

Environmental Psychology

NEW DEVELOPMENTS

Jorge Valentín
Lucila Gamez
Editors

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ENVIRONMENTAL PSYCHOLOGY NEW DEVELOPMENTS

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**ENVIRONMENTAL PSYCHOLOGY
NEW DEVELOPMENTS**

**JORGE VALENTÍN
AND
LUCILA GAMEZ
EDITORS**

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PREFACE

Environmental Psychology: New Developments presents original research results on the leading edge of environmental psychology. Each chapter has been carefully selected in an attempt to present substantial advances across a broad spectrum.

Chapter 1 - Environmental Psychology provided a crucial knowledge foundation towards the development of Environment and Behavior (EB) studies in the 1960's. The central objective was to bridge environmental design research and design practice. The perceived need for a new field could be ascribed to concerns regarding the separation between the designers and the users of a building. Over the decades, however, EB had little exemplary influence on design practice, leading to disquiet among environmental psychologists and EB scholars regarding research utilization. Events in the American healthcare industry in the 1990s became a catalyst for transformation of the research-design relationship. A report by the Institute of Medicine highlighted the level of preventable deaths occurring in American hospitals. There was growing recognition that risks and hazards of health care associated injury and harm are a result of problems with the design of systems of care rather than, solely, poor performance by individual providers. Furthermore, there was substantial evidence that the design of hospital physical environments contributes to medical errors, to increased rates of infection and injuries from falls, and to slow patient recovery and high nurse turnover. As a result, the central focus in the healthcare industry became designing safer and more efficient hospitals. There was an urgent and emerging need for a novel approach to optimize healthcare quality within cost, legal, and cultural constraints. Evidence-Based Medicine (EBM) provided a source of inspiration for healthcare design leading to Evidence-Based Design (EBD). In the past decade principles, framework, theories, and methods of Environmental Psychology have played a crucial role in the evidence-based design process. It has helped develop a structured approach to collating and examining evidence, representing information, and identifying knowledge gaps where further research is warranted to support design decisions. Growing research points to the need to change facility development and design methodologies of the past to integrate patient safety concepts in the design. This chapter describes the applications of environmental psychology to evidence-based healthcare design, and the manner in which environmental psychology concepts are transforming the design of hospitals.

Chapter 2 - This article presents a current review of the environmental psychology literature as it pertains to physical work environments. In addition to reviewing past literature, this article points out contemporary trends affecting workspaces, such as the trend toward distributed and/or remote work, the migration towards more digitized work environments, the

need for more flexible office spaces, the push towards “greener” and more environmentally friendly buildings (such as those that meet LEED certification), and the importance of increased rates of innovation at work. The article then discusses how these trends may affect the relevance of past research in this area. As relevant, research from related fields (e.g., architecture) will be incorporated to promote interdisciplinary insights and integration. The chapter will conclude with a general discussion of how environmental psychology can best position itself as a discipline given work trends/changes and lay out research questions for future inquiry.

Chapter 3 - Several years ago, proponents of the Sustainable Development (SD) approach identified four levels of impact of sustainable lifestyles (SLS) and actions on people’s wellbeing. Accordingly, a sustainable society was presumed to positively affect the ecological, social, economic and political-institutional scenarios in which people live and thrive. More recently, a number of government and social institutions have added a psychological dimension to this list of levels of impact of SD. For these governments and institutions, psychological wellbeing should be a positive consequence of sustainability. An incipient research in environmental psychology reinforces such an idea, demonstrating that people who practice pro-environmental behaviors are happier individuals. Also, psychological restoration (i.e., retrieval from exhausted psychological capabilities and health) is assumed to derive from living in sustainable scenarios. Moreover, sustainability, as practiced in the form of pro-environmental behaviors, not only is linked to their psychological consequences but also to psychological antecedents of sustainable lifestyles. More than forty years of research have demonstrated that SLS are predicted by affective and cognitive determinants of behavior. In this paper authors review studies and views encompassing the psychological dimensions of sustainability. The basic idea is that it is human psychology (i.e., environmentally destructive behaviors and propensities) the main cause of the current ecological crisis; but human behavior is also a paramount solution. Thus, any interventional strategy to be successful has to consider the psychological determinants, the remedial behaviors, and also the positive consequences linked to more sustainable behaviors. Consequently, for analytical reasons, authors identify: 1) psychological antecedents, and 2) psychological consequences of 3) sustainable behaviors. All these three levels are subject to scientific scrutiny within the realm of environmental psychology and related areas. The psychological antecedents of sustainable actions include dimensions such as environmental emotions, affinity towards diversity, ecological worldviews, future orientation, pro-environmental deliberation, pro-environmental norms and values, and pro-environmental competency, among others, which are described in this chapter. The psychological consequences of sustainability are subjective wellbeing or happiness, and psychological restoration, but a number of positive outcomes are to be added to this list. In turn, sustainable behaviors (or lifestyles) encompass pro-ecological, frugal, equitable and altruistic behaviors, which are actions resulting in the conservation of the socio-physical environment. Therefore, this chapter stresses the idea that psychology is a key constituent of sustainability. Since the environmental dilemma emerged as a consequence of human drives (i.e., motivations for exploiting and depredating the environment), and capacities (human intelligence and potential for exploiting natural resources), an important component of the solution to this dilemma has to be found in exploring human psychology across the three levels above identified. Also, in studying how human potentials (emotions, competency, deliberation, anticipation, etc.) can be converted into solutions to environmental problems.

Chapter 4 - Let's think about a person entering a simple room. The attention is drawn from a single object placed in one corner of the room, precisely a red sphere. Walls are painted light grey. Corners of the room are identical. The corner hosting the sphere is formed by two walls of different length. Thus, the participant is requested to close the eyes and, helped by the research assistant, to spin around the vertical axes for a while (this procedure generates disorientation). In the meantime, all the corners are covered with four identical blue boxes. Consequently, he/she cannot directly see where the red sphere is. Thus, he/she are invited to open the eyes and asked to choose the corner that housed the sphere. Usually participants reach / point to the box which, effectively, holds the sphere or its opposite corner, located on the same diagonal, because that corner has the same spatial properties of the correct one. Repeating the same procedure with a large number of participants, authors will see that approximately half of them would choose the correct corner, and the other half the opposite one. If authors could ask them to describe how they identified the correct corner many would answer: "I searched randomly in the room". Only few of them would answer, for instance, that their search has been driven by the fact that the sphere had the long side on the right and the short side on the left. Let us bring other participants into a room similar to the previous one with only one difference: the short wall on the left of the sphere (i.e., the target) is painted blue, while all the others are light grey. The presence of a wall painted in a different color (from now on called landmark / featural information) removes the ambiguity in detecting the correct corner, as it was in the previous room. Experimental data confirmed that almost all participants (subjected to the disorientation procedure described above) immediately chose the correct corner. Let us again ask participants to describe how they solved the task. All of them would answer that they have seen "the sphere in a certain position... close to the blue wall", or more specifically, "to the right of the blue wall". Only a few of them would declare spontaneously, "I have noticed that the room was rectangular, the sphere was located in the corner with the short wall on the left and the long wall on the right, near the blue wall". When layout and landmark are jointly presented in a room, participants reported descriptions based on the use of landmark information, and seemed to omit layout information. Why did it occur? Throughout this chapter authors will try to find an answer to this question, and more generally to the debate on the way humans recover their orientation referring to a series of very basic spatial information.

Chapter 5 - The main investigations of this study focus on explaining specific pro-environmental behaviors that have established their roots from a motivational perspective. As a result of growing interest in environmental psychology over recent years, an increasing number of researchers have attempted to identify the variables that predict environmentally responsible behavior (ERB). This chapter reflects on the different theoretical approaches – motives and self-regulatory processes – in the study of ERB motivation.

First, authors will cover the motives landscape. When a person engages in a certain form of behavior purely for reasons of intrinsic satisfaction, the satisfaction produced is associated with personal interest in the behavior; they simply feel satisfied carrying out the action. Intrinsic motivation can be related to altruism in that these actions are freely engaged in by the person, entail a certain amount of sacrifice but provide high levels of personal satisfaction. Deci and Ryans' (2000) Theory of Self-Determination suggests these psychological needs relate to motivation. Extrinsic motivation refers to obtaining some kind of social reinforcement or recognition, such as economic success, a good image or popularity.

Second, authors will cover the self-regulatory processes involved in ERB. Among the different self-regulating mechanisms, self-efficacy is the best predictor of actions and for which a greater level of personal effort is required. Self-efficacy can be defined as "the belief in one's own capacity to direct the courses of action required to cope with certain situations in the near future" (Bandura, 1997; 2002). Therefore, self-efficacy is a self-regulating mechanism that motivates the course of action required to mobilize high levels of effort, persistence in the face of adversity and achievement of expected results. However, self-efficacy does not act in isolation; motivation is explained by the relationship between this cognitive judgment of ability and the situation, emotional state and certain personality variables such as locus of control or values.

Third, after revising these motivational theories about ERB, this chapter presents the results of a study in which 1487 people in a southern province of Spain completed a questionnaire about their motivation to engage in certain behaviors to separate out rubbish in their home and the influence of self-regulation mechanisms.

Chapter 6 - Several studies have attempted to clarify the different aspects of environmental learning. Literature first focused on various kinds of sources of environmental learning. Environmental sources are qualitatively different from one another and identify a different way in which the environment can be experienced. Resulting internal representations of the environment, as well as spatial orientation strategies and abilities, influence each other and, in turn, are all influenced by both visuo-spatial working memory and gender differences. All these aspects are discussed in five sections. The first section describes different sources of environmental learning. The second section illustrates the different types of spatial knowledge in relation to the different sources of environmental learning. Then, the third section shows the role of visuo-spatial working memory in environmental learning and in spatial orientation abilities: the higher the visuo-spatial working memory span the better the environmental learning. The last section discusses gender differences in environmental learning and in spatial orientation abilities. In particular, it shows that different environmental learning strategies are responsible for different spatial orientation abilities and produce a different representation of the environment. The thesis that males approach the environment from a global perspective whereas females focus on local features is illustrated.

Chapter 7 - The concept of "Psychological Home" (PH) was introduced to describe "an underlying motive that is driven by an individual's need to identify a sense of self with a physical locale" (Sigmon, Whitcomb & Snyder, 2002). PH includes cognitive (attributions about our selves in relation to the environment), affective (emotions and feelings associated with the establishment and maintenance of psychological home, e.g. security, warmth, attachment) and behavioural components (actions taken to make a physical location more home-like). Psychological Home is understood as an individual variable, with positive consequences for individuals' identity and well being. Research studies support the positive effects of PH: individuals scoring higher report more positive psychological functioning and spend more time and effort in attempting to make a place their own (Sigmon et al., 2002).

This chapter will present the results of two studies aimed at investigating Psychological Home (PH) in the Italian context.

The first study was conducted in order to test the Italian version of the Psychological Home scale developed by Sigmon et al. (2002) on a sample of 251 adults. Differences according to socio-demographic variables, and relationships with Life Satisfaction were

assessed. Results indicated that PH is higher among women, among home owners and in individuals living in detached houses. PH positively contributes to Life Satisfaction.

The second study involved 313 individuals and was aimed at further testing the PH scale, by examining differences according to sociodemographic variables and structural characteristics of the house building, and to assess its role in explaining individuals' behavioral intentions concerning a particular type of dwelling: sustainable (or ecological) houses. Results confirmed the differences in PH according to sociodemographic variables; however, PH is not related to the intentions to buy a sustainable house.

Chapter 8 – Purpose: To describe the characteristics and conditions of working environments that can lead to the onset of mental disorders and to report the clinical evolution of some cases of work-related psychopathology after a time span of at least twelve months from initial diagnosis.

Materials and Methods: Between 2004 to 2008 more than 300 workers attended the Occupational Medicine centre, most suffering from mental disorders which they ascribed to negative working conditions. All patients had an initial consultation session with an occupational physician which focused on the environmental and relational characteristics of their place of work. A second consultation with a psychologist provided a clinical evaluation and various psychological tests were administered, such as the Minnesota Multiphasic Personality Inventory (MMPI-2), the Wartegg test and the General Health Questionnaire. Some of the patients who had been diagnosed as displaying symptoms of psychological / psychiatric disorders related to bullying were interviewed again after at least 12 months from diagnosis for an update on their current clinical condition as well as on their working condition.

Results: Our data provide evidence that a significant number of workers actually develop mental disorders that are to be regarded as work-related. Psychological support and improvements in the working environment bring notable benefits to these workers. Many of the patients diagnosed with psychological / psychiatric disorders related to bullying, when re-interviewed 12 months later, reported improvements both in the quality of conditions at work and in terms of mental health.

Conclusions: The frequency of psychopathological disorders related to occupational conditions is increasing in many industrialised countries. Improvements in work organisation together with psychological support can lead to promising results in terms of tackling these disorders from a clinical point of view.

Chapter 9 - This chapter expands on Bitner's (1992) seminal article, in which she introduces the term "servicescapes" to the marketing and environmental psychological disciplines. Bitner originally conceived the term to denote objective, physical stimuli, which are under managerial control and affect both customers and employees within a specific consumption setting. Since then, other marketing researchers have looked beyond a built environment's physical realm to stimuli found in realms that are often uncontrollable by managers. These realms include the social, the symbolic, and the restorative. This chapter reveals how consumers are influenced by a confluence of servicescape stimuli that have social, cultural, and psychological meaning and that affect approach/avoidance behaviors. In addition, the chapter highlights how marketers, environmental and natural psychologists, humanistic geographers, gerontologists, and public health researchers can further explore the influence of servicescape stimuli on human behavior.

Chapter 10 - The literature emphasizes two sets of variables fostering fear of crime. One set consists of its individual predictors (victimization, physical and social vulnerability) and the other consists of the characteristics of the environment where people live (urbanization, crime spread, and subjective perception of social and physical disorders in their life space). The main goal of the research was to analyze the influence exerted by these two sets of variables on personal fear of crime (or concrete fear) and concern about crime as a social problem (or abstract fear). Authors conducted a secondary analysis of the data gathered in January 2008 by the Observatory of North-West on a representative sample of the population over 18 living in Piedmont, a county located in North-Western Italy. Authors performed a multilevel analysis taking into consideration the following sets of variables: Socio-demographic and victimization variables, as well as the perceived spread of physical and social disorders, were analyzed at the individual level ($N = 750$); official crime rates and the size of the respondents' area of residence were considered as city-level variables ($N = 8$). Just 2% of the variation in concrete fear of crime lied at city level; the variation at the city level of abstract fear of crime was not statistically significant. Since the data were aggregate at the city level, authors decided to perform a multilevel analysis to control for the nested structure of the data. Vulnerability indicators (i.e., gender, age, and education) and the perception of disorders were the most powerful predictors of concrete fear, while education was the most effective predictor of abstract fear. In particular, as concerns environmental features, the perception of physical disorders positively influenced both the dependent variables, while the perception of social disorders positively influenced concrete fear of crime only. Limits and possible developments of the present research are discussed.

Chapter 11 - The choice and use of theory is of primary concern to the development of environmental psychology. Since there are so many potential theories that may be applied in the environmental domain, the choice of theory is greatly influencing the cumulative empirical knowledge that constitutes the field and the development of the discipline. Two issues of future theoretical developments for environmental psychology that are equally important are proposed and discussed; 1) modifying psychological theories to the environmental domain and developing new theories unique to the area of environmental psychology and 2) externally validating the theories in societal projects.

Chapter 12 - There have been major advances in the last 30 years in terms of the understanding of the relationship between natural landscapes and human health. Studies within environmental psychology have shown that the visual qualities of landscapes affect human beings in many ways, including reducing stress, improving attention capacity, facilitating recovery from illness, ameliorating physical well-being in elderly people, and assisting behavioural changes that improve mood and general well-being. These effects have been addressed by means of viewing natural landscapes either from a window, in a picture or a video or having vegetation around the residential or work environments.

Several recent reviews have assessed the evidence of health effects of different landscape types, assessing the range of landscape types currently used in environmental psychology studies. In environmental psychology the studies of restorative effects of landscapes have traditionally used a narrow range of landscape types, focussing on purely natural versus very urban settings. Little information has been available regarding particular landscape elements and structures within the urban versus natural categories. For the results to be more applicable in landscape planning and urban design, it is necessary to go beyond such coarse categories and explore the facets of the "nature" versus "urban" dichotomy. One of the key questions for

future research is: what are the particular qualities of a restorative landscape? Identifying these qualities in order to apply them to landscape design has been identified as one of the major research challenges of the future.

Extensive research on landscape preferences has explored aesthetic appreciation related to specific landscape elements and landscape types. Several researchers have started to explore the link between preferences and perceived restorativeness, and in some studies a strong relationship has been confirmed. Key theories within landscape preference research, such as the preference matrix of Kaplan and Kaplan (1989), have made the assumption that preferences are linked to positive psychological reactions. Bridging the gap between preference research and research on restorativeness can provide knowledge about the particular qualities of a landscape that enhances its positive effects on human health. Looking at current research trends within environmental psychology, several projects are underway exploring these links, identifying landscape elements and qualities of landscapes enhancing restoration and preference. These efforts provide valuable steps towards a future restorative landscape design.

Chapter 13 - Many scholars suggested that in the age of globalization place is no more a relevant reference for identity building (Bauman, 2004; Royal & Rossi, 1996) but others still underline that this does not concern all the citizens (Tartaglia, 2009). Individuals with a high rootedness in the local territory (i.e. less educated or elder) could develop high identification with the local community they live because of their intense and significant use of the territory and of the lack of other possible identifications (Lewicka, 2005). This could be true for small territorial units (i.e. the neighborhood), that could be directly experienced by people, but it is not convincing for larger territorial units (i.e. the whole city or the region) that rather could be social categories carrying ideal meanings not based on a direct contact with the territory and its inhabitants. Present work was conducted on a sample of 349 adults residing in a north Italian big city. The aim was to compare the impact of different predictors on place identification. Three progressively larger spatial ranges were considered: the neighborhood, the city, and the region. Results showed that identification to the three spatial ranges is affected by different predictors, implications are discussed.

Chapter 14 - The environment surrounds everyone. Due to the holistic concept, bio-psycho-social concern for any disorders owing to external insults should be used. For sure, environmental change has an impact on both physical and psychological aspects. In this article, the author briefly discusses environmental change and psychological aspects.

Chapter 1

APPLICATION OF ENVIRONMENTAL PSYCHOLOGY THEORIES AND FRAMEWORKS TO EVIDENCE-BASED HEALTHCARE DESIGN

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ABSTRACT

Environmental Psychology provided a crucial knowledge foundation towards the development of Environment and Behavior (EB) studies in the 1960's. The central objective was to bridge environmental design research and design practice. The perceived need for a new field could be ascribed to concerns regarding the separation between the designers and the users of a building. Over the decades, however, EB had little exemplary influence on design practice, leading to disquiet among environmental psychologists and EB scholars regarding research utilization. Events in the American healthcare industry in the 1990s became a catalyst for transformation of the research-design relationship. A report by the Institute of Medicine highlighted the level of preventable deaths occurring in American hospitals. There was growing recognition that risks and hazards of health care associated injury and harm are a result of problems with the design of systems of care rather than, solely, poor performance by individual providers. Furthermore, there was substantial evidence that the design of hospital physical environments contributes to medical errors, to increased rates of infection and injuries from falls, and to slow patient recovery and high nurse turnover. As a result, the central focus in the healthcare industry became designing safer and more efficient hospitals. There was an urgent and emerging need for a novel approach to optimize healthcare quality within cost, legal, and cultural constraints. Evidence-Based Medicine (EBM) provided a source of inspiration for healthcare design leading to Evidence-Based Design (EBD). In the past decade principles, framework, theories, and methods of Environmental Psychology have played a crucial role in the evidence-based design process. It has helped develop a structured

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approach to collating and examining evidence, representing information, and identifying knowledge gaps where further research is warranted to support design decisions. Growing research points to the need to change facility development and design methodologies of the past to integrate patient safety concepts in the design. This chapter describes the applications of environmental psychology to evidence-based healthcare design, and the manner in which environmental psychology concepts are transforming the design of hospitals.

INTRODUCTION

Environmental Psychology provided a crucial knowledge foundation towards the development of Environment and Behavior (EB) studies in the 1960's. The central objective in response to an enhanced awareness about the environment was to bridge environmental design research and design practice, and a perceived need for decision-making support related to users of built spaces (Saarinen, 1995). EB over the decades has developed as a field that is focused on understanding how the physical environment and human behavior interrelate and influence each other. A major incentive in creating the field was to enhance the utility of academic research. The primary focus was on providing decision support information to the architectural design and planning professions.

A key driver for the new field was concerns among researchers regarding the separation between the designers and the users of a building. Changing economic structure over time reduced interaction between actual users of a building and the designer. Instead, the architect came to learn about user needs and expectations through corporation boards and public agencies that did not occupy the building. The perceived need to understand how building users behave and adapt to designed spaces, and to transfer that knowledge to design decision-making, persisted in the EB community over the succeeding decades (Sommer, 1974; Zeisel, 1984).

The concern among environmental psychologists and EB scholars resulted in an accentuated focus on research utilization. There seemed to be an agreement in most quarters that valuable knowledge generated through scientific research was not reaching the building design and procurement process (Wiesman, 1998; Zeisel, 1984).

The only area where EB contributed in a significant manner to the building industry was in post-occupancy evaluations (POE). However, POEs are conducted after building occupancy, and integrating POE knowledge into the design process (feed-forward loop) proved extremely challenging. Considerable discussions in the literature have also focused on the inability to make POE findings attractive and required during the programming and design phases (Joiner, 1996; Kantrowitz & Nordhaus, 1980; Kernohan, Gray, Daish, & Joiner, 1992; Keys & Wener, 1980; Preiser, 1996; Vischer, 2001).

EVIDENCE-BASED DESIGN

The Evidence-Based Design (EBD) movement emerged in what will be recognized historically as a period of great change in health care. Strong forces working broadly in society converged to shape this movement. Among the forces are a decline in paternalism and

a rise in self-determination, a hyper-competitive economic mindset that threatened traditional ethical values, other sources of intense cost pressure, an information revolution, and rapid change that challenged old orders. Remarkable process controls in other risky industries became widely known just as the public, media, and accreditors discovered that the burden of morbidity and mortality in healthcare delivery was preventable and unacceptable. Health services faced serious problems unique to complex, technology-driven work systems.

