feel threatened by this attempt to shrink "their" room. Vischer summarizes significant research findings on office-space design and behavior from fields such as environmental psychology, architecture and interior design, employing terms that are accessible and interesting to practicing designers as well as business managers. Examples and case studies illustrate how space is a corporate resource, and how companies can improve their design decisions. The book also examines the practical aspects of planning workspace for users. Worker productivity and stress levels are affected by lighting, ventilation, temperature, noise, and furniture layout. This book takes a new approach by showing how the technical aspects of human comfort in terms of building systems does not always tally with users' perceptions and behavior. By understanding more about how

these factors affect work performance, corporate managers and design professionals can plan, design and manage the layout of the work environment more effectively.
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