Events in the American healthcare industry became a catalyst for transformation of the research-design relationship. The Institute of Medicine published a report on the state of U.S. healthcare that highlighted the level of preventable deaths occurring in American hospitals (Kohn, Corrigan, & Donaldson, 2000). More patients died of preventable medical errors – 44,000 to 98,000 - than those who died from automobile accidents, breast cancer and AIDS (the top 3 killers in the US). To put these numbers in perspective, hospitalization is more dangerous than flying in an airplane, operating a nuclear reactor, or flying off the deck of an aircraft carrier. Staying in the hospital is more dangerous than driving there. In 2004, the Robert Wood Johnson Foundation, through the Center for Health Design, funded an unprecedented review of research literature to understand the role of the physical environment in enhancing safety and efficiency of patient care (Ulrich, Zimring, Quan, & Joseph, 2004). The literature review documented the potential of the physical environment in addressing major concerns of the healthcare industry. The Agency for Healthcare Research and Quality produced two reports that underscored the physical environment as one of the most important areas warranting particular attention in healthcare research (Agency for Healthcare Research and Quality [AHRQ], 2001; AHRQ, 2003). These new developments were occurring at a time when the healthcare industry was already facing challenges in staff shortages, aging population, increasing chronic conditions, and aging facilities-- driving massive investments in new and replacement facilities (Romano, 2007). Designing safer and more efficient hospitals became the central focus.

The focus on safety and satisfaction introduced extraordinary challenges in healthcare design. The key challenge was that safety is not a binary concept; that is, safe versus unsafe. It is a function of the degree of risk stakeholders are willing to take in a particular context, coupled with the environmental constraints and affordances. Legal, cultural and financial constraints define the boundaries of flexibility in decision-making in a particular context. Since the degree of flexibility is not constant across contexts, defining the problem and identifying acceptable range of performance-based solutions posed new challenges.

Around the same time period Evidence-Based Medicine (EBM) was gaining currency as a method among medical practitioners as an effort to “integrate individual clinical expertise with the best available external clinical evidence from systematic research” (Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996). The objective was to improve outcomes of treatments by using the best available scientific evidence. EBM included three concepts: (a) individual clinical expertise, (b) patients’ values and expectations, and (c) best available clinical evidence.

The EBM model provided a source of inspiration for a new healthcare design paradigm. Evidence-Based Design (EBD) advocated an approach that focused on individual design expertise, best available scientific evidence, and a focus on the uniqueness of the context. The advent of EBD in the healthcare sector in the early 2000s provided a compelling avenue for harnessing the knowledge from environmental design research toward supporting design decision-making. Although different practitioners and advocates use different terminology for

the concept, the underlying philosophy remains the same - that of using the best available evidence to support design decision-making. It requires that decision-making should not take place solely with the support of experience. The best available scientific evidence should be employed to support critical design decisions, or evaluate alternatives. EBD offered a model to optimize performance within cost, cultural, and operational constraints.

Framework, theories, and methods of Environmental Psychology have played crucial roles in the evidence-based design process. It has helped in developing a structured approach to examining evidence, collating available evidence, representing information, and identifying knowledge gaps where further research is warranted to support design decisions. The following sections describe some important applications of environmental psychology in evidence-based healthcare design.

HUMAN FACTORS

Principles of human factors and ergonomics, perhaps, have one of the most crucial impacts on healthcare design. Human Factors (also called *ergonomics*) is the study of human interactions with tools, devices, and systems with the goal of enhancing safety, efficiency, and user satisfaction. Nearly half a century of research and hands-on experience have produced a substantial body of scientific knowledge about how people interact with each other, with technology and with their environment. Knowledge from human factors research has been productively applied to enhance human performance in a wide range of domains, from fighter planes, to kitchens, to operating rooms. One must carefully consider the impact of the many ‘performance shaping factors’ that are known to play a role in human performance to understand how best to optimize healthcare settings. Patient safety constitutes an overriding concern in healthcare settings and of the three main sources of patient safety concerns – medical errors, hospital acquired infection, and patient falls – medical errors constitute a key area of concern, resulting in large numbers of preventable deaths (Kohn et al., 2000).

Standardization and Handedness

Some of the design concepts to address medical errors were mapped from human factor studies in other high-risk sectors such as aviation and nuclear power. In particular, safety implications of standardization are largely mapped from other industries. Standardization of processes and environments in aerospace gained currency owing to substantial evidence that human factors are the underlying causes of errors (Jorna & Hoozeboom, 2004; Schutte & Willshire, 1997). Human errors have been shown to be associated with 80% of fatal accidents in aviation, and records of worldwide accidents involving commercial jet aircrafts between 1959 and 1995 show that flight crew error was the primary cause in 64.4% of the accidents (Noyes, Starr, & Kazem, 2004). Factors associated with human errors in aviation are multiple. These include procedural (as in training) factors, and those associated with the physical environment. One of the major factors highlighted in the literature pertains to the location and design of controls and flight deck interfaces, where continuously changing technology and

variations between aircraft equipments are underscored as key challenges (Lande, 1997; Singer, 2004; Spitzer, 2006). This is especially important since crew members typically fly more than a single airplane, even within the same company. The benefits of flight deck standardization were examined and codified in aviation standards (Department of Transportation, 2004; Lande, 1997; Sulzer, 1981).

Challenges associated with human-machine interactions that involve negative transfer of learning while switching aircrafts (Lande, 1997; Spitzer, 2006) and unnatural or non-intuitive interfaces (Schutte & Willshire, 1997) constitute an area of concern. Frequent advancements in technology contribute considerably to this challenge (Lande, 1997; Spitzer, 2006). Such factors introduce cognitive challenges in pilot decision-making, leading to potential errors. Standardization of equipment, processes, actions, system layout, displays and color philosophy, among others, are recommended to enhance safety in the aviation industry (Spitzer, 2006).

Identical arguments have driven the concept of standardization of patient care environment, asserting that standardization reduces cognitive demand and help automate several cognitive processes, leading to lesser demand on short-term memory (Reiling, 2007). Standardization as a concept was not new to healthcare design. It has been advocated and adopted in healthcare to enhance operational flexibility. Standardized rooms and bed units allow patient spill over from census fluctuations, and move services around a hospital in the log-run to accommodate emerging needs without resorting to large scale renovations. From a patient safety viewpoint it was asserted that standardization would reduce the cognitive burden on the clinicians while delivering care, and hence would promote safety and efficiency.

Standardization in healthcare environments could be described as creating standard care processes, supported by physical environments characterized by consistent location and design of patient care resources. The objective is to increase the caregivers' familiarity with the physical environment in which care is delivered, in order to reduce cognitive demand. Handedness of the physical environment is an optional attribute of standardized environments, where approach direction and location of the caregiver is also standardized. One of the primary reasons for the (ongoing) debate about standardization and safety is the notion of same-handedness (more specifically, right-handed patient rooms). Handedness of the physical environment has been associated with wrong patient or wrong sided procedures. Performing a procedure on the wrong side of a patient's body, performing a wrong procedure, or performing the correct procedure on the wrong patient constitute some of the worst medical errors that clinicians and patients experience (Seiden & Barach, 2006). Handedness, however, is discussed in the context of entire hospital, including acute medical-surgical inpatient rooms, and not limited to patient procedures.

In traditional hospital bed units patient rooms are configured in a mirrored (back-to-back) arrangement (Figure 1). Standardization of such environments to support standardized processes entails creation of mirror-image pairs of standardized patient rooms. The handed-configuration concept advocated right-handed patient rooms only with standardized approach and location (Figure 2), where the caregiver approaches from the patient's right side and is located on the right hand side of the patient (room handedness should not be confused with caregiver handedness, such as in left-handed or right-handed caregiver). The assertion was that the best approach to the patient and the best location of the caregiver (irrespective of the caregivers' handedness) is the right side of the patient. While empirical data was not available

to either support or refute the safety and efficiency implications of room handedness, there was also a perceived capital cost premium associated with designing same-handed units.

Empirical research provided crucial preliminary evidence for decision support. In the first phase of a study focused on acute medical-surgical inpatient units (Pati, Harvey, Evans, & Cason, 2009), 20 nurses (10 right-handed and 10 left-handed) volunteered to simulate three care processes at the University of Texas at Arlington, Smart Hospital™. The care was provided in nine physical environment configurations where direction of approach and obstructions in the environment were systematically manipulated. Data from nursing and kinesiology coding of 540 video segments demonstrated that standardization augments familiarity with the care environment, with potential positive impacts on efficiency and safety. However, there was little evidence to suggest that the care processes could be standardized to an extent where caregiver localization on the right side of the patient could be force functioned. Designing room handedness in low acuity care environments, as a result, may not contribute to performance enhancement.

A related issue of importance is one of individual handedness (as opposed to physical environment handedness). Aviation literatures state that problems with laterality are accentuated in high-stress and high-workload environment thereby compromising one's internal awareness of up and down and right and left – a potential factor compromising safety (Whittingham, 2004). High stress levels also impact performance in other ways. Physical design factors (light, sound, ergonomics, air quality, hassles) and operational factors (work load, shift length, and so forth) are known to influence stress and alertness levels in caregivers, and hence, performance. Environmental psychology frameworks help address stress and alertness issues in healthcare design.

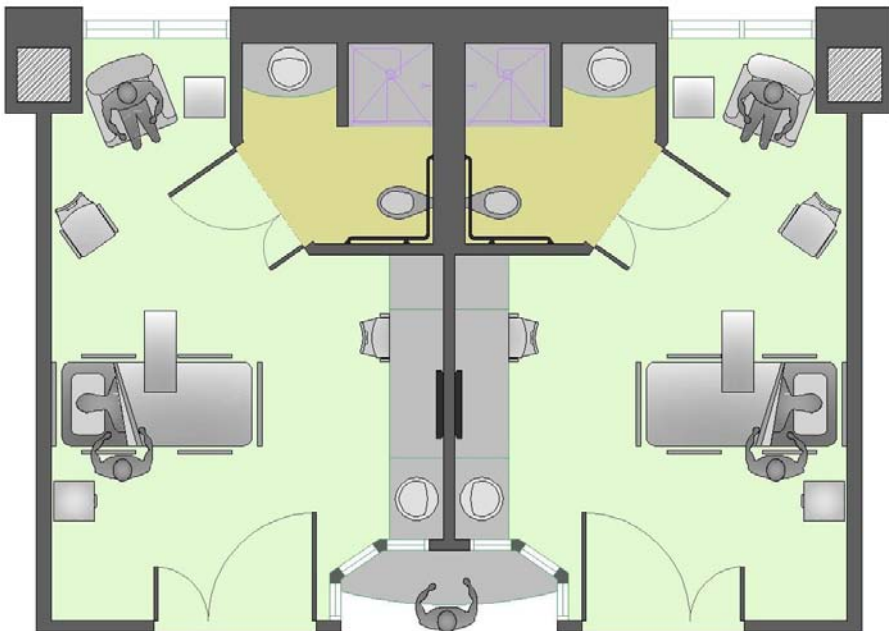


Figure 1. A pair of traditional patient rooms in mirrored configuration.

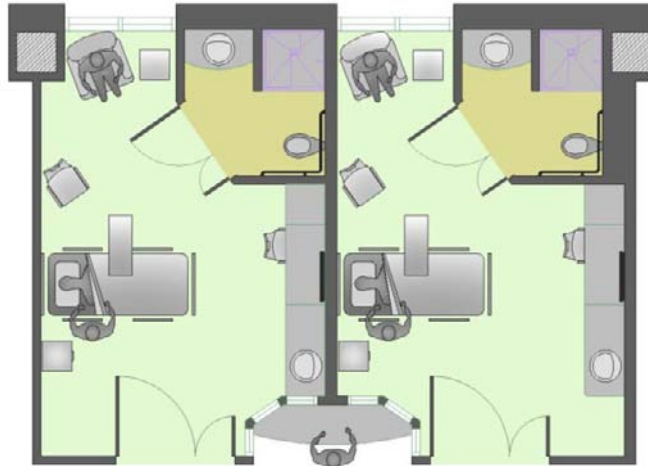


Figure 2. A pair of right-handed patient rooms. Note that the caregiver approach is from the right side of the patient and is positioned on the right hand side of the patient.

STRESS, HASSLE, FATIGUE AND ALERTNESS

Acute Stress

It could be argued that patient well-being is a function of caregiver well-being. Numerous studies, as elaborated below, demonstrate that nurses are frequently stressed and fatigued with possible detrimental implications on patient care. The high-stressed work environment in which nurses provide care is not new (see Hinshaw & Atwood, 1984). In a 2001 nationwide survey of 4,826 nurses, survey results revealed that over 70% of the respondents reported stress as one of their top three concerns (Houle, 2001), a finding that has been replicated later (Tabone, 2004a). More recent studies have focused on nursing empowerment, nurse burnouts, and satisfaction (Greco, Laschinger & Wong, 2006, including several of Laschinger's previous work) and underscore the prevalence, and acuteness of the problem.

The high stress levels of direct caregivers, while a severe problem by itself, raises serious concerns pertaining to patient well-being and safety. Studies from other settings suggest that high levels of stress and fatigue could have serious implications on performance and patient outcomes. Stress and fatigue could impact critical performance aspects including reaction time or alertness, irritability, attention to details, problem solving ability, energy level, and decision-making ability, and thus, could contribute to errors (Bognar et al., 2008; Page, 2004; Tabone, 2004b).

Moreover, reduced motivation and work performance are typical of tired workers in workplaces, which could equally apply to stressed and tired caregivers in healthcare settings (Tabone, 2004a). While the Institute of Medicine report (Page, 2004) firmly established that patient safety and well being is heavily dependent on nurses, robust studies linking nurse stress and fatigue with work performance and patient safety are not widely available. Recent studies in healthcare settings are beginning to identify the relationship between stress, fatigue and medication errors, especially dealing with sleep deprivation and scheduling in nursing

care (AHRQ, 2001). In a 2005 study that tracked work pattern of 393 nurses (for example, shift, overtime, hours worked) along with errors and near misses it was found that caregiver errors and lapses were correlated with their work pattern (Oklahoma Nurse Association, 2005-6). The study suggested that overtime aggravated the situation, especially when it followed a 12-hour shift. The impact of scheduling, a classic human factor, is key as nurses are known to working more than 12 hours regularly, and as long as 22.5 hours at a stretch, in some instances (Page, 2004).

The Harvard Work Hours Health and Safety Group has systematically demonstrated an association between work hours and scheduling among interns, and patient safety. Landrigan et al (2004), demonstrated that the traditional schedule was associated with 35.9% more serious medical errors and 56.6% more non-intercepted serious errors in a randomized study involving interns' work schedule that compared a traditional schedule with extended work hours with an intervention schedule that eliminated extended work shifts and reduced weekly work hours. In a similar interventional study focused on sleep and attentional failure involving 20 interns over a three-week period, Lockley et al (2004) found that the rate of attentional failure was half for interns in the intervention schedule as compared to the traditional schedule during on-call nights.

The literature shows that the physical environment could be a source of stress, or could interact with the operational factors in modulating the stress of the work environment. The physical environment as a stressor has been well documented, for example, noise in the environment has been shown to be a significant environmental stressor, with potentially unsafe consequences for patients and staff (Moore et al., 1998). Noise has been shown to affect patient's physiologically (blood pressure, heart rate) as well as psychologically - sleep deprivation, pain, ICU psychosis, self reported stress and annoyance (Baker, 1984; Morrison, Haas, Shaffner, Garrett, & Fackler, 2003; Topf & Thompson, 2001), and constitutes one of the most important environmental stressors. Noise has a substantial effect on staff. The detrimental impacts of noise on communication, concentration, and cognitive performance, leading to stress and fatigue have been reported by the World Health Organization (AHRQ, 2005). Occupational stress originating from high noise levels (that is, telephones, alarms, and beepers) have been shown to be positively related to nurse burnouts (Topf & Dillon, 1988). The auditory environment also has been shown to have beneficial influence on patients. For instance, music in waiting rooms has been shown to reduce stress levels in patients (Routhieaux & Tansik, 1997).

Beside the auditory environment, the impacts of other environmental factors are also supported in available literature. Studies in other contexts suggest that inappropriate lighting and thermal environments could induce stress in users (Boff & Lincoln, 1988a; Boff & Lincoln, 1988b).

Alertness

Light appears to have an exceptional influence on alertness. Cognitive scientists have demonstrated decades ago that alertness is important since it has a direct association with performance and safety (Reason 1997). More alert staff translates to faster reaction time and better capacity to detect errors. Recent sleep lab studies are articulating precisely the associations between light wavelength, circadian rhythm, and alerting function of human

brain. Lockley et al (2005) designed a between subject study, involving 16 healthy adults, at the Intensive Physiological Monitoring Unit at Brigham and Women's Hospital, Boston, MA. One group was exposed to monochromatic light wavelength of 460 nm (blue light) and the other group was exposed to monochromatic light wavelength of 555 nm (green light), for a period of 6.5 hours. They found that subjects exposed to 460 nm light had fewer attentional failures, decreased auditory reaction time, and lower sleepiness ratings. The study was an extension of an earlier study that articulated the variable impact of light wavelengths on human circadian rhythm, specifically the impact of blue light on resetting the human circadian pacemaker (Lockley, Brainard, & Czeisler, 2003). These studies begin to suggest that spectral qualities of light (including natural light) may significantly impact alertness of caregivers with identifiable implications on patient safety.

Data on acute stress, chronic stress, and alertness of nurses was collected before and after 12-hour shifts in a 2006 study at Children's Healthcare of Atlanta at Egleston and Scottish Rite (Pati, Harvey, & Barach, 2008). Control measures included physical environment stressors (that is, lighting, noise, thermal, and ergonomic), organizational stressor, work load, and personal characteristics (that is, age, experience, and income). Data was collected from 32 nurses on 19 different units at two hospitals in November 2006. Findings showed that duration of exposure to windows is the second most influential factor affecting alertness and acute stress, among the variables considered in the study. The association between exposure duration and alertness and stress is conditional on the exterior view content (that is, nature view, non-nature view). Of all the nurses whose alertness level remained the same or improved, almost 60% had exposure to exterior and nature view. In contrast, of all nurses whose alertness levels deteriorated, 67% were exposed to no view or to only non-nature view. Similarly, of all nurses whose acute stress condition remained the same or reduced, 64% had exposure to views (71% of that 64% were exposed to nature view). Of nurses whose acute stress levels increased, 56% had no view or only non-nature view.

Hassle

Beside known factors influencing acute stress and alertness, a potential contributor to stress is rarely addressed in scientific literature – the stress effect of hassles in the environment. The theory of cumulative risk in childhood development psychology suggests that minor hassles or irritants in the environment, while not stressors individually, could result in tangible stress when acting together (Evans, 2003). Could that theory be applicable to healthcare settings? By just focusing on major known stressors, and not focusing on hassles, are we inadvertently ignoring potential factors that could compromise care quality?

When Integris Baptist Medical Center (IBMC), Oklahoma City, decided to renovate its bed tower, it offered an unprecedented natural experiment opportunity to study the hassle issue. The study (Pati & Evans, 2009) compared two patient room configurations: one with the patient toilet located along the corridor (in-board) and one with the patient toilet located along the outside window wall (out-board). The inboard configurations (Figure 3) typically permit larger patient windows and more privacy from the corridor. However, the bathroom location could generate additional traffic on the corridor side of the caregiver zone (traffic to bathroom), and reduce space available for clinical use. The configuration also typically results in an entrance vestibule that could create maneuvering difficulties during patient transport and

greater distance between the entrance and the patient. The out-board configuration (Figure 3) offers better line of sight to the patient, and can more readily be converted to progressive or ICU beds. Traffic to the bathroom by the patient or family members interferes less with clinical activities, leaving all space on the corridor side of the caregiver zone for clinical use. However, exposure of the patient to the exterior through windows is comparatively less than typical in-board configurations.

The IBMC bed tower contains nursing units that have patient rooms with a combination of both in-board and out-board configurations (in both the old and the newly renovated unit). In preparation for a larger research project, a preliminary study was conducted in the old unit (Pati & Evans, 2009). One of the underlying hypotheses was that physical design attributes around the patient bed (the caregiver zone) could create challenges that would be perceived as hassles by caregivers.

Data was collected from 20 volunteering nurses over a period of seven days in November 2007. During that period, the nurses were randomly assigned during any morning or evening shift to either all in-board rooms or all out-board rooms with single occupancy. Data was collected on 16 dimensions pertaining to nursing care (see Pati et al. 2009, for details of the dimensions). The instrument (or rating system) was designed in a way to allow the subjects to rate the suitability of the physical environment for specific activities on a 7-point scale.

The results found that the out-board configuration created a hassle-free environment for nurses. However, in the in-board patient room configuration, 8 of the 16 questionnaire responses qualified as potential sources of hassles. A major study finding was that five of the eight criteria qualifying as sources of hassle are directly associated with the caregiver zone and access to the caregiver zone. The hassle issues identified by the caregivers included (a) access the medical gases, (b) the positioning of necessary equipment close to the patient during emergent and non-emergent situations, (c) access the head of the patient without difficulty, (d) allowing equipment to remain at the bedside and still have access to the patient, and (e) bringing a stretcher and other caregivers into the room and easily transfer a patient.

In addition, four of the eight hassle factors demonstrated significant correlation with acute stress of nurses, namely (a) allowing equipment to remain at the bedside and still have access to the patient, (b) the positioning of necessary equipment close to the patient during emergent and non-emergent situations, (c) access the head of the patient without difficulty, and (d) bring a mobile workstation into the room or access the computer in the patient room.

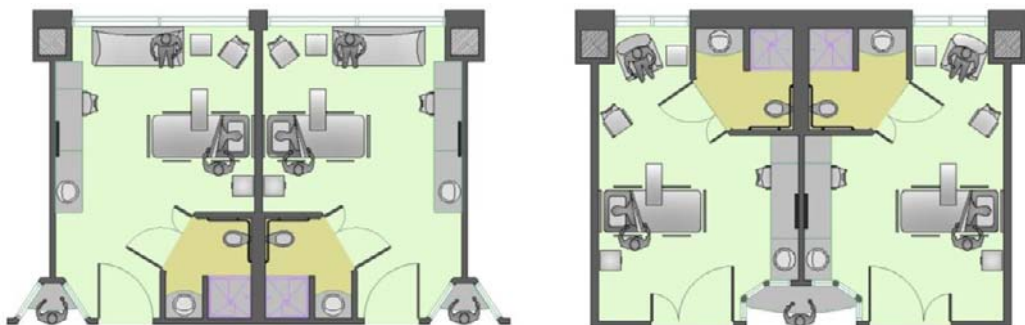


Figure 3. The inboard configuration (left) locates the bathroom on the corridor wall. In the outboard configuration (right) bathroom is located on the window wall.

Addressing the various physical environment stressors, hassles, and potential alerting agents through design is a complex task mainly because physical design is not independent of operational and cultural issues. Solutions in narrow domains have been examined, such as incorporating acoustical ceiling tiles to increase sound absorption (Blomkvist, Eriksen, Theorell, Ulrich, & Rasmanis, 2005; Hagerman et al., 2005).

Perhaps, a trend analysis of the inpatient care unit will better illustrate the complexities involved. Traditionally, patients' accommodation was typically semi-private, with two or four patients sharing a room. Private rooms were mostly reserved for isolation patients. With rising awareness regarding hospital acquired infections, research demonstrated that single patient rooms are better suited to control infection (Ben-Abraham et al., 2002; Davidson, Smylie, Macdonald, & Smith, 1971; Gardner, Court, Brocklebank, Downham, & Weightman, 1973; McManus, Mason, McManus, & Pruitt, 1992; McManus, McManus, Mason, Aitchison, & Pruitt, 1985; Mulin et al., 1997; Pegues and Woernle, 1993; Roundtree, Beard, Loewenthal, May, & Renwick, 1967; Smylie, Davidson, Macdonald and Smith, 1971). After all, private rooms are easier to disinfect completely on patient discharge, which is not true in case of semi-private rooms. Private rooms also resulted in better bed utilization, since matching patient attributes is not a factor in bed assignment (Detsky & Etchells, 2008). The single patient room concept also emerged during a period of high prosperity and rising consumerism among the nation's baby boomer generation that was approaching retirement, and went hand in hand with hospitals' strategy to attract customers in a highly competitive market.

A major problem introduced by the single patient room concept was the footprint of a bed unit. With one patient per room, the floor area of units grew several folds. According to an estimate departmental gross square feet of adult acute care units grew by 118% over the past 20 years (Latimer, Gutknecht, & Hardesty, 2008). The patient room also increased in area by 77% over the same period. This increase was partly due to increases in caregiver work zone, intuitively appreciating the hassle involved in patient care delivery. Another factor was an increasing acceptance of family involvement in patient care, and the resulting increase in family amenities in patient rooms. The increase in floor area was, however, not accompanied by any change in staffing ratios (number of patients per caregiver). With larger footprints the race track configuration increasingly became popular as compared to traditional double loaded corridor configurations (Figure 4). The racetrack configuration pulled all nursing support spaces to the core with patient rooms arrayed around the central core space to get the support spaces close to the patient rooms. This model essentially cut off most nursing and support staff workspaces from exposure to exterior windows.

Furthermore, the unit size (number of beds) did not reduce. Operational factors (staffing, FTEs) continued to promote large units for optimizing departmental performance. To compound the problem, nursing staff in many situations were reluctant to give up the central nurse station as the primary workspace. What ensued was a substantial aggravation of noise in hospital inpatient units. One study recorded a noise level as high as 113 dBA during shift change – a level perceived as equivalent to an operating jackhammer (Britt, 2005). The larger footprint and more family involvement meant more foot traffic. Additional foot traffic was also generated from newer models of collaborative patient care. New care models promoted greater involvement of pharmacists and dieticians in direct patient care, which shifted personnel hitherto restricted to hospital basements to the inpatient floors (Pati, Harvey, & Cason, 2008).

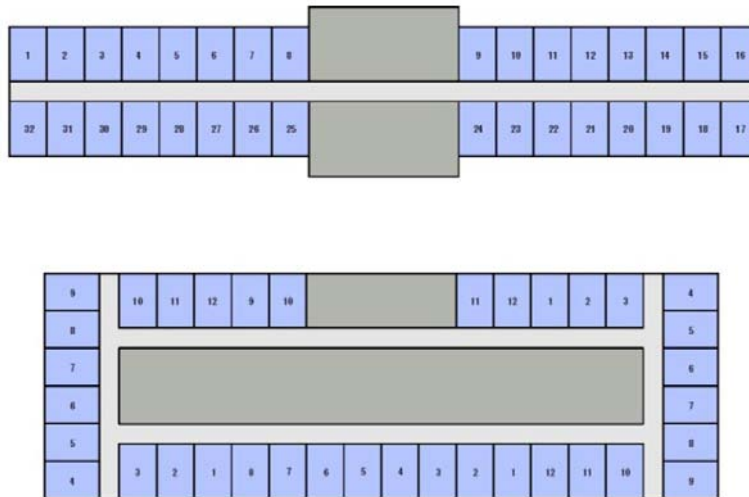


Figure 4. Diagrammatic representation of the double-loaded (top) and the racetrack (bottom) configurations. The central core in the racetrack configuration allows proximal location of nursing support spaces.

While empirical data is not available, the environmental chaos that resulted from improper lighting, high noise levels, and more foot traffic, is frequently attributed to causing medical errors. Reducing disruptions from environmental chaos has been attempted through support space decentralization. This has included moving nursing supplies and medications closer to patient rooms, with the hope that it will reduce the nurses' need to walk to obtain supplies. Furthermore, this strategy was also important since studies show unproductive use of nursing time. In a recent study conducted by Ascension Health, Kaiser Permanente and Purdue University involving 767 nurses from 36 medical surgical units, it was found that nurses spend only 19.3% of their time in patient care activities, and 7.2% for patient assessment and checking vital signs. They found that the nurses on medical-surgical units walked 2.4 - 3.4 miles in a typical 10-hour day shift (Hendrich, Chow, Skierczynski, & Lu, 2008). This was in confirmation with an earlier study, which reported that nurses walked an average distance of 3.89 miles per shift in a general care unit, and 5.13 miles in an intensive care unit (Shepley & Davies, 2006).

Documentations of the benefits of decentralized supplies and support have not been widely published. A recent study at Houston Medical Center, Georgia, involved predicting the time nurses spent on medication-related activities (Lima & Pati, 2008). Their research predicted that designing decentralized medication storage, specifically through nurse servers, would have a significant impact on reducing walking distances and increasing patient care time. Nurse servers are cabinets on the corridor walls of patient rooms, typically with a door from the corridor and another from the room interior. Medication and supplies are delivered to the nurse server. Caregivers access the medication and supplies from inside the room thus reducing opportunities for medication errors.

The administrators looked to improve efficiencies within the Houston Medical Center's surgical neurological/orthopedic units. The first option was creating a central medication room while the second one included creating a number of decentralized nurse servers with a

smaller central medication room to store controlled drugs. To assess the two alternative scenarios, they conducted a MedModel simulation study, working with a team of clinicians and management staff. The result of the MedModel simulation suggested that, on average, nurse servers in patient rooms reduced nurse walking by 576 feet over a 12-hour shift for medication related activities alone (note that reduction in walking will vary depending on the patient population being served, unit size, and staffing model). The average predicted increase in direct care time was 30 minutes. Considering that a neuro-ortho unit still retains a central medication room for securing controlled drugs and narcotics, the time saved in other population types, and when other supplies are included, could be significantly higher.

The single patient room offered numerous benefits to the patient although introducing challenges in facility operations. One of the benefits was the greater access to the exterior through the room window. In addition to the benefits of natural light, the potential access to nature view was a definitive advantage. Specifically, the evolutionary theory explains a positive impact of visual nature themes on stress, as measured by physiological outcomes, and in healthcare settings, stress can significantly affect medical outcomes through physiological reactions such as increased heart rate and increased blood pressure (Ulrich, 1992). Short-term visual contacts with nature can be effective in promoting recovery from stress. For example, subjects who watched photographic simulations of natural settings showed faster physiological recovery (measured through skin conductance, muscle tension, and pulse transit time) than those who viewed simulated urban settings (Ulrich et al., 1991). Heart rate measurements collected in a dental clinic suggested that patients experienced lower stress on days when a large mural depicting a natural scene was hung on the waiting room wall, versus days when the wall was left blank (Heerwagen & Orians, 1990). Patients on gurneys viewing ceiling mounted scenes of nature and/or water had systolic blood pressure levels 10 to 15 points lower than patients exposed to either aesthetically pleasing pictures or a control condition of no picture (Cross, 1990). Ulrich (1984), demonstrated that patients exposed to view of trees (as opposed to matched patients exposed to a brick wall) through their room windows were associated with shorter post-operative stay, fewer pain medications, more favorable comments on nurses' notes, and fewer minor complications. A subsequent study focusing on preferences (Verderber, 1986) found that nature views were preferred over monotonous views and views of architectural features, such as buildings.

The complexity of the issues described above--stress, hassle, and alertness-- lie in the fact that none of the issues examined in this section can be addressed in isolation. At the very least, the questions of unit size, patient room size, census fluctuation, environmental chaos, and excessive nurse walking (potentially leading to stress and fatigue) needs to be addressed simultaneously, and intricately linked to operational strategies. Determining the right unit size is a complex tug of war between conflicting performance parameters, including environmental chaos control, teamwork and peer support, staffing productivity, nurse manager span of control, and walking distances (Ritchey & Pati, 2009).

WORKPLACE AND BEHAVIORAL PSYCHOLOGY

The transition from the traditional unit with semi-private rooms, double loaded corridor configuration, and centralized charting and support spaces to single patient room, race track

configuration and decentralized workspace and support presented numerous challenges to workplace culture. A 2006 study on physical design factors influencing operational flexibility (Pati, Harvey, & Cason, 2008) identified nine domains of physical design decision-making impacting operational flexibility. Two of those domains – maintaining peer lines of sight, and patient visibility – were areas influencing the sociology of healthcare workplace. The first issue relates to nurses as social beings, mentoring aspects of collegial collaborations, and perception of peer support. The second aspect relates to nurses' innate passion in caring for the patient.

Peer Line of Sight

It is frequently envisioned that nurses work independently in providing care to their assigned patients. In contrast, teaming of caregivers constitutes a major managerial decision. While, generally, nurses are assigned to a group of patients to whom they are primarily responsible, many situations in the care giving process demand helping hands. Teaming nurses helps optimize care during such situations, which are frequent owing to the uncertainties that characterize acute patient care. Teaming nurses helps develop social networks, mentoring, and stress mitigation in a high-stress work environment (Pati, Harvey, & Cason, 2008). A key factor influencing effective teaming is peer lines-of-sight or having a peer within one's peripheral vision. Direct or peripheral visibility of peers enhances efficiency and provides a sense of safety and security for caregivers (Pati, Harvey, & Cason, 2008). Obstructed peer lines of sight increase stress by reducing the perceived and actual availability of help, opportunity for mentoring and socialization, and potential for de-stressing. Moreover, in crisis or stressful situations, clinical staff may revert to their senses rather than technology, and hence the importance of peer visibility (Pati, Harvey, & Cason, 2008). Stress levels increase and perceptions of flexibility decrease when nurses feel they are operating alone. The above factors could impede or improve one's ability to be flexible to new or unique situations, and constitute an issue affecting direct care givers (Pati, Harvey, & Cason, 2008).

The contemporary practice in healthcare design is to shift the principal work zones of the caregiver closer to the patient by providing documentation areas and supplies storage closer to patient rooms. This is essential to minimizing travel distances and increasing direct care time available to patients. However, design of these work areas is critical to the nurses' sense of flexibility. Embedding these work areas too deeply out of the line of sight down corridors or in areas comprising blind corners off of the racetrack of circulation creates lines-of-sight obstructions. Of particular interest might be the feedback from several caregivers that the gently curving corridors often designed to give elegant exterior form and to minimize the perception of corridor length on the interior, was an impediment to desired visibility throughout the unit (Pati, Harvey, & Cason, 2008).

The study suggested that several design characteristics improve peer visibility: simply shaped unit configurations that permit as much distal visibility as possible, corner locations of any caregiver work stations within the support core, and back stage corridors linking caregiver stations that may be designed within the core space (Pati, Harvey, & Cason, 2008). On the other hand several design characteristics create potential obstructions to peer lines-of-sight, including: double-loaded corridors of patient rooms extending off of and beyond a

racetrack configuration, curvilinear corridor configurations (particularly with the dramatic increase in size of today's patient rooms), charting alcoves that are so deep that sight lines are lost, and opaque support cores that obstruct visibility across a unit.

Patient Visibility

Higher acuity in medical-surgical units necessitates direct sensory (sight and hearing) links to patient rooms. Further, the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO), National Patient Safety Goal # 6b (Joint Commission on the Accreditation of Healthcare Organizations, 2004) requires that nurses, respiratory therapists, and other staff be able to hear equipment alarms from a satellite or central workstation. Nursing assignment frequently involves non contiguous patient rooms where sensory links could be potentially obstructed.

It is conventionally believed that direct patient visibility is important only in intensive care environments. However, the rise in the acuity level of medical-surgical inpatient population, as well as increasing risk of falls, has resulted in the imperative for the nurse to have improved visibility and auditory connection with the patient room. This includes greater visibility of the patient from the corridor. The ability to, at a minimum, see the patient room door from the main or sub-workstation provides the nurse with the proximity to hear activity in the room as well as see the patient room door. Inadequate patient visibility affects staffing efficiency as well as caregiver efficiency.

Location of patient rooms in relation to caregiver workstations, medication stations, and utility room doorways is the key physical design factor influencing patient visibility. Recent data suggests that several design characteristics aid in patient visibility, including, multiple caregiver work centers with proximal patient room locations, so that shifts with fewer staff who may congregate periodically can still keep an eye (and ear) on the unit territory, unobstructed line of sight between nurse work zones and patient room door, and outboard location of patient room toilet/shower rooms. (Pati, Harvey, & Cason, 2008)

A subsequent study (Pati, Harvey, & Ragan, 2009) showed that unit level design attributes may actually be more critical to patient visibility than room level attributes (such as outboard location of patient bathroom). A third dimension of patient visibility emerged from the study at Integris Baptist Medical Center. One of the surprising findings was that in-board rooms (with completely obstructed sightline from the corridor) were perceived to offer better patient visibility as compared to outboard rooms (with full and easy visibility of the patient from the corridor). A closer analysis showed that the mean distance between the in-board room locations and the documenting and support spaces was half of the mean distance between the out-board rooms (included in the study) and documenting and support spaces (Figure 5). Physical proximity, where caregivers can document, mentor, and socialize in locations proximal to assigned patients, is a significant third dimension of the construct 'visibility', and may in fact be more important than sightline obstructions from the patient room door.

Incidentally, patient visibility is not only an issue affecting workplace behavior, but is also a major patient safety issue. In a study involving a representative sample of 20 hospitals across the USA, a team of researchers found that facility failure (or physical design related factors) was the top factor affecting patient safety (sharing the top spot with equipment and

supply failure), and one of the factors related to facility failure was the difficulty in observing patients (Tucker, Singer, Hayes, & Falwell, 2008).

Patient Falls

Patient falls remain a major concern in the healthcare industry. An important outcome affected by patient visibility challenges is falls. Patients, by virtue of their impairment and treatment, are susceptible to imbalance. An ageing patient population (Department of Health and Human Services, 2002) further contributes to physical frailty and imbalance, as abnormalities of gait or balance was found to be a consistent predictor of patient falls in older patients (Ganz, Bao, Shekelle, & Rubenstein, 2007).

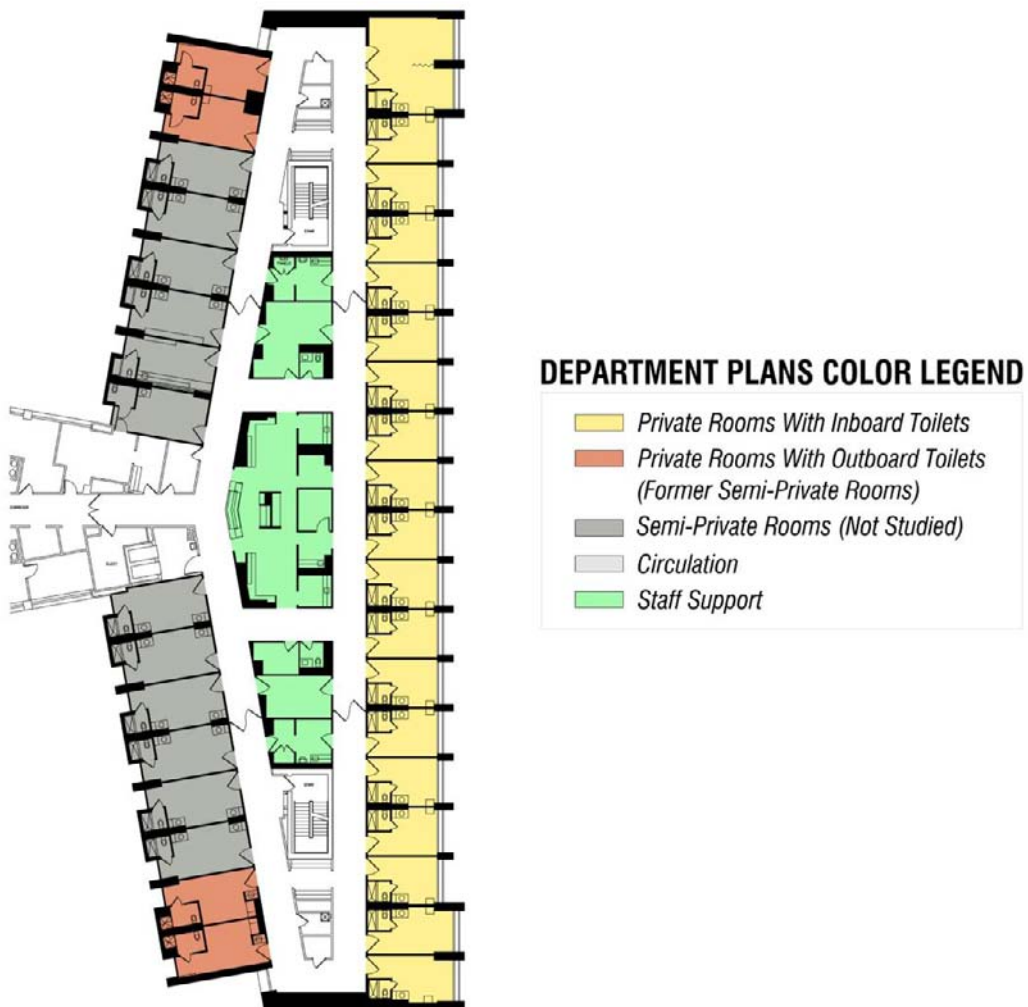


Figure 5. Floor plan of the inpatient unit at Integris Baptist Medical Center, Oklahoma City, OK showing the inboard and outboard rooms included in the study.

Numerous studies demonstrate that patient falls typically occur in and around the patient bed and the bathroom (Alcee, 2000; Brandis, 1999; Morgan, Mathison, Rice, & Clemmer, 1985; Wong, Glennie, Muise, Lambie, & Meagher, 1981). One study reported that about 34%, or one third, of all falls in the hospital under study occurred on the way to or from the bathroom (Morgan et al., 1985). A factor that complicates this further is the fact that patients typically move with their intra-venous pole, which renders only one hand available for balancing and maintaining stability during ambulation. Although patients are discouraged to attempt movement without the aid of a caregiver, they continue to do so in practice.

Proximity to assigned patients – thus enhancing visual, auditory and physical access to patient – promises reduction in patient falls. A study involving an operational intervention in the Cardiac Critical Care Unit at Methodist Hospital, Indianapolis, that combined the coronary critical care and step-down unit to a single acuity-adaptable unit, demonstrated that falls in the unit were reduced to just 2 falls for 1000 patient days, after intervention (Hendrich, Fay, & Sorrells, 2004). Causation was not explored, but it could be surmised that the decentralization of nurse workspace, which positioned nurses proximal to the assigned patients, could be a factor. The challenge, however, is in balancing patient proximity with team interaction, collaboration, communication, mentoring, and socialization.

The challenges faced in replication of the model were uniquely cultural. After the Indianapolis experiment, several hospitals adopted the acuity-adaptable nursing model. The model is based on patients spending their entire duration of stay, from admission to discharge, in the same room. New types of patient rooms emerged (the universal patient room), which were designed with sufficient space and provision for equipment, medical gases, and power capacity to accommodate any level of patient acuity (Figure 6). This paradigm shift warranted a radically different approach to nursing. Since different acuity levels demand different levels of skill and expertise, the acuity adaptable nursing model was founded on cross-trained, adaptable nurses. Several potential advantages exist with the acuity adaptable nursing model over traditional models of care. Patient transfers, lengths of stay, and medical errors are reduced while nurse and patient relationships are enhanced.

A subsequent study found enormous challenges to the successful implementation of the concept (Evans, Pati, & Harvey, 2008). The acuity adaptable model requires nurses that are cross trained (or willing to be cross trained) to address all levels of acuity. This is a challenge because nurses typically have preferences for a certain type of care environment (in level of acuity as well as in type of illness or injury). A mix of cross trained staff on acuity adaptable units creates less opportunity for mentoring and support of other intensive care nurses. Physicians, especially intensive care specialists, perceived a loss of ability to readily build relationships with the intensive care nurses. Other factors included misconceptions regarding workload between nurses caring for patients with different levels of acuity, cost of maintaining equipment in all rooms, and maintaining staff competencies in their individual areas of expertise.

Teamwork

The role of effective teamwork in accomplishing complex tasks is well accepted in many domains (Barach & Weinger, 2007). Even without the acuity-adaptable model, decentralization of work and support spaces attracted considerable attention from a teamwork

perspective. While primarily an operational issue, the physical environment could support optimal teamwork, or constraints imposed by the physical environment could result in sub-optimal level of teamwork.

Team training has a long history in aviation and, more recently, these experiences have been translated to health care. Studies of aviation teams revealed problems associated with failures of coordination, communication, workload management, loss of group situation awareness, and inability to use available resources (Bowles, Ursin, & Picano, 2000; Foushee & Helmreich, 1988; Jones & Endsley, 1996; Kanki, Lozito, & Foushee, 1989).

Situation awareness is one of the most important decision skills in health care, where data overload is the rule and the patient's status changes continually. It is the ability to recognize clinical cues quickly and completely, detect patterns, and set aside distracting or unimportant data. Situation awareness (or situation assessment) is a comprehensive and coherent representation of the (patient's) current state that is continuously updated based on repetitive assessment (Sarter & Woods, 1991).

Situation awareness appears to be an essential prerequisite for safe operation of any complex dynamic system. In the case of trauma care, adequate mental models of the trauma patient and the associated trauma unit facilities, equipment, and personnel are essential to effective situational awareness. Successful team awareness allows all members to converge on a shared mental model of the situation and course of action. Effective teams adapt to changes in task requirements, anticipate each other's actions and needs, monitor the team's ongoing performance, and offer constructive feedback to other team members (Baker, Battles, King, Salas, & Barach, 2005). When team members share a common mental model of the team's on-going activities, each may instinctively know what each of their teammates will do next (and why), and often communicate their intentions and needs non-verbally (sometimes called implicit communication).



Figure 6. Universal rooms at the Clarian West Medical Center, Avon, IN, are designed to accommodate patients at all levels of acuity (Source: HKS, Inc.).



Figure 7. Different types of meeting spaces are being designed on bed units to support varying needs for collaboration and communication among caregivers (photo courtesy: Herman Miller).



Figure 8. Greater attention is being accorded to ergonomic and appropriate design of furniture to support team communication (photo courtesy: Herman Miller).

Teamwork, in clinical literature, has received considerable attention as it relates to patient safety. For instance, data on the frequency and type of factors contributing to patient harm

from 23 ICUs suggested that of all factors affecting patient safety in ICUs, teamwork issues constituted 32% (Pronovost et al., 2006). In another before-after study in a 28-bed medical-surgical ICU, the primary focus was to observe the impact of several interventions on reduction of adverse ICU events (Jain, Miller, Belt, King, & Berwick, 2006). The intervention included a major thrust on teamwork, and found a significant improvement in lowered nosocomial infection rates, a reduction in adverse events and length of stay per episode, and a reduction in cost per ICU episode after the intervention.

In addition to patient safety, Becker (2007) cites earlier work on the subject that show the benefit of teamwork on meeting patient needs, improving patient care, and increasing staff satisfaction, among others, which are critical to the care delivery process. While robust studies on the impact of the physical environment (in association with operational design and policy measures) on teamwork among caregivers is at a nascent phase, earlier studies in other setting types (corporate offices, research laboratories) have shown strong association between physical design and teamwork and communication, both within and without one's workgroup (Hatch, 1987; Penn, Desyllas, & Vaughan, 1999; Serrato, & Wineman, 1997).

One aspect of teamwork occurs at the bedside where ergonomics and spatial flexibility constitute key influence on the performance of the team (Pati, Evans, Waggner, & Harvey, 2008). The other vital aspect of teamwork is communication between team members. Decentralization and large unit sizes reduce the probability of chance encounter, and increase the problem of locating someone for discussion when needed. An increasing number of hospitals are depending on communication technology to locate personnel for voice communication as well as when a personal meeting is deemed essential. The design industry is responding to the needs for communication by incorporating a variety of meeting spaces in the support core. Such spaces range from small curb-side spontaneous meeting spaces to more formal meeting rooms (Figure 7). Greater attention is being accorded to ergonomic and appropriate design of furniture to support team communication (Figure 8). Hard empirical evidence of the impact of physical design on team communication is yet to come. However, ergonomics and teamwork literature has made substantial contributions to the design of clinician work environments to support communication and teamwork.

Behavior Modification

A critical issue pertaining to patient safety is infection control. While air-borne sources of contamination constitute a major factor for hospital acquired infection, a review of literature show that caregivers are a major source of infection too, especially as compliance with hand washing regulations are not adhered to (Bauer, Ofner, Just, Just, & Daschner, 1990; Bures, Fishbain, Uyehara, Parker, & Berg, 2000; Devine, Cooke, & Wright, 2001; Krediet, Kalkman, & Barach, 2009; Larson, 1988).

Studies involving educational and physical design interventions to increase hand washing compliance have not been conclusive, and show conflicting results (Conly, Hill, Ross, Lertzman, & Louie, 1989; Dorsey, Cydulka, & Emerman, 1996; Dubbert, Dolce, Richter, Miller, & Chapman, 1990; Larson et al., 1991; Larson, Bryan, Adler, & Blane, 1997; Muto, Sistrom, & Farr, 2000; Pittet et al., 2000). Pending further and more robust studies on the issue, existing studies suggest that two factors could contribute positively to hand washing compliance by caregivers: (a) visibility of hand washing sink, and (b) location or easy

accessibility to the hand washing sink. An additional factor addressed in the literature is bed-to-sink ratio (Kaplan & McGuckin, 1986; Vernon, Trick, Welbel, Peterson, & Weinstein, 2003). These studies, however, were typically conducted in multi-occupancy rooms. Since single patient rooms are increasingly becoming the norm today, and all patient rooms are provided with sink for caregivers, bed-to-sink ratio is no longer a factor but the location of the sink relative to the bed might be a factor.

A disappointing aspect of the infection control strategies is the inability to arrive at solutions that improve hand washing compliance. Educational and physical design interventions have not shown consistency in compliance improvement. Deeper analysis is warranted in the domain of behavior modification through environmental cues and operational policies, to see whether compliance can be improved.

Private patient rooms offered one potential advantage in infection control. One patient in a room raised the ratio of sink to patient to 1:1. While it was possible to skip hand washing when moving between patients within a room, leaving one room and entering another provides the necessary environmental cue to wash hands.

CONTROL AND SOCIAL SUPPORT

Private patient rooms also became an attraction factor in a consumer-driven healthcare economy. While the associated pitfalls of larger footprint and longer distances for the staff are described above, the private room also helped provide greater degree of control to the patients. Patients now have greater control over their ambient environment, including artificial and day light, temperature, and noise. The ability to close the room door afforded greater control over visual and auditory privacy, when desired, in addition to shutting out any external noise.

Single rooms have lead to increased patient satisfaction with their hospital stay (Janssen, Harris, Soolsma, Klein, & Seymour, 2001; Janssen, Klein, Harris, Soolsma, & Seymour, 2000; Lawson & Phiri, 2000; Nguyen Thi, Briancon, Empereur, & Guillemin, 2002). Studies also show the improvement in quality of sleep when noise level is reduced (Aaron et al., 1996; Topf, Bookman, & Arand, 1996), a key factor in improving recovery rate. While empirical studies are not widely available, greater control over day light promises appropriate resetting of the circadian pacemaker leading to better quality of sleep, and potentially improved recovery.

The auditory privacy offered by the room has also been shown to improve communication between clinicians and patients (Chaudhury, Mahmood, & Valente, 2005). With appropriate level of perceived privacy, patients are less reluctant to open up to their clinicians. The noise reduction associated with private rooms could also reduce patient stress, and clinician errors associated with verbal communication – an aspect with important implications for patient safety. Less noise represents less chaos and disturbance for the staff, and better comprehensibility of human speech.

The private patient room also made another key strategic change possible – of family involvement in patient care. Social support has been shown to reduce stress (Cohen & Wills, 1985), and the presence of family and friends in the patient room was considered a crucial piece to patient care quality. Newer patient rooms included better family amenities to support

the presence of a family member throughout the duration of the patient stay. Rooms are furnished with sleeper sofa, work tables, internet connection, and other amenities to help family members stay in touch with work (Figure 9). The inclusion of the family in patient care was accompanied by major changes in visitation hour rules. From the traditional practice of restricted visitation hours, in-patient units opened up their doors for twenty four hours visitation and accommodation. Additional family amenities were created at the unit level, including lounges, kitchenette, and shower rooms to support this trend.

Few research studies are available to show the benefits of family presence. Anecdotes describe family presence helping to reduce medication errors and patient falls. Initial results of an experimental project at Emory University Hospital in Atlanta show promise. The Neurology Department at Emory University Hospital, a 600 bed academic medical center in Atlanta, realized that the critically ill patient census they were experiencing could not be accommodated in their existing aging intensive care unit. With an annual neurocritical care admission of 1,400, they were stretching the patient handling capacity of the then existing 27 critical care beds. The budget for a 24-bed temporary ICU was sanctioned in 2005, with an emphasis on maximizing room counts and a fast track procurement process so as to occupy the new facility by September 2007.

The interim nature of the project provided a fertile opportunity to design an experiment that would provide an evidentiary base for policy formulation, and articulate programmatic parameters for the future expansion program. A team of researchers from the neuroscience critical care medicine at Emory University Hospital, Georgia Institute of Technology, College of Architecture, and HKS Architects embarked upon the challenging task of redesigning the neuro critical care environment. The team focused on providing an optimal patient and family focused care environment adopting an evidence based design approach. A series of ethnographic studies in the existing neuro ICU quickly highlighted a stressful environment for patients, families, and staff. The study explored the environment's impact on medical errors, patient safety, staff retention, and quality of care. Four performance dimensions were identified as design drivers for the new ICU, namely (a) support for family, (b) support for bed side procedures, (c) reduce hospital acquired infection, and (d) reduce medical errors.

Evidence was collected from existing scientific literature and from ten award winning ICU designs. Among the physical design attributes that transformed an initial 24-bed conventional ICU program to a 20-bed award winning ICU design were optimally supportive family accommodation inside patient rooms (Figure 9), family locker and shower, ceiling mounted utilities to support bed-side procedures, strategically located hand sanitation stations and alcohol hand rubs for infection control, noise control, and decentralized nurse stations for proximal location of caregivers.

The ICU received the 2007 SCCM (Society of Critical Care Medicine) ICU Design Award as the best new ICU in the U.S. Post-occupancy data from the unit is one indication of why the unit is considered successful. Patient surveys report 100% satisfaction with friendliness and courtesy of ICU nurses, 95% in skill of ICU nurses, 95% in the nurse's response to patient requests, and 95% in overall rating of the nursing staff (from hospital data). Laura Landro (2007), in an article on the Emory unit in the Wall Street Journal, articulates the novelty of family centered care, the outcomes of the elimination of family visitation hours, and the resultant increase in satisfaction among patients and families.



Figure 9. The family space in the new ICU at the Neurology Department of Emory University Hospital includes all amenities to help family members stay comfortably and be in touch with work (Source: HKS, Inc.).

CROWDING AND DENSITY

Private rooms and decentralization of nurse work spaces also reduced crowding. The negative impact of crowding and high social density in occupied spaces, in other contexts, is well documented (Bechtel, 1997). The decentralization of nurse documentation areas reduced the traditional crowding in the central nurse station. Decentralization of medication rooms and supply rooms also reduced crowding in these areas. The central nurse station model, however, had its own advantages in terms of staff communication, collaboration, mentoring, and socializing. As a result, from a physical design viewpoint the main challenge is to decide on the level of decentralization that would retain the benefit of the central nurse station model while reducing the negative impacts of crowding. Optimizing decentralization between the two ends of the decentralization scale – central nurse station only, and bed side documentation only – constitutes an area of ongoing examination.

Private rooms also enabled spilling over to adjoining units in response to census fluctuations, without affecting the operations of these units. With private rooms, there remains lesser necessity of matching patient attributes during bed assignment. As long as the support spaces are appropriate for the patient population being accommodated, flexibility of temporary expansion of a service across physical units became easier. That helps reduce potential crowding in in-patient units.

AESTHETICS

One of the major goals in reducing patient stress, improving safety, and improving recovery rate is to increase patient satisfaction with a hospital. In a highly competitive environment, patient satisfaction level is directly correlated with hospital revenue. As a result, aesthetics began to play an important role in the new generation hospitals. In contrast with the institutional looks of traditional hospitals, new hospitals consciously endeavor to adopt a non-institutional aura both from the outside as well as the inside. Hospitality style and home-like were some of the emerging concepts in the industry that is witnessing one of the largest investment in new and replacement infrastructure in American history (Romano, 2007).

The new vision of hospital design brought artwork and a restful ambience into a sharper focus. After all, artwork has the advantage of transforming the quality of a built space easily, and could be introduced and replaced with ease. What ensued was a major transformation of hospital lobbies and public lounges. Aesthetic finishing materials, furniture and artwork (Figure 10) began to define the entrance and public lobbies of modern American hospitals (Peck, 2009).



Source: HKS, Inc.

Figure 10. The lobby at the Parker Adventist Hospital, Parker, CO is an example of the new role of aesthetics in hospital design

Whether the hospitality style environment resulted in any positive outcomes is unknown, and has not been examined to date. However, literature on the impact of artwork in the form of positive distractions during procedures and treatments attracted attention. A positive distraction has been defined as "an environmental feature that elicits positive feelings and holds attention without taxing or stressing the individual, thereby blocking worrisome thoughts" (Ulrich, 1991). The term distraction itself refers to "the direction of attention to a non-toxious event or stimulus in the immediate environment" (Fernandez, 1986; Vessey, Carlson, & McGill, 1994). Multitudes of studies have shown significant influence of positive distractions on clinical and behavioral outcomes of patients. Adult patients in a procedure room reported better pain control when exposed to a nature scene with nature sound in the ceiling (Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003). Breast cancer patients reported reduced anxiety, fatigue and distress during chemotherapy when exposed to virtual reality intervention displaying underwater and art museum scenes (Schneider, Ellis, Coombs, Shonkwiler, & Folsom, 2003). Murals resulted in a significant decrease in reported pain intensity, pain quality and anxiety by burn patients (Miller, Hickman & LeMaster, 1992). A similar finding was made by using virtual reality (VR) where patients were asked to enter a virtual environment by playing video games or wearing a headset (Hoffman & Patterson, 2001). Positive distraction interventions on 157 elective colonoscopy patients between 16-75 years found that a combination of music and visual distraction (home movies of scenic views) resulted in significant reduction of patient-controlled sedation doses, as compared to only visual distraction or no distraction conditions (Lee et al, 2004). In a test comparing absence of any distraction to a non-VR distraction on a computer screen, and a VR distraction (simulated visit to a gorilla habitat), pediatric cancer patients reported lowest pain, and recorded lowest pulse rate in the VR distraction condition (Gershon, Zimand, Lemons, Rothbaum, & Hodges, 2003). Similarly, in an experiment comparing 5 conditions (a) no distractions, (b) aquarium, (c) poster, (d) aquarium + hypnosis, and (e) poster + hypnosis, in a dental surgery waiting room, both aquarium conditions produced greatest relaxation (reduced anxiety, increased comfort), in 42 patients during elective dental surgery (Katcher, Segal, & Beck, 1984). Children aged 3.5 to 12 years during blood draws reported less pain when encouraged to use a kaleidoscope (Vessey, Carlson, & McGill, 1994), as compared to a control group. Children reported less pain during injections when distracted by touch, and bubble-blowing (Sparks, 2001). Interacting with clowns reduced preoperative anxiety for children in the age of 5-12 (Vagnoli & Messeri, 2005).

Does the quality of the physical environment in waiting areas influence one's judgment on waiting time and quality of care? The positive impact of appealing sensory stimulation during treatments and procedures stimulated studies in waiting environments of hospitals. In a study across six clinical outpatient practices, involving 787 patients, located in six facilities within the Weill Cornell Medical Center/New York Presbyterian Hospital, New York City, the attractiveness of waiting areas were measured independently and correlated with the perceived care quality, perceived waiting time, and other perceptions of interest (Becker & Douglass, 2008). The data analysis discovered significant correlations between the degree of attractiveness of the waiting area physical environment and perceived quality of medical care, reported reduction of anxiety, perceived waiting time, and quality of interaction with staff.

The Cornell study raised further possibilities. Could the introduction of positive distractions as a sensory stimulus add to the attractiveness of waiting areas and enhance the waiting area experience too? Hospital waiting environments are characteristically chaotic,

typified by highly stressed and disoriented patients and families (Carpman, Grant, & Simmons, 1984; Nelson-Shulman, 1983-84), and highly stressed and fatigued staff (Houle, 2001). In many ways the chaos – result of disoriented patients and families and stressed staff – contributes further to the elevated stress levels. Positive distractions may have some salutary effects. A study at the Children's Medical Center Dallas introduced five distraction conditions randomly in the waiting area of the dental and cardiac clinics (Pati, Nanda, & Waggener, 2009). Attention, behavior, and activities of children while waiting were recorded. The parents of the children completed a questionnaire survey at the conclusion of their visit. Data on 158 pediatric patients, and questionnaire responses from 75 accompanying adults were collected over 12 days of data collection during December 2008 and January 2009. The data demonstrate that the introduction of distraction conditions was associated with significantly higher calm behavior and less fine and gross movement, suggesting considerable calming effects of the distraction conditions. The data also demonstrated that positive distraction conditions are significant attention grabbers.

Some notable findings of interest originated from the analysis of the parents' responses. Correlation analysis of the children's behavior data with parents' responses on the questionnaire showed that a number of dimensions of the parents' waiting experience were significantly correlated with children's behavior and activities while waiting. In addition, the waiting experience demonstrated significant correlations with perceived waiting time, the exam room experience, the perception regarding staff, the overall visit, and the overall experience. The dimensions of the parent's experience included their inclination to recommend the clinic to others, and their perceived quality of interaction with the staff and the physician. Although causation was not explored, the study data show a potential causal path between positive distractions in waiting areas, the waiting experience, and the overall healthcare experience.

Further replication of these findings in other settings could lead to a change in the role of artwork and positive distractions in hospital public areas from one of aesthetical appeal to one of strategic function. Indeed, studies in neurosciences provide preliminary evidence that visual stimuli undergo an aesthetic evaluation process in the human brain, by default, even when not prompted, that responses to visual stimuli may be immediate and emotional, and that aesthetics can be a source of pleasure, a fundamental perceptual reward, that can help mitigate the stress of a healthcare environment (Nanda, Pati, & McCurry, 2009). Future research will strengthen the explanatory base that neuroscience is beginning to offer, when artwork and positive distractions will potentially become integral to the design decision-making process.

CONCLUSION

The evidence-based design paradigm has resulted in a fundamental transformation in the relationship between environmental design research and design practice. There is growing recognition that risks and hazards of health care associated injury and harm are a result of problems with the design of systems of care rather than, solely, poor performance by individual providers. Furthermore, there is substantial evidence that the design of hospital

physical environments contributes to medical errors, to increased rates of infection and injuries from falls, and to slow patient recovery and high nurse turnover.

“The design professions have been slow to comprehend the gravity and character of the problem. Designers appear to be taking "solution based" approaches rather than using intensive, focused research to develop environments that support care giving processes. Key causes for these deficits relate to the way designers are trained, the way design knowledge is shared and propagated, and the history of architectural theory”. (Dickerman & Barach, 2008).

From a situation with little or limited interactions, the EBD paradigm thrust scientific research into the core of the design decision-making process. Environmental psychology research has provided the foundation to understand and articulate key relationships, develop meaningful hypotheses, and adopt the appropriate framework for performance optimization dialogues.

The emergence of EBD, however, occurred during a period of high prosperity. As a result, some relatively costly concepts such as the hospitality style lobbies and patient rooms received encouraging acceptance and little in terms of constructive criticisms. In some ways EBD was perceived in many circles as an expensive proposition. The financial meltdown of 2008 has challenged the notion of EBD and forced it to justify its costs with hard evidence. Could EBD be sustained when the financial climate has drastically changed? Did this decade represent a short honeymoon between research and design practice? Is good financial climate a minimum necessary condition for research-design integration?

That warrants a closer look at EBD. It is a method of decision-making, and not a product. The method uses empirical data (in conjunction with experience) to optimize performance on multiple dimensions, within legal, cost and cultural constraints. There is no one-solution-fit-all approach across all contexts. Adopting an option with full knowledge on its performance is the underlying essence of EBD.

Understanding this is important since safety (the overriding and perpetual issue) is not a binary concept as described in the introduction. It is a function of the degree of risk a culture is willing to take coupled with the affordances and constraints imposed by the environment. Thus, the EBD method could result in different solutions in different contexts depending on context specific, and other performance shaping, factors. In design decision-making, such as physical configurations, flooring materials, sink design, ventilation systems, and so forth, informed choices have to be made between designs with different performance and cost. Insofar as physical design alone may not produce the desired results, staff attributes and operational cultures, which are not constant across contexts, come into consideration while designing for healthcare quality.

The financial meltdown has magnified safety or quality concerns in healthcare. Emerging legislation and reimbursement models in the U.S. will necessitate deeper examination of the patient safety issues. In 2008, the Center for Medicare & Medicaid Services (CMS) introduced an unparallel condition in the reimbursement system for healthcare providers in the United States. Costs pertaining to several types of hospital-acquired infections and medical errors will not be reimbursed in a new pay-for-performance model. Healthcare providers will bear the burden of several harmful outcomes resulting from either unsafe clinical practices or inappropriate physical environment – or both. EBD will have a greater role to play since the stakes are higher in the delicate act of balancing performance and cost.

Understanding the performance implications of the designed healthcare setting needs research.

EBD should be viewed as a process to optimize performance within cost, legal, and cultural boundaries. As financial sources get tighter, research and evidence supported design will result in better optimization of resource utilization. The probability is high that the research-design integration that was witnessed over the past decade will continue to drive design practice, with environmental psychology playing a central role in the relationship.

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Chapter 2

CONTEMPORARY PHYSICAL WORKSPACES: A REVIEW OF CURRENT RESEARCH, TRENDS, AND IMPLICATIONS FOR FUTURE ENVIRONMENTAL PSYCHOLOGY INQUIRY

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ABSTRACT

This article presents a current review of the environmental psychology literature as it pertains to physical work environments. In addition to reviewing past literature, this article points out contemporary trends affecting workspaces, such as the trend toward distributed and/or remote work, the migration towards more digitized work environments, the need for more flexible office spaces, the push towards “greener” and more environmentally friendly buildings (such as those that meet LEED certification), and the importance of increased rates of innovation at work. The article then discusses how these trends may affect the relevance of past research in this area. As relevant, research from related fields (e.g., architecture) will be incorporated to promote interdisciplinary insights and integration. The chapter will conclude with a general discussion of how environmental psychology can best position itself as a discipline given work trends/changes and lay out research questions for future inquiry.

INTRODUCTION

“Minimally, where we work should be part of a healthy ecosystem in which we as individuals, teams, and organizations can not just survive or be productive but flourish.”

– Franklin Becker (2004; p.5)

Environmental psychology is an inherently multidisciplinary field of inquiry. It concerns the study of individual behaviors and experience in context. Environmental psychology can

be defined as “the study of the transactions between individuals and their socio-physical environments (Cassidy, 2003, p. 4). Environments can be defined based on their objective, hard and quantifiable physical properties, such as intensity of lighting, volume of background noise, and color of a room. The same environments can also be described based on their perceived and socially constructed aesthetic and symbolic attributes. Architects and engineers focus most of their efforts on the creation and optimization of those objective, quantifiable physical properties of spaces as well as their symbolic nature. In contrast, the social sciences (i.e., psychology, sociology, and communications), take into account the cognitive, behavioral, and social elements of spaces. None of these disciplines is able to offer a complete picture and understanding of the interactions between workspaces and employees alone, but together they allow for a more robust understanding of the complex system of interactions.

The field of environmental psychology also spans multiple levels of analysis. It involves the interactions and mutual influence of environments and the individual occupant(s), environments and the group, and environments and the organization as a whole. This chapter specifically focuses on environmental psychology as it pertains to work spaces. Within the work context, environments can be broken into four levels: (1) those of specific work stations or workspaces occupied by each individual employee, (2) the shared or communal workspaces, such as an overall “bull pen”, hall ways, entryways, cafeterias, meeting rooms, etc., (3) buildings as a whole, and (4) all of the buildings occupied by a particular organization as a collective unit.

As a field of inquiry, environmental psychology has long been pushed forward by utilitarian goals, seeking gains in employee productivity (Gorawara-Bhat, 2000). Leading this charge were the efforts of scientific management and Taylorism (F. W. Taylor, 1911), where components of work were broken into their smallest components to promote efficient movement and increased job task performance. Specific changes in environmental conditions were studied for their direct effects on performance (i.e., changes in lighting in the Hawthorne studies) (Roethlisberger & Dickson, 1941). This perspective, consistent with manufacturing goals of the time, which emphasized assembly line productivity and replaceable parts, viewed humans as another type of cog in the machine. This represents the first of three types of theories on organizations, classical theories or “machine theories” (Sundstrom, 1986).

Extending this perspective, while maintaining the utilitarian aims, the human relations movement shifted the focus somewhat by prioritizing the psychological components of the equation (Homans, 1950) above efficiency. The human relations movement gave rise to humanistic theories of organizations which incorporate issues such as how job satisfaction and the work environment affect performance through the individual’s needs and perceptions (Gorawara-Bhat, 2000; Sundstrom, 1986). Indeed, high job satisfaction is associated with several psychological and physiological health benefits, such as lower levels of depression (Greenberger & O’Neil, 1993; Kasl, 1973) and elevated physical health (Cooper & Marshall, 1976; Ivancevich & Matteson, 1980; Jenkins, 1976; Sales & House, 1971).

Much like the transition from Taylorism to the human relations movement, the theoretical frames used to study the environment have evolved. Much of the earlier environmental psychology work viewed individuals of passive responders to the environment, such that their behavior was dictated by environmental conditions (Gorawara-Bhat, 2000). This perspective of environmental determinism of behavior can be found in the literature on crowding (Cunningham, 1979; Glass & Singer, 1972; Rotton, Frey, Barry, Mulligan, & Fitzpatrick,

1979; Sundstrom, 1987), territoriality (Altman, 1975), physical proximity (Festinger, Schachter, & Back, 1950), and spatial layout (Bavelas, 1960; Leavitt, 1951; Strodtbeck & Hook, 1961). Later, the field began to consider the individual and the context as interacting entities, exerting mutual influence (Baum, Calesnick, Davis, & Gatchel, 1982). Not only is there an effect of the environment on the employee, but also the employee on the environment. Barker took an ecological approach and defined these systems of mutual interaction as behavioral settings (1968).

In recent times, scholars have come to recognize that the systems of interactions between occupants and environments are not only exerting mutual influence but are also interdependent. A transactional approach helps to take into account the interdependencies and is used to “understand the patterns of relationships among persons, processes, and context as they mutually define one another and serve as aspects of the whole, not as separate elements” (Gorawara-Bhat, 2000, p. 16). When studying these relationships, the various dimensions of the environment must be taken into account, including the functional, aesthetic, and symbolic qualities (Elsbach & Pratt, 2008). We must also understand these patterns of relationships across the multiple levels of analysis—at the levels of the individual, group, and organization as a whole (Sundstrom, 1986). Given this recognition of the inherent complexity in interaction between elements, a useful contemporary frame with which to view environmental psychology issues is systems theory. This theory recognizes the complexity and interdependency of the relationship between individuals and the spaces they occupy in a sociotechnical system, defined as the merging of a social system with a technological one (Katz & Kahn, 1978)¹.

The following sections present a current review of environmental research organized by level of analysis—examining the environment from an idiosyncratic micro perspective to an organizational macro overview. Following this review of current literature, emerging trends affecting workspaces and the field of environmental psychology will be presented. Directions for future research to study the impact of these changes will be proposed.

Individual Differences in Experiencing the Environment

A significant difficulty associated with predicting effects of environmental variables on an individual is the idiosyncratic nature in which an individual experiences the world around them. An assortment of individual-level characteristics define an individual’s experience through the role these characteristics play in the interpretation and processing of the information surrounding them. The list of variables includes, but is in no way limited to, elements such as attention (Ellis, 1994; Krohne, Pieper, Knoll, & Breimer, 2002), personality (Cantor, et al., 1991; Ilies & Judge, 2002), prior knowledge and experience (Cassar, 2006; Lee & Tsang, 2001; Robinson & Sexton, 1994; Stuart & Abetti, 1990), and motivations (Cantor, et al., 1991; Schwarz, 1998).

It seems that three basic types of processing occur as individuals perceive and respond to environments: cognitive, emotional, and physiological (Elsbach & Pratt, 2008; Mano & Oliver, 1993; Schachter & Singer, 1962; Tarrant, Manfreda, & Driver, 1994). Still,

¹ For a more extensive review of the various theories that have been used in environmental psychology, please see Cassidy, 2003.

researchers do not currently agree upon the order by which these processes occur (Barrett, 2006; Lazarus & Folkman, 1984; Zajonc, 1984), nor their relative influence on each other in the shaping of an experience.

Cognitive theorists argue that people actively shape experience and mold it to their requirements (Rychlak, 1981). Indeed, Lazarus (1982) proposes that cognition mediates the relationship between an individual and the environment. Research has shown that people employ a number of cognitive shortcuts in order to efficiently process the extensive information available in their environments. These shortcuts are specific to the individual and can take the form of cognitive maps (Evans, 1980), heuristics (Kahneman, 2003; Simon & Newell, 1958), and schemas (Evans, 1980).

Emotional processing contributes to idiosyncratic experiences through an initial stimulus reaction leading to positive or negative affect (Lord & Maher, 1991). Affect is an “innately structured, non-cognitive evaluative sensation that may or may not register in consciousness” (Masters, 2000), which then becomes evaluated in sync with the physical and cognitive elements to identify a “feeling” (Masters, 2000). The outcome of these emotional internal processing stages creates emotion, defined by Masters (2000) as a “psychosocially constructed, dramatized feeling.” When certain emotions are experienced frequently or over long periods of time, they become classified as moods (Plutchik & Kellerman, 1980).

Physiological responses include a variety of body-level changes driven by neuron-based signal transport mechanisms (e.g., hormones and neurotransmitters), leading to outcomes such as heart rate fluctuations, sweating, nausea, or shaking—all of which impact an individual’s degree of arousal (Krauss & Putnam, 1985; Poulton, 1970). Over time, an accumulation of certain physiological responses (i.e., periods of extended arousal or stress) may have an effect on the individual’s longer-term health (Blonna, 1996; Cohen, Miller, & Rabin, 2001; Sarafino & Ewing, 1999).

Through the mechanisms mentioned above, environments have the capability to negatively or positively affect an individual’s health through the cognitive, emotional, and physiological responses they may elicit. While processing their environments, individuals are also simultaneously situated within a continually evolving, contextually sensitive feedback loop (Rae, 2005; Reuber & Fischer, 1999). In other words, social (Rae, 2005), hegemonic (Lefebvre, 1991), and cultural (D. Taylor & Thorpe, 2004) factors also play an on-going role in how an individual will interpret and respond to their environment.

Characteristics of the Physical Environmental

Specific aspects of the physical environment have been studied as to their effect on individuals. These aspects include: lighting, noise, color, personalization, and air quality. A review of research with respect to each of these factors is presented in greater detail below. Most of the research on these factors has been conducted in laboratory settings. Although laboratory settings allow for isolation of these physical environment attributes to test for their impact on various outcomes, the effects of the larger organizational context on the findings (e.g., possible organizational culture moderators) need to be tested. Therefore, research on physical environment attributes should be tested for consistency of findings within a variety of work contexts.

Lighting

With respect to lighting, studies have examined the intensity of lighting on the ability of workers to perform various tasks. Generally, and as would be expected, the optimal intensity of lighting required depends on the visual requirements associated with the task, but all workers seem to perform these tasks best within a certain range of luminosity, about 30-35 footcandles (Sundstrom, 1986). However, there have been fewer studies that take into account the impact of glare, something that becomes a complaint as more lighting gets added (Sundstrom, 1986). Issues of glare and luminance surrounding visual displays have become increasingly relevant given the widespread use of computers at work and the interaction effect of lighting and computer screens (Sheedy, Smith, & Hayes, 2005). Also, as automated systems have been incorporated into buildings, such as automated fenestration systems or shade screens, their ability to optimize indoor lighting conditions has come into question. The difficulty with configuring these automated systems comes into play when one considers that the lighting must be consistently or optimally configured for all heights within the space and across the various furniture obstacles to each workstation, and must take into account a variety of environmental conditions (Selkowitz & Lee, 1998). There is a wide variety of factors that impact natural lighting conditions, including the time of day, weather conditions, or even the time of year, each of which could significantly impact lighting conditions within buildings, especially when paired with the wide variety of fenestration systems available today (Laouadi & Parekh, 2007; Selkowitz & Lee, 1998).

Related to issues of light intensity is the effect lighting has on an individual's circadian rhythm. Exposure to light of varying intensity at different times of the day has been shown to play a significant role in setting the individual's sleep/wake cycle. Problems emerge when a worker is expected to perform but has been entrained to be in the sleep portion of the cycle during their working hours (Boyce, Hunter, & Howlett, 2003; Rea, Figueiro, & Bullough, 2002; Rea, Figueiro, Bullough, & Bierman, 2005; Van Bommel & Van den Beld, 2004). Little, if any, of the literature takes the effects on worker circadian rhythm into account when planning building and lighting conditions, but clearly this is an important consideration, especially for employees working non-standard shifts (Boyce, et al., 2003).

Indeed, some medical researchers propose that changes in light-dark (e.g. shift-work, light-at-night, dim light) exposure can desynchronize internal circadian rhythms from the external environment (Rea, et al., 2002; Rea, et al., 2005; Stevens, 2006, in press; Stevens, et al., 2007; Stevens & Rea, 2001). This can not only disrupt the wake-sleep cycle, but also impact physiological and metabolic processes—possibly leading to negative pregnancy health outcomes or diseases such as gastrointestinal disease, cardiovascular disease, and breast cancer (Bullough, Rea, & Figueiro, 2006; Kloog, et al., 2008; Knutsson, 2003; O'Leary, et al., 2006; Stevens, 2006, in press; Stevens, et al., 2007; Stevens & Rea, 2001). Together, these findings could have huge implications for designing lighting for work environments.

In addition to lighting intensity, other lighting qualities have been examined, such as source, and color spectrum. Natural lighting, or that which comes from the sun, as compared to artificial or fluorescent lighting, has been shown to result in more positive mood (Boyce, et al., 2003). But, how those benefits are impacted by time of day, varying weather conditions or seasonal changes in sunlight quality still need attention (Boyce, et al., 2003).

Windows have been shown as highly desirable by office workers, with occupants vying for the offices with windows, perhaps not only for the beliefs in the benefits natural light has

to offer (Boyce, et al., 2003), but also for the symbolic rank associated with possessing a windowed office in American culture (Gorawara-Bhat, 2000). Windows are also capable of offering benefits such as a view, fine control over lighting conditions through an assortment of window coverings, ventilation, awareness of time passage and weather conditions, and even the possibility of eye fatigue relief by providing distant focal objects (Boyce, et al., 2003; Sundstrom, 1986). The view provided by a window, especially when a natural view, has been shown to have positive effects on an individual's ability to direct attention or to restore directed attention (Tenessen & Cimprich, 1995), providing support for the proposed links between the natural environment, attentional fatigue, and restoration of attention (R. Kaplan & Kaplan, 1989; S. Kaplan, 1995).

Some studies examining fluorescent lighting have not shown a difference in performance or mood based on whether the fluorescent lights are cool or warm in tone (Veitch, 1997). Other studies, however, have shown that differences in the illuminance provided to space occupants can have mood effects (Baron, Rea, & Daniels, 1992; Knez, 1995, 2001; Küller, Ballal, Laike, Mikellides, & Tonello, 2006; McCloughan, Aspinall, & Webb, 1999). Given these conflicting findings plus results that vary with individual differences such as gender (Boyce, et al., 2003; Knez, 2001), changes in mood seem to be influenced by several factors besides the lighting component being examined. The interaction effects of multiple factors, outside of one environmental characteristic and the interdependence of these factors provide further support for the systems theory perspective of these interactions.

In sum, preferences for different lighting conditions across individuals or even across tasks may indicate that controls over lighting might be better left in the hands of the occupants of the spaces, rather than setting a global lighting condition. Support for this comes from the fact that individuals experience more positive mood from lighting when it closely conforms to their expectations as to what the lighting should be like (Purcell & Nasar, 1992). This is further supported by the fact that the most positively perceived lighting is non-uniform (Sundstrom, 1986). However, people's reactions to control may not be as intended if their choices affect others in the vicinity of their own workstation and this should be considered as part of the equation (Boyce, et al., 2003).

Noise

Studies of the impact of ambient noise, sounds, music, etc. tend to show that increased levels of noise lead to increased arousal and stress (Sundstrom, 1986) but that these results are contingent upon the work context or task at hand (Leather, Beale, & Sullivan, 2003). Noise can be distracting or annoying, not only based on volume or sound quality, but also because of the content (i.e., conversation) (Sundstrom, 1986). Sounds become increasingly troublesome the more they deviate from the base level of background noise, when they are not controlled by the perceiver, or when they are unpredictable (Kjellberg, Landstrom, Tesarz, Soderberg, & Akerlund, 1996; Sundstrom, 1986). Noise can become a source of dissatisfaction with both the environment and the job (Banbury & Berry, 2005; Sundstrom, 1986), but not the supervisor or self (Banbury & Berry, 2005). It has these negative consequences by creating feelings of annoyance (Sailer & Hassenzahl, 2000; Sundstrom, Town, Rice, Osborn, & Brill, 1994), impairing performance (Banbury & Berry, 1997, 2005; Loewen & Suedfeld, 1992; Veitch, 1997; Veitch, Gifford, & Hine, 1991) and decreasing motivation (Evans & Johnson, 2000). Unfortunately, one of the ways in which noise negatively impacts work is through breaking concentration of the worker, an effect which

does not seem to go away with time or habituation (Banbury & Berry, 2005). Also, people who face prolonged exposure to relatively noisy environments suffer deleterious health effects, both physiologically and mentally (Cassidy, 2003).

Music at work has a rich history, as explained in a review by Prichard, Korczynski, & Elmes (2007). The authors explain that in pre-industrialized nations, manual laborers (e.g., miners, agricultural laborers, and domestic servants) would sing songs, apparently for pacing and coordination of labor. However, industrialization introduced obstacles to workplace music, namely noisy machines and management practices to control the “soundscape” of the environment. Then in the 1940s, factories in the U.S. and U.K. began broadcasting music through loudspeakers, somewhat inspired by studies that demonstrated improvements on productivity and a reduction in fatigue (Korczynski & Jones, 2006; Oldham, Cummings, Mischel, Schmidtke, & Zhou, 1995).

Now in a post-industrialization era, music takes on a new role: control. Much of the recent research on music in the social sciences examines how music can alter the experience of and behavior of workers and customers. For example, background music is used in service industries to increase customer spending (North, Hargreaves, & McKendrick, 1999) and reduce frustration while waiting in line (Hul, Dube, & Chebat, 1997). For workers, music can increase simple task performance, reduce turnover, and elevate mood (Oldham, et al., 1995). Still, other studies focus on music as a motivational force, such as using music to increase employee stairwell use (Boutelle, Jeffery, Murray, & Schmitz, 2001) or promote organizational culture (Nissley, Taylor, & Butler, 2002).

As opposed to music, white noise is meant to mask unexpected or unwanted sounds that may be a stressor (e.g. conversations, printers, ringing phones). The demonstrated usefulness of white noise for sound masking purposes has had mixed results. One study found that as ambient white noise increased, simple helping behaviors decreased (Mathews & Canon, 1975). Indeed, the same phenomena was found with studies examining the effects of loud noises (Page, 1977). Helping behaviors after noise termination was higher for those listening to “soothing ocean sound” versus loud and distracting music (Sherrod & Downs, 1974). Additionally, perceived control over the high-intensity (over 95 dB[A]) white noise appears to be an important mediator: already angry subjects without perceived control were further agitated, whereas there was no effect on those with perceived control (Donnerstein & Wilson, 1976).

Areas for future research with respect to noise in office or work environments include the effects of noise on collaborative activities or interactions between individuals. Also, there is some evidence that end users of spaces perceive sound differently than those that design work spaces. Trying to find a way for these two groups to understand each other so that spaces can be appropriately designed to maximize comfort and productivity of end users is of critical import (Chigot, 2005).

Color

Preferences for color are fairly varied, but some trends do exist. People seem to prefer lighter/brighter and more saturated colors (Guilford & Smith, 1959; Sundstrom, 1986). Guilford & Smith (1959) report that the typical order of color preference as shown in the laboratory setting presented in order from most preferred to least preferred is: blue, red, green, violet, orange, and yellow. Colors also vary in their impact on emotional reactions when tested using the PAD model of emotion (pleasure-arousal-dominance) (Valdez &

Mehrabian, 1994). Valdez & Mehrabian (1994) showed that the most pleasing colors come from the cool range of the color spectrum: blue, blue-green, green, red-purple, purple and purple-blue. In contrast, yellow and green-yellow were least pleasant (Valdez & Mehrabian, 1994). The patterns change for arousal, with green-yellow, blue-green, and green as most arousing, with purple-blue and yellow-red as least arousing (Valdez & Mehrabian, 1994). On the dominance-submissiveness scale of the PAD model, Valdez & Mehrabian (1994) found that brighter (lighter) colors are much lower in dominance, while more saturated colors tended to be higher in dominance. Men and women's emotional responses to color were largely similar, though women did seem to be slightly more sensitive to differences in saturation and brightness having stronger emotional reactions than men (Valdez & Mehrabian, 1994). This difference in gender perception of color seems to exist in children as well, with girls demonstrating a stronger preference for lighter and brighter colors as compared to boys (Cohen & Trostle, 1990). Further supporting the findings above regarding the reduced dominance and diminished arousal associated with lighter colors, anecdotal evidence and results of studies that have been conducted using Baker-Miller pink, demonstrate a calming effect, with lower levels of anxiety, aggression, and arousal – both emotional and physiological (Bennett, Hague, & Perkins, 1991; Gilliam & Unruh, 1988; Profusek & Rainey, 1987; Schauss, 1985).

In rooms, colors have been shown to affect the perceived size and temperature of rooms (Sundstrom, 1986). Light colors have been associated with larger perceived room sizes. Some colors are perceived as “advancing” making surfaces appear closer to the viewer, typically warmer and lighter shades while others are perceived as “receding,” making surfaces appear further from the viewer, typically cooler and darker shades. With respect to temperature, colors on the cooler side of the color spectrum, in the blues and some greens, have been associated with some perceptions of being a colder room. In contrast, rooms with surfaces in the warmer spectrum of reds, oranges and yellows, have been perceived as being warmer in temperature (Cassidy, 2003). The warmer spectrum of colors has also been shown to be associated with the perceived creativity potential of a room and increased creative performance (McCoy & Evans, 2002).

Color has also been shown to have an interaction effect with task type on performance and mood, indicating again that the relationships between physical environment factors and other outcome measures varies based on context. For instance, Stone & English (1998) found results suggesting that working in a cubicle with light blue walls led to a greater focus on the task while dark red walls led to more attention being focused on the environment. In a later study, Stone (2003) also found interaction effects between color, presence of a scenic poster, mood, task difficulty, feelings of isolation, desire to be seen, and performance on the task.

Studies of color should be expanded to look not only at predominant color of rooms but color schemes. For instance, does a contrasting palette provide the benefits of warm as well as cool colors? How do murals or patterns impact the findings related to color? Are there optimal color mixes in terms of performance, arousal, or creativity? As in Stone's studies (1998; 2003), how do these various color configurations interact with task type and demands? These are some of the many avenues still available for exploration within the color dimension of environmental psychology of offices.

Personalization

Although personalization could be looked at in the groups or organization-level categories, we decided to place it here under individual-level environmental characteristics because personalization is largely used to express personal identity and can affect each individual's level of satisfaction. In fact, numerous studies have demonstrated that personalization of space plays an important role in the level of satisfaction individuals feel towards their work environments and their jobs (BOSTI, 1981; Brill, Margulis, & Konar, 1984; Harris & Associates, 1978; Sundstrom, 1986; Sundstrom, Burt, & Kamp, 1980; Sundstrom, Herbert, & Brown, 1982; Wells, 2000). It has been shown that there is a positive correlation between the amount of space available for personalization and a worker's satisfaction with their work environment (Buffalo Organization for Social and Technological Innovation BOSTI, 1981). In Sundstrom's model of job satisfaction (1986), personalization contributes to a worker's overall assessment of satisfaction with the work environment, which then also leads to overall job satisfaction (BOSTI, 1981; Brill, et al., 1984; Sundstrom, et al., 1980; Sundstrom, et al., 1982). An indirect positive relationship of personalization to employee well-being was also found in a study conducted by Wells (2000). Key factors magnifying the positive relationship between personalization and well-being include the extent of display, the correlation between desire to personalize and allowance to do so, and extent to which workspace arrangement was determined by the employee (Wells, 2000).

Some gender differences have been revealed in studies regarding workspace personalization. For instance, women tend to personalize their workspaces more than men do, especially with pieces featuring family, friends, and pets, and plants. In contrast, men typically decorate their workspaces with sports items or symbols of their achievements (Wells, 2000). Women tend to use their personalization of their workspaces to express their identities while men seem to express their status within the organization (Wells, 2000). In addition, men seem to make few, but permanent changes to their work spaces, such as through modification of the walls or flooring, while women tend to make frequent temporary changes to their offices, such as through layout or object placement changes (Dinç, 2009). Making modifications to one's environment seems to serve many purposes: to allow for identity expression, to allow for greater attachment to the work environment, and to facilitate adaptation to one's job (Goodrich, 1986).

Air Quality

Another component of the environment that has been shown to effect workspace occupants is air quality. First, increases in temperature have been found to be associated with decrements in performance, motivation, and satisfaction with the environment, while also increasing stress, body temperature, and annoyance (Sundstrom, 1986). The impact of specific temperatures varies by individual; some individuals will experience a rise in body temperature at a higher rate than other individuals when put in a hot environment (McNall & Schlegel, 1968a, 1968b).

Also, some literature on air quality suggests there are a number of ill effects of poor air quality on office occupants. When air quality negatively impacts a certain proportion of the total number of occupants, a building is considered "sick", and the occupants to be suffering from sick building syndrome (Godish, 1995; Murphy, 2006). Effects of poor air quality can include a whole host of psychological and physiological effects, such as headache, nausea,

confusion, dizziness, inability to concentrate, wheezing, hoarseness, and eye and nose irritations (Spivack, 2010).

Social Environmental Characteristics

In this next section, we present characteristics that deal less with the physical environment and more with the social environment. This section will deal with groups of individuals and how they interact within and across the organization. With respect to environmental influences on groups, specific factors that have been studied include: privacy and two related topics: territoriality and crowding, layout, and communication patterns. Each of these topic areas is presented in further detail below.

Privacy

Sundstrom (1986) presents three central offerings of privacy. First, as a retreat from people, privacy offers the individual an ability to withdraw from interaction with others (Altman, 1976; Altman, Vinsel, & Brown, 1981; Bates, 1964). Second, privacy provides control over information by allowing an individual to make choices regarding what information about them is revealed to others. In the theory of self-presentation, Goffman (1959) discusses the “presentation of self” as the way in which an individual moves between public and private domains. The “front” aspects of the self are put on display to various audiences when in a variety of public domains, while the “back” aspects are only allowed to emerge in private domains. The third offering of privacy is the ability to regulate interaction, stemming from the “theory of the regulation of social exchange” (Altman, 1975). This theory suggests that individuals work to maintain a level of optimal social interaction, which may be low, moderate, or high, depending on the individual (Altman, 1975; Sundstrom, 1986). It is this optimum level of interaction that Altman refers to as “privacy” (1975).

Privacy comes in three forms: 1) conversational, 2) acoustical, and 3) visual (Sundstrom, 1986). Private offices are able to offer all three of these types of privacy, as opposed to open office plans, which may only allow for some, if any of these types of privacy, depending on how the space is constructed. Privacy may be granted through several means, however, such as through enclosures, specially allocated spaces, social norms, and other verbal or nonverbal communications (Sundstrom, 1986). Research has shown that employees consistently prefer private offices to open office plans, regardless of job type (Cassidy, 2003). Also, satisfaction with privacy is positively correlated with both job, and workplace, satisfaction, as well as job performance (Cassidy, 2003).

Territoriality

Environmental psychologists have pointed out patterns of behavior exhibited by people, supporting the notion that humans are territorial. Some of these “territorial” behaviors or indicators of territoriality have included the tendency of people to frequent specific places and control access to those places by others (Altman, 1975; Edney, 1974; Sundstrom, 1984, 1986; Sundstrom & Altman, 1974). Territorial behaviors can be defined as those that “‘owners’ use to signal to others the boundaries of a territory and, if necessary, prevent others from

accessing the territory” (G. Brown, 2009, p. 44). Similarly, Altman describes territorial behavior as:

“a self-other boundary regulation mechanism that involves personalization of or marking of a place or object and communication that is ‘owned’ by a person or group. Personalization and ownership are designed to regulate social interaction and to help satisfy various social and physical motives. Defense responses may sometimes occur when territorial boundaries are violated” (1975, p. 107).

Territorial behaviors can be used to establish a desired level of privacy through the regulation of information or social exchange with others. Four types of territorial behavior have been identified: 1) identity-oriented marking, 2) control-oriented marking, 3) anticipatory defending, and 4) reactionary defending (Altman, 1975; B. Brown, 1987; G. Brown, 2009; G. Brown, Lawrence, & Robinson, 2005). Identity-oriented marking is much like the type of personalization that women tend to engage in, as mentioned earlier – it seems to provide the function of self-expression or expression of one’s identity and distinctiveness from others (G. Brown, 2009; McGuire & McGuire, 1981). Control-oriented marking “involves marking an organizational object with symbols that communicate the boundaries of a territory and who has psychological ownership over it” (G. Brown, 2009, p. 45). Anticipatory defending involves attempts by individuals to thwart an infringement attempt, or the attempted claim or use of a physical or social entity that one believes belongs to him/herself (G. Brown, 2009; Dyson-Hudson & Smith, 1978; Edney, 1976; Knapp, 1978), such as through securing the “owned” entity by a lock, password, or other mechanism. Reactionary defending, as the name implies, occurs after an infringement attempt, in an effort to restore the claim to the object (G. Brown, 2009). Some preliminary evidence provides support for this four-factor structure of the territoriality construct (G. Brown, 2009).

Crowding

Crowding can be consistently predicted in the laboratory setting through an increasing number of people in a given environment and their proximity to the perceiver (Knowles, 1983). A few theories suggest that this perception of crowding could vary when other factors are taken into account, such as the perceived discomfort to the other people in the situation (Patterson, 1976), amount of time the individual spends in that particular setting relative to others, and whether or not the individual engages in personally meaningful activities (Stokols, 1976). Perceptions of crowding have been shown to be positively correlated with physiological arousal and discomfort (Aiello, Epstein, & Karlin, 1975; Evans, 1979).

Layout

Layout can be defined as the spatial configuration of a room. Although layout might be thought of as an element of the physical environment relevant to the individual, especially when examined from a perspective such as feng shui, most of the research in environmental psychology has examined it from a social perspective, such that layout only takes on meaning when more than one person occupies a space. Here, layout can take one of two forms: sociopetal or sociofugal (Osmond, 1957). Sociopetal spaces are those that provide opportunities for eye contact and ease of conversation between individuals within a space. In contrast, sociofugally arranged rooms are those that inhibit eye contact and make

conversation more challenging. People use a number of techniques to manage their involvement with each other when occupying the same room with a given layout. Some of these techniques include making eye contact, facing certain directions, or maintaining a certain distance (Sundstrom, 1986). In offices, typical furniture includes seating and a desk, with typical arrangements either positioning the desk between the seats or off to the side of the seats. A “desk-between” arrangement signifies a certain level of formality and is seen as less open than the alternative. The desk becomes a barrier between occupants, creating a psychological distance between them. Some research has suggested that this may be desirable to visitors of certain professionals, such as clients meeting with lawyers, but less desirable to others, such as students meeting with professors and looking to connect with them (Joiner, 1976).

Elements of the physical environment can also impact patterns of communication among members of an organization. A number of factors have been shown to increase the frequency of informal communication, at least among neighbors. These factors include proximity and lack of barriers between workspaces (Sundstrom, 1986). Formal communication is not as easily impacted by these factors, however. Instead, formal communications or private communication may be hindered (Sundstrom, 1986).

Symbolic Environmental Characteristics

At the organizational level, symbolic properties of the environment have been studied. As people congregate and perform their work duties, workspaces become imbued with meaning and the workspace becomes a symbol of social position, legitimacy of a job, and legitimacy of the organization (Durkheim, 1947; Gorawara-Bhat, 2000). The literature on semiotics talks about how space becomes encoded with meaning (Eco, 1979). Instead of only putting the burden of interpretation of environments on the individual, semiotics recognizes the role of culture and society in shaping what those interpretations might be (Gorawara-Bhat, 2000). Rather than beginning with an exploration of space based on the aesthetic or physical elements, attention should be focused on the semiotic structures in which the perceiver is embedded. Semiotic structures include the culture in which the organization is embedded as well as the culture associated with the organization itself or any groups below that level that may play a role in an individual’s experience and perceptions (Gorawara-Bhat, 2000). “The way in which the individual articulates the world in any domain of activity is controlled by the historically determined system of culture and by its appropriate subsystems” (Gorawara-Bhat, 2000, p. 13).

Two especially salient social organizational constructs that are communicated through the physical environment are status and role (Gorawara-Bhat, 2000). Usually the social system within an organization will operate in such a way that the symbolic aspects of workspaces will be congruent with an employee’s status and role. However, when undergoing certain changes, such as outgrowing the size of the building in terms of number of employees, these three elements—workspace, status, and role, may come into conflict. An example of this might be if one of the higher level managers suddenly has to move into an open office part of the organization with subordinates, due to a lack of private office availability. When these conflicts occur, Gorawara-Bhat (2000) demonstrated that social tension is increased at either or both the individual or department levels. In this example, the lower-level employees will

not be able to make sense of the high-level manager's occupation of space similar to their own. The tension will only be eased when the other components of status and/or role are adjusted to reinforce each other (Gorawara-Bhat, 2000). One way that might happen in this example is for the employees to shift their view of the manager's status to that of an equal rank as their own. As you can see, these types of incongruencies can have detrimental effects if not carefully managed, demonstrating the importance of paying attention to the symbolic nature of workspaces.

Current Trends

Now that the most commonly studied facets of the environment have been presented, this paper will present a few current workplace trends that will play a large role in shaping work environments of the future. The first of the current trends to be discussed is the development and use of alternative work sites, whether home, hoteling, or flexible work spaces. As a side effect of these alternative work site strategies being employed, another trend is the reduced co-location of employees, and increase in digitized work environments. Next, the emphasis on building "green" will be presented. Finally, the push towards continuous innovation in all organizations is explored. Given these trends, new avenues for research in environmental psychology have emerged or are currently emerging. These areas for future research are identified below.

Alternative Work Sites

Telecommuting

Telecommuting is defined as an arrangement where employees perform tasks outside of a primary or central workplace for at least a portion of their work schedule, using communication technology to interact with people inside and outside the organization (Bailey & Kurland, 2002; Baruch, 2001; Feldman & Gainey, 1997) in the accomplishment of their job tasks. This type of work arrangement has been on the rise—in 2008, about 33.7 million Americans telecommuted at least one day a month, up from 28.7 million in 2006. Recent projections by Forrester Research, Inc. expect 63 million Americans (43%) to telecommute by 2016. (Schadler, 2009). Partially influencing the rapid adoption of this work strategy may have been the organizational restructuring that occurred in response to the economic downturn of 2008. Another positive force that could be assisting adoption of telecommuting as a business practice might be the support of and compliance with U.S. federal and state legislation by reducing barriers for the disabled (Bailey & Kurland, 2002).

With such rapid growth in the number of employers and employees engaging in telecommuting activities, it is easy to see the desirability of and call for spaces that support the needs of these workers. And, since this group comprises so much of the population, estimated to reach 43% by 2016 (Schadler, 2009), it is highly probable that architectural and city planning projects will be influenced by the needs of communities of telecommuters. Indeed, telecommuters have already been trying a variety of environments to meet their work needs and organizations have been responding to their experimentation. The number and

variety of establishments (e.g., airports, hotels, restaurant chains like McDonald's, Panera Bread, etc.) offering wi-fi internet access to their patrons provide evidence of organizational responses to telecommuters' needs. Also, there are now "coworking" sites where teleworkers can go to work amongst other teleworkers, artists, writers, programmers, etc. from other organizations for a monthly rental fee (e.g., Coworking Brooklyn, Jelly, New Work City) that guarantees them a chair.

Despite these offerings, the most commonly chosen telework environments include the employee's home, a customer/client's place of business, and/or the employee's car. While many people still think cafés and restaurants are commonly chosen venues, their use for telecommuting has actually dropped since 2006. Performing job tasks at home increases perceptions of autonomy through increased control over breaks, clothing, layout, decoration, lighting, ventilation, music, and other ambient elements (Elsbach, 2003; Standen, 2000).

A recent meta-analysis of telecommuting research by Gajendran and Harrison (2007) identified three conceptual themes within telecommuting research: 1) psychological control/perceived autonomy; 2) work-family conflict, and 3) interpersonal relationship quality with supervisors and co-workers. The results of this study shed light upon a "telecommuting paradox," in which the benefits of increased autonomy and decreased work-family conflict are believed to come at the expense of interpersonal relationships at work. These variables are hypothesized to have opposite effects on job satisfaction, performance, turnover intentions, role stress, and perceived career prospects. However, the results of the meta-analysis countered most of these hypotheses by showing that telecommuting is predominantly a good thing. It is associated with increased perceptions of autonomy and lower work-family conflict, and also that it does not damage one's interpersonal relationships with coworkers. Contrary to expectations, telecommuting was positively related to employee-supervisor relationship quality and did not adversely impact career prospects. Combined, these results refute the proposed paradox. The findings are overwhelmingly positive, but there is, however, one tradeoff. Employees that worked primarily from home saw reduced work-family conflict, but also experienced a negative impact on their coworker relationships. One possible area for future research is to devise ways of promoting coworker relationships through digital environments.

Unfortunately, realizing the benefits associated with telework may be more difficult than simply implementing these arrangements. Autonomy has been identified as a key moderator to the benefits of telecommuting, such that it fully mediates the effect on job satisfaction and partially mediates the impact on ratings of performance, turnover intent, and role stress. The autonomy benefit of telecommuting could be lost if organizational policies become too stringent, by overly specifying work tasks, performance expectations, and dictating activities in great detail for telecommuters (Harrison, Johns, & Martocchio, 2000). Likewise, if their work is electronically monitored, feelings of autonomy may be diminished (Alder & Ambrose, 2005; Daniels, 2000; Stanton & Weiss, 2000). Also, legal issues may provide another threat to autonomy if employers are responsible for an employee's health and safety when telecommuting from a home office, as is the case in Australia. This type of legislation may permit or require a certain amount of employer control of the physical environment of a home office, which may reduce an employee's autonomy in the configuration of their work space or how they choose to work.

Environmental psychologists interested in workspaces should be monitoring this trend closely, as it is opening up a wide variety of settings as potential workspaces. It'll be

interesting to note and understand shifting preferences for the different types of teleworking settings that have become available and continue to emerge. In addition, the impact of these choices on individual, social, and organizational outcomes are important to examine. For instance, although autonomy may increase by being able to choose a work site, what sort of impact does this same decision make on individuals with respect to feelings of social isolation or even commitment to their host organization? At the same time that telework has become more commonplace, so too have the technologies that facilitate it—mobile technologies like cell phones, laptops, and ubiquitous wireless internet access. These technologies have permeated and impacted the work and public realms, encroaching upon the physical environment and spaces that traditionally served other purposes. Indeed, recent research found that wireless internet hotspots within urban spaces encourage interactions with existing acquaintances, but at the same time largely preclude participation in the public realm (Hampton, Livio, & Sessions, in press). However, the authors suggest that “infrastructure for wireless Internet connectivity within urban public spaces may have unanticipated and positive consequences for participation in the public sphere – including political and diverse social engagement –beyond what could have previously been afforded by urban public spaces that are free of Internet connectivity” (Hampton, Livio, & Sessions, in press). This area is rich with opportunities for future inquiry.

Hoteling & Flexible Office Spaces

One way that organizations have been trying to cut real estate costs is to transform traditional work spaces into flexible work spaces. Rather than having one assigned workstation per employee to meet all of their various tasks’ needs, some other strategies are being employed. One strategy has been to create generic spaces that can be reserved by employees when they have a need for it, referred to as hoteling. This is typically used for employees that telecommute or have a flexible work schedule. Another strategy has been to develop an activity-based work system (Becker, 2004). A series of work settings is created such that each setting is optimized for a particular type of work activity. Employees are encouraged to move throughout the organization across these different settings to best match their personal work task needs. Environmental psychologists should examine these settings for their variety and ability to support the varied tasks workers are required to perform. In addition, it would be interesting to see if need for personalization or territoriality interferes with the success of the hoteling or activity-based work system strategies or what other factors might influence their success.

Digitized Work Environments

Though environmental psychology is rooted in considerations of the physical work environment, the increasing incorporation of virtual environments into work settings has created a new frontier for environmental psychology research. These settings have been increasing in use for the accomplishment of work tasks and to communicate with coworkers or clients. A deeper understanding of human behavior in virtual world settings for work is needed (e.g., Second Life and MPK20). Therefore future research should examine the development of optimal virtual environments for accomplishment of work tasks that can also promote interpersonal relationships with distributed coworkers or clients. As more virtual teams, virtual communities, and virtual communities of practice (VCoPs) are tasked with innovation it will become increasingly important to understand how the virtual environment

can best be designed to encourage and support those activities. For example, the use of reputation systems and other virtual world features that facilitate the formation of trust among users and enable the exchange of knowledge are already recognized as important to creativity and idea generation for these groups (e.g., Askay & Spivack, 2010). In addition, although the work environment may be a virtual one, the worker still occupies a physical space, and the characteristics of an environment in which this person feels most comfortable accessing their virtual work world is an important consideration.

Green Buildings

The push for green, or environmentally friendly, buildings in the U.S. has led to rapid growth in the market for green buildings. Within the next four years, the market for green buildings is expected to more than double to between \$96 and \$140 billion (USGBC, 2009). As organizations begin to occupy “green” buildings, examining the impact of this trend is important to study. Research should be focused on the impact of this trend on employee perceptions, attitudes, and health. At the individual level, how are the green materials used in this type of construction impacting air quality, lighting, and other physical attributes of the building housing an organization? How are jobs or work tasks impacted by this trend, if at all? What sorts of symbolic meaning is conveyed by organizations occupying green buildings and will that meaning disappear at some point with market saturation? Are there certain green strategies that induce more positive effects for occupants as opposed to others (i.e., maximizing the use of sunlight versus global fluorescent light bulb installations)? These are some of the many questions that environmental psychologists should look to address.

Biophilic Design

Biophilic design is a current and innovative trend in design of the built environment, which goes beyond the low-environmental impact goals commonly associated with green building by also taking into account humankind’s affinity for natural processes and systems, referred to as biophilia (Kellert, Heerwagen, & Mador, 2008; Kellert & Wilson, 1993; Wilson, 1984). In a review of the literature, Kellert (2005) found support for a longstanding assumption that contact with nature is essential for human functioning, health, and well-being. For instance, contact with nature, whether through direct (e.g., sunlight), indirect (e.g., potted plant) or symbolic (e.g., photos of natural scenes) means, has been linked with improved recovery from illness or surgery, reduced health or social problems, improved worker performance, decreased stress, and increased motivation, and improved cognitive functioning and concentration (for a review of this literature see Kellert, 2005).

There are two basic dimensions of biophilic design—the organic or naturalist dimension and the place-based or vernacular dimension (Kellert et al., 2008). The organic or naturalist dimension deals with the shapes and forms of the built environment that “directly, indirectly, or symbolically reflect the inherent human affinity for nature” (Kellert, et al., 2008, p. 5). The place-based or vernacular dimension is defined as “buildings and landscapes that connect to the culture and ecology of a locality or geographic area” (Kellert, et al., 2008, p. 6). Together, these two dimensions give rise to six biophilic design elements: (1) environmental features,

(2) natural shapes and forms, (3) natural patterns and processes, (4) light and space, (5) place-based relationships, and (6) evolved human-nature relationships (Kellert, et al., 2008).

As more biophilic design elements make their way into workspaces, such as solar panels that mimic photosynthetic properties of plants, the impact of these changes on attitudes, health, and well-being of employees as well as productivity or performance of job tasks should be monitored. Providing some initial evidence in support of the use of biophilic elements in workspace design are the results of a study conducted by McCoy & Evans (2002). In their study, they found that there are five environmental characteristics that predict greater perceived and performed creativity (McCoy & Evans, 2002). First, having surfaces with a variety of textural detail was associated with higher creativity potential. The presence of glass in the setting also enhanced ratings. Second, access to a view of natural environment improved the creativity potential. Third, creative potential of a space was greater when there were materials of an identifiable natural source such as wood or stone visible. In contrast, the presence and use of manufactured or composite materials had the opposite effect. And, finally, having surfaces mostly colored with the warm side of the color palette increased creative potential of the setting.

Another area of future research should include the impact of biophilic design on social and organizational outcomes. In addition, while we are making the transition to virtual worlds and digital environments, examining ways of successfully incorporating natural elements into these settings and whether or not such a transplant has equally beneficial outcomes for the user is a critical area of inquiry.

CONCLUSION

Environmental psychology as a field has gone through some dramatic changes through the years in terms of defining environments and understanding how individuals process and respond to them. Simultaneously, theoretical, methodological, and computational developments have facilitated researchers' abilities to explore these relationships and systems. However, while our tools to explore these relationships are expanding, so are the boundaries of the domain as a whole (e.g., digitized work environments). The challenge for researchers in environmental psychology is to adapt and innovate alongside these changes in the field and expand our abilities to explore these questions in greater depth. This chapter presents an overview of past environmental psychology research and a few trends currently facing the field, including proposed research questions. Other trends the reader may want to consider are those dealing with invasions of privacy due to new technological capabilities, the increasing risks to safety with active terrorist groups, and the graying of the workforce. In sum, we hope that you will agree that environmental psychology is an exciting field of research that encompasses a wide array of topics offering many opportunities for future exploration.

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Chapter 3

THE PSYCHOLOGICAL DIMENSIONS OF SUSTAINABILITY

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ABSTRACT

Several years ago, proponents of the Sustainable Development (SD) approach identified four levels of impact of sustainable lifestyles (SLS) and actions on people's wellbeing. Accordingly, a sustainable society was presumed to positively affect the ecological, social, economic and political-institutional scenarios in which people live and thrive. More recently, a number of government and social institutions have added a psychological dimension to this list of levels of impact of SD. For these governments and institutions, psychological wellbeing should be a positive consequence of sustainability. An incipient research in environmental psychology reinforces such an idea, demonstrating that people who practice pro-environmental behaviors are happier individuals. Also, psychological restoration (i.e., retrieval from exhausted psychological capabilities and health) is assumed to derive from living in sustainable scenarios. Moreover, sustainability, as practiced in the form of pro-environmental behaviors, not only is linked to their psychological consequences but also to psychological antecedents of sustainable lifestyles. More than forty years of research have demonstrated that SLS are predicted by affective and cognitive determinants of behavior. In this paper I review studies and views encompassing the psychological dimensions of sustainability. The basic idea is that it is human psychology (i.e., environmentally destructive behaviors and propensities) the main cause of the current ecological crisis; but human behavior is also a paramount solution. Thus, any interventional strategy to be successful has to consider the psychological determinants, the remedial behaviors, and also the positive consequences linked to more sustainable behaviors. Consequently, for analytical reasons, I identify: 1) psychological antecedents, and 2) psychological consequences of 3) sustainable behaviors. All these three levels are subject to scientific scrutiny within the realm of environmental psychology and related areas. The psychological antecedents of

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sustainable actions include dimensions such as environmental emotions, affinity towards diversity, ecological worldviews, future orientation, pro-environmental deliberation, pro-environmental norms and values, and pro-environmental competency, among others, which are described in this chapter. The psychological consequences of sustainability are subjective wellbeing or happiness, and psychological restoration, but a number of positive outcomes are to be added to this list. In turn, sustainable behaviors (or lifestyles) encompass pro-ecological, frugal, equitable and altruistic behaviors, which are actions resulting in the conservation of the socio-physical environment. Therefore, this chapter stresses the idea that psychology is a key constituent of sustainability. Since the environmental dilemma emerged as a consequence of human drives (i.e., motivations for exploiting and depleting the environment), and capacities (human intelligence and potential for exploiting natural resources), an important component of the solution to this dilemma has to be found in exploring human psychology across the three levels above identified. Also, in studying how human potentials (emotions, competency, deliberation, anticipation, etc.) can be converted into solutions to environmental problems.

INTRODUCTION

As never before, we humans face a predicament: the satisfaction of our needs and desires is threatening the availability of natural resources, which, if affected, will be insufficient to meet those aspirations in the mediate future. Not long ago, the survival of our species depended mainly on our capacity to extract environmental resources which, as abundant as they were, we conceived as unlimited. Unfortunately, the rhythm of extraction of resources, and the contamination of water, soil, and air already exceeded Earth's capacity to replenish them so that a further consumption and use in the next decades and centuries can be guaranteed (World Wide Fund for Nature (2002). In an aggravating manner, we are dramatically changing our planet's atmosphere, by making it warmer than it used to be at any time since temperature records began. A warmer world implies massive species extinction, floods, an increase in the frequency and intensity of hurricanes, and a modification in land's availability for the production of food (Flavin & Engelman, 2009). Such situation will foreseeable continue unless we change our lifestyles and consumption patterns.

The abovementioned predicament constitutes an *environmental dilemma*, which leads people to deal with two apparently contradictory situations: On the one hand, human needs expand exponentially along with population growth and the desire for reaching a decent life, the access to water, housing, food, job, and related aspirations. On the other hand, there are limits to the use of natural resources to satisfy human needs, since they are progressively scarcer, concentrated among minority sectors of the population and -many of them- contaminated due to a non-careful use. Therefore, the environmental dilemma manifests as a conflict between the human desire to obtain and consume more resources and the need to conserve such resources (Tanimoto, 2004; Wiseman & Bogner, 2003).

Overpopulation, consumerism, and inequity are fundamental causes of the environmental dilemma. The Earth cannot sustain an unlimited human population, especially in view of our significant potential for modifying the planet's structure and composition. However, population growth continues, especially in underdeveloped regions, which makes its solution particularly problematic (Oskamp, 2000). The more developed regions also contribute to environmental deterioration with their high levels of products consumption. This practice

represents a significant burden for the integrity of the ecosystems, which are depredated to satisfy the desire of acquiring, accumulating and consuming Earth's resources. A single individual in a rich country consumes more products than those consumed by dozens in poorer nations: Fifteen percent of the world population consumes 71% of the annual production (Brown & Cameron, 2000). In addition to these two problematic situations, a third emerges to constitute a paramount cause of environmental degradation: inequity (Ehrlich & Ehrlich, 2004). Most social problems are propitiated –at least partially- by an unfair distribution of resources: poverty, injustice, delinquency, violence, war, social discrimination, common dilemmas, and the current environmental crisis. All of those problems have roots in an unequal distribution of resources, power and risks among social and demographic groups (Talbert, 2008; Vlek, 2000).

These three major causes of the environmental dilemma have their roots in the psychological structure of human functioning. Sexual desire, accumulation/overconsumption of resources, and inequity are embedded in human mind and they share the egoistic trait that characterizes a good deal of human behavior (Sober & Wilson, 1998). Indeed, people's conduct is also motivated by unselfish drivers, but sometimes the balance between altruism and egoism results more inclined towards the latter, which make us to act in anti-social and anti-ecological ways (Corral-Verdugo and Frías-Armenta, 2006). Thus, the potent psychological drivers linked to selfishness guide our behavior towards the depredation of nature's resources and the subsequent environmental dilemma.

Solutions to the abovementioned sources of the environmental dilemma have been proposed since, at least, four decades ago. One of those solutions calls for stopping human's impact on nature until guaranteeing the restoration of the environment from the damage caused by human action. The notion of "limits to growth" derives from this *preservationist* approach, which, in its most radical version claims that the protection of natural resources should prevail over the option of meeting human needs when those resources' integrity is threatened (Siurua, 2006). Alternatively, the *conservationist* posture establishes that it is possible (and desirable) the protection of the environment while, coincidentally, meeting human needs (Bonnes & Bonaiuto, 2002).

Sustainable development (SD) shares the conservationist vision. Such approach, encouraged by governments, civil institutions and international organizations is intended at balancing the satisfaction of people's needs with the conservation of the natural environment (WCED, 1987). The ideals of sustainable development have been supported by theoreticians and researchers in every branch of science. Psychology is among the disciplines looking for the instauration of sustainable behaviors, which are aimed at substituting the consumerist, non-equitable, egoistic, and anti-ecological lifestyles that have characterized human behavior since the dawn of civilization.

Although all scientific disciplines are important in searching for the instauration of a sustainable society, psychology plays the crucial role of determining individual causes of pro-environmental behaviors, so that effective strategies might be developed to change maladaptive (anti-ecological) conducts into more sustainable behaviors. Among those causes, researchers have found cognitive (perceptions, beliefs, values, norms), and affective (attitudes, motives, emotions) factors, as well as psychological capacities (knowledge, skills, competencies) that determine and/or facilitate the display of pro-environmental behaviors. We will call these factors the psychological antecedents of sustainable behavior.

Studying what kind of actions can be considered “sustainable” is another task to take into account in psycho-environmental research. The more investigated sustainable behaviors include actions intended at conserving the physical environment; also the behaviors aimed at minimizing the consumption of resources. More recently, the investigation of altruistic and equitable behaviors have been added to the list of sustainable actions under scrutiny.

Moreover, psychology is in charge of investigating the psychological repercussions of sustainable behaviors, as we will see in this chapter. Two of those repercussions are of special interest: happiness and psychological restoration, which I will henceforth refer to as the psychological consequences of sustainable behavior.

Therefore, the sum of these three aspects –antecedents, behaviors, and consequences– linked to sustainable acting constitutes one of the main aims of environmental psychology. These three aspects encompass the psychological dimensions of sustainability. The objective of this chapter is to review what is known regarding sustainable behavior, its determinants and consequences, so that this knowledge serves to promote lifestyles more attuned with the aim of conserving the biophysical and social resources of our planet.

SUSTAINABLE BEHAVIOR

Sustainable behavior (SD) is conceived as the set of deliberate and effective actions resulting in the conservation of Earth’s physical and social resources (Corral-Verdugo, Garća-Cadena, & Frías-Armenta, *in press*). For most researchers, SD is deliberate (*i.e.*, purposeful) and effective (*i.e.*, problem-solving) for reasons that will be explained later in this chapter. This behavior is also anticipatory; that is: it is future-oriented, by definition, because it considers the needs of forthcoming times coincidentally with the satisfaction of present needs (Bonnes & Bonaito, 2002). Since sustainable development claims for the active protection of natural resources while, at the same time, meeting the needs of people, it results clear that the conservation of human resources (society, culture, people’s survival and wellbeing) is as important as the conservation of ecosystems (all living beings and the inanimate substrate on which they base their subsistence). That is why psycho-environmental researchers include pro-ecological, frugal, altruistic and equitable conducts as instances of sustainable behavior. As we will see, when these actions are practiced in a consistent and enduring way, they can constitute sustainable lifestyles.

PROECOLOGICAL BEHAVIORS

Pro-ecological behaviors are defined as the purposeful and effective actions which respond to social and individual requirements and that result in the conservation of the physical environment (Corral-Verdugo, *in press*). Psycho-environmental researchers have studied a variety of proecological conducts, including reuse, recycling, composting, solid refuse control, the purchasing of environmentally friendly products, water conservation, energy-saving behaviors, car-use reduction, gas-use reduction, reading about environmental topics, pro-ecological persuasion to others, pro-environmental lobbying, pro-ecological design and building, ecosystem conservation, and family planning (Baasell-Tillis & Tucker-

Carver, 1998; Corral-Verdugo, 1996; Hsu, 2004; Gatersleben, Steg & Vlek, 2002; Joreiman, Van Lange & Van Vugt, 2004; Kellert, Heerwagen & Mador, 2008; Moser, Ratiu & de Vanssay, 2004; Pimentel & Pimentel, 2006; Suárez, 2000), among many others. The study of these actions constituted the classical approach to pro-environmental behavior during the first years of research in this area. Understandably, the preservationist approach stresses the importance of pro-ecological behaviors, along with reduced-consumption actions, due to their significant impact on the protection of the physical environment.

In order to assess pro-ecological behaviors, a number of instruments have been created and validated, including the self-report and recording of environmentally-friendly actions across a series of behaviors, as is the case of the General Environmental Behavior (GEB) scale, developed by Kaiser (1998). The advantages of using these self reports include their high reliability and the possibility of assessing a large number of behaviors. The main inconvenience, however, is their limited validity, which has led to the use of alternative measures such as the observational recordings of pro-environmental behavior. These measures, however, are not as practical as self-reports are, and they allow the assessment of only a limited number of behaviors (see, for instance, Corral-verdugo, 2002).

FRUGAL BEHAVIORS

Frugality is a fundamental behavioral characteristic of a sustainable lifestyle. It refers to a decreased level of consumption or to austere behaviors intended at diminishing the impact of human behavior on the availability and renewability of natural resources (De Young, 1996; Iwata, 2001). Of course, frugal behaviors are antagonist to consumerism, the prevalent lifestyle of modern societies, especially of those in the industrialized world (Jackson, 2008; McCollough, 2007). Consumerism is one of the essential causes of environmental problems (Oskamp, 2000) and economic income is one of its drivers. The effects of consumerism include an increase in the ecological footprint, inequity in the access to resources and the generation of waste polluting the natural environment. The higher the people's income the higher the likelihood that they generate such a waste (McCollough, 2007).

Frugality is a psychological dimension, manifested in a reduced consumption that depends on personal satisfaction, motivational aspects and cultural norms (Duncan, 1999). De Young (1996) defines frugality as the prudent use of resources and the interest in avoiding waste. Frugal actions involve daily reduced-consumption actions as well as the type of items purchased, the activities individuals engage in, and the way wastes are discarded or disposed. These actions could constitute a voluntary simplicity lifestyle, which is predicated long time ago by spiritual and religious leaders (such as Mahatma Gandhi) and movements, but also by civil groups. Simplicity is based on the idea of voluntarily living without luxury, with just the necessary, in contact with nature, without worries that are not derived from the needs of surviving, and having in mind one's and others' wellbeing. Therefore, frugality positively impacts on both the physical and the social environments.

De Young (1996), Iwata (2002) and Corral-Verdugo, Tapia, Fraijo, Mireles & Márquez (2008) have created and administered instruments assessing frugal behaviors. Their results reveal that these behaviors correlate with diverse instances of sustainable lifestyles and also with a number of determinants of pro-environmental behaviors.

ALTRUISTIC BEHAVIORS

Since the beginnings of psycho-environmental research, pro-environmental acting has been conceived as altruistic behavior; that is, pro-environmental actions are thought as having repercussions on others' integrity and wellbeing (Ebreo, Hershey & Vinning, 1999; Hooper & Nielsen, 1991). Altruism, in fact, has been defined as a motivational state aimed at increasing others' wellbeing (Batson, 1991) or a tendency to maximize others' benefits with little or null interest in gains for oneself (Van Lange, 2000). Since sustainable behaviors have positive impacts on the environment, they indirectly benefit other individuals. Moreover, some practitioners of those behaviors deliberately engage in pro-environmental actions with the intention to protect those other individuals; that is why Sevillano, Aragonés & Schultz (in press) consider these motivated behaviors as acts aimed at "protecting *your* environment," as opposed to actions motivated at protecting "my environment." Also, altruistic people are interested not only in the wellbeing of humans living in the present, but also in the needs of future persons, and their acts constitute what Pol (2002) calls *inter and intra-generational solidarity*, a necessary condition for sustainability.

Schultz (2001) suggests that altruism is a fundamental component of the motivation that originates and maintains environmentally-protective actions. Most researchers also agree that, since environmental quality is a public good, altruistic motivations and actions are required to maintain such quality, in order to avoid environmental degradation. (Stern, 2000). People might be altruistic or pro-social, on the one hand, or individualistic, on the other hand (Kopelman, Weber & Messik, 2002). In situations of environmental dilemmas, the former are more cooperative than the individualistic ones (Kopelman et al, *op cit*), and altruistic people are also prone to make sustainable decision in daily life (Bonaiuto, Bilotta, Bonnes, Carrus, Ceccareli, & Martorella, 2008).

Altruism is also related to the consideration of future consequences and to personal responsibility within the Norm Activation Model (Schwartz, 1973), one of the most used theoretical approaches in explaining pro-environmental behavior. In utilizing this model, a number of authors have found a significant relationship between altruism and other sustainable behaviors (Stern & Dietz, 1994; Joreiman, Lasane, Bennett, Richards, & Solaimani, 2001; Gärling, Fujii, Gärling, & Jakobsson, 2003). This evidences a clear altruistic component of sustainable lifestyles.

EQUITABLE BEHAVIORS

The sustainable development definition implicitly alludes the idea of intra and inter-generational equity. By sharing the satisfaction of needs between the present and future generations, sustainable development looks for a balance between the benefits gained by people living today and those to be obtained by the forthcoming human groups (WCED, 1987). Moreover, SD claims that the satisfaction of needs among all individuals *currently* living in this planet should be guaranteed. Equity also implies a balance between human wellbeing and ecosystems' integrity, making possible the access of resources for people and the preservation of the physical environment.

Equity is defined as “Justice according to natural law or right; specifically: freedom from bias or favoritism. Something that is equitable.”(Merriam-Webster Online Dictionary, 2008). Equity has to do with the sharing of power and wellbeing. In non-equitable societies this power is unbalanced between the rich and the poor (economic inequity), between men and women (sexism), between adults and children (ageism), between ethnic and racial majorities and minorities (social discrimination), and between people of diverse sexual and religious orientations. Richer countries use their power against their poorer counterparts (Ehrlich & Ehrlich, 2004). All of this unbalance generates a climate that propitiates violence, anxiety, injustice, and environmental damage; in other words: non-sustainability (De Botton, 2005; Renner, 2005; Talbert, 2008).

Social equity is usually assessed by considering the distribution of resources or the access that people has to them. One measure is the *Gini* coefficient –after Corrado Gini who developed it- (Talbert, 2008), which indicates how much the economic income deviates from an equitable distribution; zero means a perfect equitable distribution and 1 indicates a maximum inequity. Corral-Verdugo, García-Cadena, Castro, Viramontes, & Limones (in press) produced a psychological measure of equitable behavior, which has been used in studies of sustainable acting. This instrument includes the assessment of social, racial, economic, age, and gender equity. Their study showed a significant relationship between equitable actions and other sustainable lifestyles.

SUSTAINABLE LIFESTYLES

Pro-ecological, frugal, altruistic, and equitable behaviors, though different from each other, have been found highly and significantly interrelated. This is interpreted as a confirmation that these are diverse manifestations of a higher-order tendency to behave in a sustainable way, which encompasses environmentally protective actions intended at conserve the socio-physical environment.

When practiced in a consistent and enduring manner, the set of sustainable behaviors, constituted by pro-ecological, frugal, altruistic and equitable actions, become a *Sustainable Lifestyle* (SLS). SLS is defined as a pattern of action used by people to affiliate and differentiate themselves from other individuals; such a pattern: a) satisfy basic needs, b) provide a better quality of life, c) minimize both the use of natural resources and the emission of contaminants and d) do not compromise the needs of future generations (CSD 2004). All these behavioral patterns are characterized by the four sets of actions we have been describing so far in this chapter.

In order to demonstrate that these behavioral sets are parts of a SLS, a series of studies have been conducted, which show that pro-ecological, frugal, altruistic and equitable behaviors are significantly interrelated, as expected. In one study, Corral-Verdugo, Tapia, Frías, Fraijo, & González (in press) found that frugality predicted pro-ecological behavior but also that frugal actions covaried with other indicators of pro-sustainability orientation, such as affinity towards diversity, equity, altruism, and environmental emotions. In one more study, Corral-Verdugo et al (2008) demonstrated that the inter-relations among frugality, pro-ecological behavior, equitable actions and altruistic behavior constitute a higher-order factor which they called “sustainable lifestyles.” Although these results are relevant, a crucial

component of SLS is yet to be investigated: its endurance. Individuals who are characterized by a sustainable style of living should consistently and for a long time engage in sustainable actions. Therefore, prospective studies have to consider this feature of SLS.

PSYCHOLOGICAL ANTECEDENTS OF SUSTAINABLE BEHAVIOR

After having identified the main actions that constitute sustainable behaviors and lifestyles, along with their distinctive features, I now will refer to the psychological determinants of sustainable acting. The literature includes dispositional (i.e., psychological), contextual and demographic factors among the prominent causes of such an acting. It is true that contextual and demographic variables exert a significant effect on sustainable behaviors (Bamberg, S. & Möser, 2007; Barr, 2007; Tanner, 1999, for instance). Yet, most of the effect of these variables is mediated through psychological processes and states (Gaspar de carvalho, Palma & Corral-verdugo, in press). Therefore, a summary of the influence of psychological drivers of sustainability might constitute an inclusive representation of the main causes of pro-environmental behavior. The following factors are mentioned among the most important psychological determinants of sustainable behavior.

ECOLOGICAL WORLDVIEWS

Worldviews are framework used by people to make sense of life and the world in its most significant aspects and dimensions (Irzik and Nola, 2009). They provide a set of principles that act as an interpretative schema, in addition to defining the way in which these principles are expressed in social practices (Hernández, Suárez, Hess, & Corral-Verdugo, in press).

Most ancient worldviews were based upon fear, respect, and lack of knowledge regarding nature. Its phenomena were often identified and revered as nature's deities or spirits (Varner, 2006). A direct contact with the natural environment and humankind's dependence on its resources –water, food, fire, and shelter- reinforced such a vision of the environment in relation to human beings (Hutton, 1991). Thus, people conceived themselves as subordinated before nature's unknown forces.

This "naturocentric" worldview was replaced in several regions of the world by a system of beliefs that privileged humans over the rest of living species and nature's inanimate elements. This *anthropocentric* vision stressed the satisfaction of people's needs, a non-limited trust in science and technology, and the growth of human activities, which often resulted in progress but also in the depredation of resources (Thompson & Barton, 1994, Nordlund & Garvill, 2003). Under the anthropocentric beliefs people conceived nature as subordinated to humankind.

This situation led to the apparition of a new, *ecocentric* worldview, which emphasizes the need of a natural balance, and the need to impose limits to human growth (Dunlap, Van Liere, Mertig & Jones, 2000). Ecocentric beliefs are significant and positive predictors of pro-environmental behavior: the more the adherence to these beliefs, the more the likelihood of practicing environmentally responsible behaviors (Corral-Verdugo & Armendáriz, 2000). Although the anthropocentric view sometimes guide behavior towards environmental

protection (i.e., one might be interested in protecting the environment to favor the satisfaction of human needs; see Nordlund & Garvill, 2003), it often results in wasteful and destructive conducts, while the ecocentric approach is more preservationist (Casey & Scott, 2006; Schultz, Zelezny & Darlympe, 2000). Indeed, some studies show that these postures antagonize each other so that, in some cultures, a person can either be ecocentric or anthropocentric but cannot be both (Bechtel, Corral-Verdugo, & Pinheiro, 1999; Bechtel, Corral, Asai & González-Riesle, 2006).

However, it is possible to find compatibility between ecocentric and anthropocentric worldviews (i.e., believing that nature should be protected, while, simultaneously considering humans' right to use natural resources to satisfy their needs). A number of authors (Gärling, Biel, & Gustafsson, 2002; Corral-Verdugo, Carrus, Bonnes, Moser, & Sinha, 2008; Hernández et al, in press) conceive that a *New Human Interdependence Paradigm* (the NHIP) is emerging, considering such compatibility. According to Corral-Verdugo et al (2008), the NHIP considers that people and nature resources depend on each other, and that, also, an interdependence between present and future bio-social ecosystems exists. This new worldview is also a significant determinant of pro-environmental behavior (Corral-Verdugo et al, 2008; Hernández et al, in press).

TIME PERSPECTIVE

Time perspective is the way individuals mentally distribute the passage of events in past, present, and future events. Although most people use those time frameworks depending on the daily situations they face, a lot of them exhibit a bias towards some of those time orientations. Zimbardo & Boyd (2008) divide time perspective in propensities towards a positive past, a negative past, a hedonistic present, a fatalistic present, the future in general, and a transcendental future. Thus, there are present, past or future oriented people. Strathman, Gleicher, Boninger, & Edwards (1994) focus more on a future perspective, producing the *Anticipation of Future Consequences* construct, which implies the projection of current behavior to forthcoming times, assuming the consequences of here-and-now actions.

The definition of sustainable development as the lifestyle that meets the needs of the present without compromising the needs of the future (WCED, 1987), explicitly acknowledges the importance of anticipating the future impact of behaviors. This explains the interest of psychologists in studying how a bias in future orientation relates to environmentally relevant behaviors. Moreover, environmental psychologists are also interested in investigating the influence that past and present perspectives may exert on pro-environmental behaviors.

Research on sustainable behavior indicates that future orientation positively correlates with people's pro-environmental dispositions and actions. Those who think of forthcoming times and anticipate their own acts' consequences are more inclined to protect both natural resources and other persons, as compared with those who have a weaker future orientation (Corral-Verdugo & Pinheiro, 2006; Joreiman, Van Lange, & Van Vugt, 2004; Joreiman et al, 2001). Alternatively, individuals with a strong present orientation exhibit a higher inclination to enjoy, here-and-now, natural resources, in a wasteful way, showing a lack of consideration

for the needs of other people. Such a strong present orientation can be manifested as anti-social and anti-environmental behavior (Pinheiro & Corral-Verdugo, in press).

In contrast, past orientation seems not be related to sustainable behavior in any way. People with this time perspective may or may be not involved in environmentally protective behaviors of any sort, which implies that their time orientation is particularly important in leading them to any sustainable actions (Corral-Verdugo, Fraijo, & Pinheiro, 2006). Yet, Pinheiro and Corral-Verdugo (in press), by attending to Zimbardo and Boyd's (2008) suggestions, seem to demonstrate that a positive past, and –probably- a component of the hedonistic present could exert an indirect and positive effect on sustainable behavior, through future orientation. In any case, the key temporal factor to sustainable behavior is the future time perspective.

PRO-ENVIRONMENTAL DELIBERATION

According to authors in the fields of environmental psychology and environmental education, the sustainability ideals can only be achieved through a *purposeful* behavior and the willingness to conserve the socio-physical environment.

Yet, discrepancies exist among philosophers, scientists, clergymen, and even the laymen, regarding the level of self-determination and free will that may exist in people to produce sustainable behavior. Determinism argues that these processes do not exist, since behavior falls under control of external environmental events, economy or history (Kane, 1996). Radical behaviorists, for instance, assure that reinforcement and punishment, among other external consequences of behavior, are sufficient enough to induce behavioral change, in the direction of sustainability, even in the absence of self-determination (see, for instance, Cone and Hayes, 1980). On the contrary, those who postulate that free will and determination exist, consider that the capacity of humans to overcome environmental and historical restrictions, solving adaptive problems of social, economical, and even environmental nature, is the best evidence for this (Bamberg, 2002; Eriksson, Garvill & Nordlund, 2008). They also argue that only through deliberate actions the survival of our species might be guaranteed (Tonn, 2007). Therefore, deliberation implies that a fundamental part of behavioral control rests within the individual and his/her capacities. Pro-social or altruistic acting, an indicator of sustainable behavior is explicitly defined as deliberate actions intended at benefiting others (Eisenberg, Losoya & Spinrad, 2003). Emmons (1997) establishes that any act resulting in environmental conservation that is not deliberately directed towards such an end cannot be characterized as pro-environmental.

Deliberation has been studied in numerous sustainable behavior models as willingness to sacrifice oneself in favor of the environment (Iwata, 2002), as intentions to act in a pro-environmental manner (Bamberg, 2002), as willingness to pay for conserving environmental integrity (Nixon, Saphores, Ogunseitan & Shapiro, 2009), or as pro-environmental implementation intentions (Bamberg, 2002). Most researchers have conceived deliberation as a cognitive-rational process, yet, more recently, some have started to identify affective aspects linked to deliberation, in the form of anticipated emotions (Carrus, Pasafaro, & Bonnes, 2008).

The specified and tested models consider that pro-environmental deliberation significantly and directly affect environmentally relevant behavior. Empirical tests of these models have demonstrated that deliberative dispositional factors are salient predictors of such a behavior. In turn, deliberation or intentions to act are predicted by a variety of factors such as pro-environmental attitudes, subjective norms, and perceived behavioral control. This framework of relations is included in the *Theory of Planned Action* (Ajzen, 1991), one of the models most utilized in the study of sustainable behavior.

Habits, facilitating situations, universal values, environmental beliefs, perceived moral obligation, behavior's perceived reputation, behavior's perceived difficulty and intrinsic motivation, among others, are also mentioned as predictors of pro-environmental intentions (Carrus et al., 2008; Chu & Chiu, 2003; Mosler, Tamas, Tobias, Caballero, & Guzmán, 2008; Nordlund & Garvill, 2003; Osbaldiston y Sheldon, 2003).

Although research has shown that pro-environmental habits have a positive effect on sustainable behavior –besides the one they have on intentions- some authors suggest that a negative effect on the deliberative component of behavior could result from habits (Emmons, 1997; Corral-Verdugo, in press). Awareness of own actions is a decisive factor when planning and anticipating a sustainable behavior; thus, trusting totally in habits is not recommendable since these automatic actions could prevent rectifications from occurring when planning, starting and maintaining pro-environmental behavior.

MORAL CONSIDERATIONS, NORMS AND VALUES

The determinants of ecological behavior also include moral considerations, personal norms and values. Personal norms have been identified as sentiments of moral obligation (Schwartz, 1992). Schultz (2002) establishes that a personal norm is like an obligation or sensitivity to act in a particular way in specific situations, as it is the case of environmental protection. The difference between social norms and personal norms is that the former establish an external influence (the perception of what others are doing or what they have to do), while personal norms are related to internalized self-expectations (what I should do). Social and personal norms have been related to pro-environmental behavior (Corral-Verdugo & Frías, 2006; Schultz & Tyra, 2000; Hunecke, Blöbaum, Matthies, & Höger, 2001).

In regard to moral norms, Bamberg and Möser (2007) conducted a meta analysis resulting in a mean correlation between these norms and pro-ecological behavior of about $r = .40$. In their study, using a modified version of the theory of planned behavior, they found that moral norms explain 10% of people's intention to behave in a pro-environmental manner. Other authors (Kaiser, 2006; Lindenberg and Steg, 2007) have found a significant influence of moral norms on sustainable behavior. One of the most important theoretical frameworks used to explain sustainable behavior is the theory of activation of norms Schwartz (1977), which considers that behavior occurs when personal moral norms, or a person's feeling of a moral obligation, are activated, which is illustrated by the studies of Hunecke et al, (2001) and Guagnano, Stern, & Dietz (1995), among many others.

Finally, with regard to values, Gutiérrez-Karp (1996) used Schwartz's (1977) measure, and examined the influence of values on pro-environmental behavior. The values he found to have a positive influence on such a behavior were self-transcendence/openness to change and

universalism/biospheric, while values with a negative negative effect were self-enhancement conservation.

PRO-ENVIRONMENTAL COMPETENCY

Effectiveness or competency is an essential psychological component of sustainability. Since the goals of sustainable development constitute challenges or problems to be solved, citizens are required to develop pro-environmental knowledge, skills, and competencies in order to achieve such a goals (Corral-Verdugo, 2002).

Effectiveness has to do with problem-solving capacities. These capacities require the knowledge of the social and ecological crisis faced by humankind and its possible solutions (Day, 2004). It is also required that such knowledge be transformed into pro-environmental skills aimed at solving the multiple problems constituting the environmental crisis (Laurian, 2003). Ideally, skills should shape pro-environmental competencies, which are defined as the set of skills that allow responding in an effective and versatile manner before environmental-protection requirements (Fraijo, Corral-Verdugo, Tapia, & Gonz lez, in press). Therefore, environmental knowledge is an antecedent of pro-ecological skills, which, in turn, might be transformed into pro-environmental competencies.

Now, *environmental competency* is defined as the capacity to respond in an effective and stimulant way to opportunities and challenges afforded by the environment (Steele, 1980). This competency can be used either for environmental exploitation (i.e., being environmentally competent to extract, degrade and waste natural resources) or for environmental protection (i.e., using one's competency to make a wise use of resources) (Pedersen, 1999). That is why, a special term is used: *pro-environmental competency* which implies behaving skillfully before requirements of ecological conservation. Such a capacity involves not only the possession of skills but also the concurrence of motivational states and other psychological predispositions (values, beliefs, perceptions, goals) leading the individual to sustainable acting (Corral-Verdugo, 2002).

A number of studies indicate that the display of pro-ecological skills predict environmental conservation (Smith-Sebasto & Fortner, 1994). When linked to personal and social pro-environmental requirements those skills constitute a pro-environmental competency, which functions as a potent instigator of conservationist actions. Effectiveness also is related to other psychological dimensions of sustainability such as pro-ecological deliberation and worldviews, which reinforces the idea that competency is an essential component of pro-sustainable orientation (Fraijo et al., in press). Finally, the perception of self-efficacy, resulting from knowing that oneself is competent, is a predictor of sustainable behavior (Michel, 2007). Pro-environmental competency might induce states of psychological wellbeing, as I will detail further in this chapter.

AFFINITY TOWARDS DIVERSITY

Human beings exhibit a preference towards complexity and diversity in the environment they operate (Kaplan, 1992). It is likely that such preference has to do with the opportunities

that rich and complex scenarios provide, in terms of variety of resources available for survival (Roberts, 2007). The more the variety, the more the opportunity for obtaining resources; thus, the preference for diversity would be a psychological tendency selected by human evolution.

Diversity is one of the most distinctive features of ecosystems and one of the key principles for their functioning. An ecological system depends on its elements' variety, which implies that the richer the ecosystem is, the fitter is to face the risks challenging its permanence (Pradhan, 2006). Human beings have threatened biological diversity as ever since the massive extinction of species during the Quaternary Period. Cultural diversity is also seriously threatened. All of this represents an extreme danger to the set of living species on the planet, including the human race (Elewa, 2008, di Castri, 2003).

Environmental psychologists have found a psychological dimension orienting people towards diversity conservation. Since the 1970's they identified a preference towards environmental complexity, as a human psychological feature. Individuals tend to like complex environmental stimuli and settings rather than the simpler ones. This preference includes liking complexity in, both, natural scenarios (the most preferred) and the built environment (Kaplan, 1992). This leads to assume that a specific preference towards biological and social diversity exists, which has been demonstrated in a series of studies on attitudes towards biological diversity in urban areas (Carrus, Passafaro & Bonnes, 2004) and affinity towards socio and bio-diversity (Corral-Verdugo, Bonnes, Tapia, Fraijo, Frías, & Carrus, 2009).

Affinity towards diversity (ATD) is defined as a tendency to prefer diversity and variations in the biophysical and socio-cultural scenarios of human life. ATD reflects a stable liking for the biophysical and cultural diversity that individuals face in their everyday life: i.e., physical (landscapes, weather), biological (plants, animals) and socio-cultural (ethnicity, religions, sexual orientations, political inclinations) diversity encountered in daily interaction with the social world. Studies that have tested the pertinence of this concept have found that liking biological diversity is intimately linked to preference towards socio-diversity, and also that ATD predicts sustainable behavior (Corral-Verdugo et al, 2009; Bonnes, Carrus, Corral-Verdugo, & Passafaro, in press). These findings suggest that people's exposition to biological diversity (direct contact with nature) and cultural (social integration), as well as the provision of benefits from biodiversity are plausible strategies to promote the adoption of more sustainable lifestyles.

ENVIRONMENTAL EMOTIONS

Emotional processes complement cognitive factors in the determination of sustainable behaviors. The existence of an affective component in motivations demonstrates that emotions are necessary elements of motives that guide behavior towards a pro-ecological and a pro-social goal (Vining & Ebreo, 2002). Unfortunately, the investigation of the effect of affective states on sustainable behavior is still scarce. Pooley and O'Connor (2002) explicitly declare that one of the reasons explaining the limited success of interventions aimed to develop pro-environmental behavior is the emphasis placed on the cognitive determinants of pro-ecological action. Vining and Ebreo (2002) make clear that the role played by emotions has been largely ignored –with few exceptions– in studies and interventions in conservation

behavior. Damasio (1998), a leading neuroscientist, mentions that the interaction between human emotions and reasoned decisions represents a key research area in future investigations on pro-environmental behavior.

Environmental positive emotions, such as emotional affinity towards the environment, indignation due to an insufficient ecological protection, guilt resulting from not conserving the environment, interest and appreciation for nature, as well as affinity towards diversity, among others, predict people's engagement in pro-ecological behaviors (Kals, Schumacher & Montada, 1999; Kaiser & Shimoda, 1999; Corral-Verdugo et al., 2009). Clayton (2003) and Montada et al. (1999) have found that appreciation for nature *per se* explains up to 60 % of pro-environmental behavior's variance. Yet, not all affective states lead to environmental conservation. Negative emotions, such as fear, have a counterproductive effect (Rochford and Blocker (1991).

Similarly, pro-social conducts are influenced by positive emotions such as empathy, which leads to sympathy and concern for others; also by the affinity towards sociodiversity and by moral emotions (Eisenberg et al., 2003; Corral-Verdugo et al., 2009). Yet, as in the case of pro-ecological behaviors, some negative emotions, as personal distress and shame inhibit altruistic and pro-social behaviors (Eisenberg et al., 2003).

Environmental emotions are linked to frugal and equitable behaviors (Tapia, Corral-Verdugo, Gutírrez, Mireles, & Tirado, in press) in addition to their being related to pro-ecological and altruistic conducts and to a series of dispositional determinants of sustainable behaviors. This demonstrates the powerful and significant influence that the affective components of human psychology have on a sustainable lifestyle.

CONTEXTUAL FACTORS AND THEIR PSYCHOLOGICAL MEDIATORS

Contexts are essential in understanding sustainable actions because behavior, including the sustainable one, always occurs in situations. Contexts include physical and normative components; the former are constituted by tangible, material and observable elements of a situation, like temperature, humidity, illumination, etc., while the latter are the social agreements: norms, rules and conventions of the culture in which the individual live. Both, physical and normative components significantly affect sustainable behavior, while the presence of situational barriers and constraints (either physical or normative) inhibits pro-environmental behaviors (Tanner, 1999).

Physical situations with impact on pro-environmental actions include weather, resources' abundance or scarcity, technological devices for conserving natural resources, convenience of behavior, environmental risks and the design of human spaces. In extreme-temperature conditions, energy conservation behavior is more difficult to practice than in temperate places (Hunecke, Haustein, Grischkat & Böhler, 2007); the scarcity of a natural resource encourages its conservation (Corral-Verdugo, 2002); energy-saving devices facilitate conservation behavior (Geller, Erickson, & Buttram, 1983); the more convenient (i.e., easy to implement) a pro-environmental behavior, the more likely its performance (Barr, 2007); living in places where environmental risks are frequent predisposes people to protect their environment (Heath & Gifford, 2006); and so on. Normative situations consider social pro-environmental norms, pro-ecological laws, normative frameworks and social goals, social competition and

group attachment, among others. Individuals living in places that adopt stronger pro-environmental policies tend to engage in sustainable behaviors (Borek & Bohon, 2008). Pro-environmental social norms influence ecological behavior (Schultz & Tyra, 2000) and the social group operates as inductor of sustainable behaviors (Martiskainen, 2007). People might also compete with each other to be better environmentalists (He & Greenberg, 2008).

Since perceptual factors are key elements in mediating the effect of contexts on pro-environmental behavior (i.e., a context only affects behavior after some or all of its components are perceived by the individual), the psychological dimensions of sustainability also act at the level of situational influences on behavior (Gardner & Stern, 2002; Gaspar de Carvalho et al., in press). Emotions also mediate the effects of normative situations on sustainable behavior. Frias-Armenta and Martín (in press), for instance, show the importance of emotional control in integrating pro-environmental norms that lead to pro-ecological behavior.

PSYCHOLOGICAL CONSEQUENCES OF SUSTAINABLE BEHAVIOR

Most of the research on sustainable acting focuses on the antecedents of this kind of behavior, neglecting the study of their consequences. Although there is strong evidence showing that pro-ecological and pro-social actions have repercussions on other people and on the individual performing such behaviors, there is a limited research on this topic.

The ideals of sustainable development include ecological, social, political, and economical benefits, explicitly declared. As a result of sustainable acting, the physical environment can be restored and conserved; communities have access to education, physical infrastructure, jobs, and justice; resources are more equitably distributed, and the levels of corruption are reduced (Gouveia, 2002). Moreover, some governments have started to add psychological benefits to that list, subjective wellbeing or happiness, among them (Gardner & Prugh, 2008). Sadly, very few psycho-environmental researchers have investigated the link between happiness and sustainability.

It is also convenient investigating whether additional psychological repercussions of sustainability exist. One mentioned is the possibility of restoring psychological processes that are essential for health and for an adequate functioning of individuals in their daily living. These exhausted processes are commonly lost as a result of modern life's stress (Hartig, Kaiser & Bowler, 2001). The restorative and subjective-wellbeing effects that sustainable settings and behavior propitiate are fundamental because the human *psyche* might receive benefits, which, in turn, would drive environmentally-protective actions. This section is about those benefits.

PSYCHOLOGICAL RESTORATION

Sustainable behavior results in the conservation of nature, which, in turn, positively impacts people's wellbeing. One instance of this is psychological restoration. Hartig, Kaiser & Bowler (2001, p. 592) define *restorative experiences* as those that "involve the renewal of depleted psychological resources." Such resources are necessary for generating and

maintaining the required homeostatic states for living in a healthy manner. Attention, positive mood, and mental health are parts of those resources.

Direct contact with nature is a powerful source of restoration (Laumann, Gaärling, & Stormark, 2001; Herzog, Maguire & Nebel, 2002; Hernández & Hidalgo, 2005). The preference that humans exhibit for natural settings is highly determined by its restorative capacity, indicated by human beings' wellbeing (Hartig & Staats, 2006; Peron, Berto & Purcell, 2002).

Retrieval of lost attention due to fatigue is one of the manifestations of direct contact with nature (Berto, 2005). The optimization of cognitive functions is another positive effect (Wells, 2000). Yet, the most spectacular effect is the acceleration of health recovery produced by the exposition to naturalness (Ulrich, 1984).

According to Hartig et al (2001), pro-ecological behavior should not just be approached in terms of avoiding future undesirable conditions (i.e., pollution, depletion of resources, etc.), but also in the sense of maintaining or achieving desired situations, such as intact habitats, which, in turn, promote psychological restoration. In their study, these authors found that perceptions of nature's restorative capacity predicted 23% of pro-ecological behavior's variance. Clearly, individuals anticipated that their environmentally responsible behavior could result in the conservation of a scenario that, in turn, would help in the restoration of their physical and mental resources. In one more study, Van den Berg, Hartig & Staats (2007) reported that people recognize the restorative effects of the environment, so that the design of scenarios for human living should lead to the possibility of psychological restoration.

HAPPINESS

Happiness –or *subjective wellbeing*, as some authors also call it- is a declared aim of sustainable development, which conceives this psychological state among the ecological, social, economical, and political benefits of sustainability (Gardner & Prugh, 2008). Subjective wellbeing is more frequent in people of extroverted and optimistic nature, with a heritage of “happy” genes, competent, and with a significant personal control (Frederikson & Joiner, 2002, Lyubomirsky, King & Diener, 2005). Having a job, a satisfactory economic income, a good educational level, and the positive experiences accumulated with age also help in achieving happiness (Staw, Sutton & Pelled, 1995). Physical health, exercising, humor, affection from friends, family and the emotional partner are situations stimulating happiness (Williams, 2003). An incipient number of studies in environmental psychology and related areas are also showing that people who protect their physical and social environment are happy persons and, incidentally, make others happy.

Happy individuals are cooperative, pro-social, charitable, and focused on the needs of others (Kasser & Ryan, 1996), which means that happiness impacts on one fundamental dimension of sustainability: altruism. Schroeder, Penner, Dovidio, & Piliavin (1995) have demonstrated that pro-social thoughts and spontaneous help to other persons frequently occur in people who manifest positive emotions (like happiness), and Buunk & Schaufeli (1999) associate close relations with other persons to happiness states.

In addition, equitable individuals experience higher levels of subjective wellbeing (Amato, Booth, Johnson, & Rogers, 2007; Chibucos, Leites, & Weiss, 2005) but,

coincidentally, they suffer more knowing that inequity abound among their fellow citizens (Napier & Jost, 2008). Frugality, as a lifestyle, induces a state of satisfaction that leads to both psychological wellbeing and to intrinsic motivation reinforcing a lightly consumption of resources (De Young, 1996; Iwata, 2001). Something similar occurs in regard to those behaviors aimed at protecting the physical environment: people who frequently engage in pro-ecological behaviors perceive themselves happier than those who are not pro-environmental (Brown & Kasser, 2005; Bechtel and Corral-Verdugo, in press). These studies demonstrate the positive psychological consequences of being sustainably oriented.

CONCLUSION

From theories, antecedents and research results reviewed in this chapter it is possible to integrate the relevant knowledge in an explanatory model including sustainable behavior, its determinants and its consequences.

Sustainable behavior can be studied as sustainable lifestyles manifested in behaviors protecting the physical and social environments. Its determinants include cognitive and affective psychological predictors as well as physical and normative contextual determinants. Finally, the repercussions of pro-environmental behavior can be assessed as benefits of sustainable lifestyles: happiness and psychological restoration.

This general model is sketched in Figure 1. Ovals represent situational dimensions, psychological dispositions and behaviors, while rectangles are the indicators of those dimensions, dispositions and behaviors. As it can be seen, the situational factors affect behavior through the mediation of psychological (either cognitive or emotional) dimensions.

The psychological dimensions, indicated by emotional and cognitive variables, directly influence sustainable behavior, which includes pro-ecological, frugal, equitable and altruistic behaviors.

Thus, according to the model, situations are the exogenous factors of this explanatory framework, influencing directly the psychological determinants of sustainable lifestyles (and indirectly, sustainable behavior). Such psychological determinants, as well as sustainable lifestyles, emerge in particular contexts and are constantly influenced by physical and normative situations. Finally, sustainable lifestyles positively affect the happiness and the subjective wellbeing achieved by individuals. Although Figure 1 does not include "causal" arrows from happiness/restoration towards the psychological determinants of sustainability, some authors (see Bechtel & Corral-Verdugo, in press, for instance) suggest that these positive consequences could affect a person's orientation towards sustainability and her/his engagement in pro-environmental behavior. This means that subjective wellbeing is both, a promoter and a consequence of sustainable behavior.

Future psycho-environmental research could be benefited from the consideration and further test of this framework. The inclusion of the psychological positive repercussions of sustainability, within research models, is a particularly interesting area that, surely, will provide valuable information for the promotion of sustainable lifestyles, in forthcoming times.

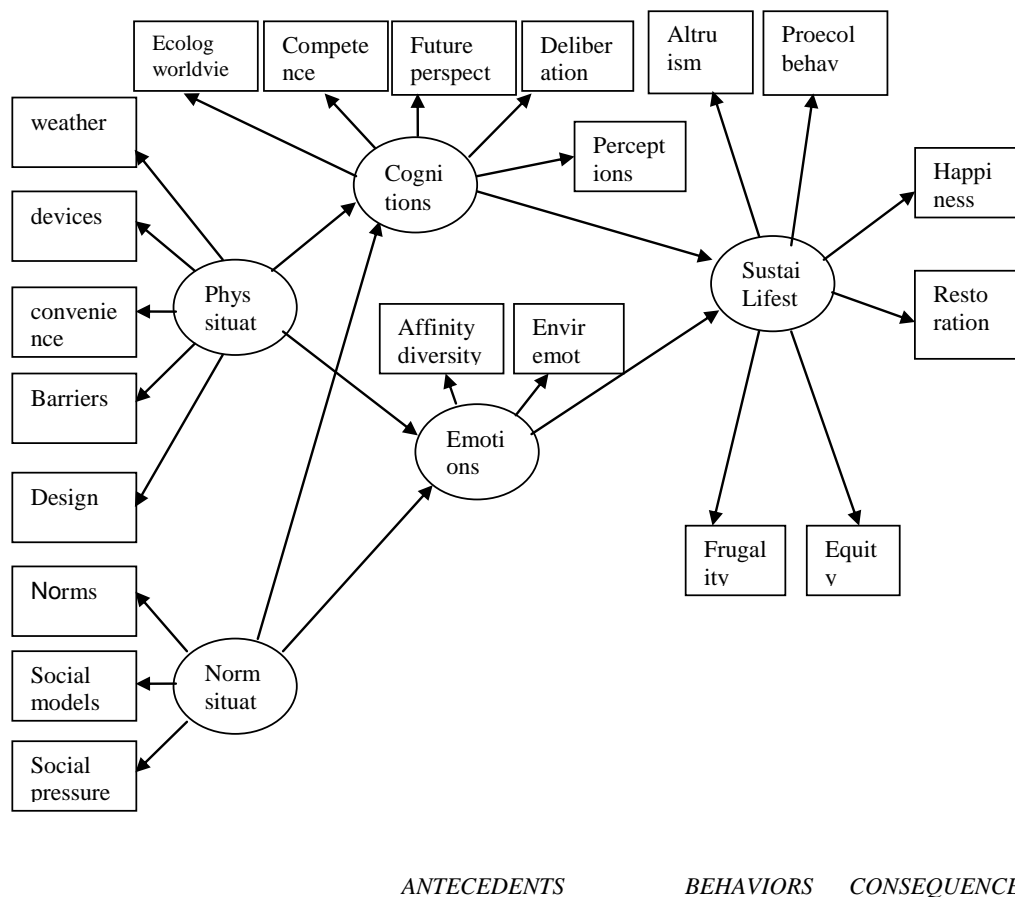


Figure 1. An integrative model of relations between sustainable lifestyles, their situational and psychological determinants, and the positive consequences of sustainable behavior (adapted from Corral-Verdugo, in press).

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Chapter 4

CURRENT DEBATE ON HUMAN SPATIAL REORIENTATION: HOW GEOMETRIC AND NON- GEOMETRIC CUES INTERACT

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Let's think about a person entering a simple room. The attention is drawn from a single object placed in one corner of the room, precisely a red sphere. Walls are painted light grey. Corners of the room are identical. The corner hosting the sphere is formed by two walls of different length. Thus, the participant is requested to close the eyes and, helped by the research assistant, to spin around the vertical axes for a while (this procedure generates disorientation). In the meantime, all the corners are covered with four identical blue boxes. Consequently, he/she cannot directly see where the red sphere is. Thus, he/she are invited to open the eyes and asked to choose the corner that housed the sphere. Usually participants reach / point to the box which, effectively, holds the sphere or its opposite corner, located on the same diagonal, because that corner has the same spatial properties of the correct one. Repeating the same procedure with a large number of participants, we will see that approximately half of them would choose the correct corner, and the other half the opposite one. If we could ask them to describe how they identified the correct corner many would answer: "I searched randomly in the room". Only few of them would answer, for instance, that their search has been driven by the fact that the sphere had the long side on the right and the short side on the left. Let us bring other participants into a room similar to the previous one with only one difference: the short wall on the left of the sphere (i.e., the target) is painted blue, while all the others are light grey. The presence of a wall painted in a different color (from now on called landmark / featural information) removes the ambiguity in detecting the correct corner, as it was in the previous room. Experimental data confirmed that almost all participants (subjected to the disorientation procedure described above) immediately chose

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the correct corner. Let us again ask participants to describe how they solved the task. All of them would answer that they have seen “the sphere in a certain position... close to the blue wall”, or more specifically, “to the right of the blue wall”. Only a few of them would declare spontaneously, “I have noticed that the room was rectangular, the sphere was located in the corner with the short wall on the left and the long wall on the right, near the blue wall”. When layout and landmark are jointly presented in a room, participants reported descriptions based on the use of landmark information, and seemed to omit layout information. Why did it occur? Throughout this chapter we will try to find an answer to this question, and more generally to the debate on the way humans recover their orientation referring to a series of very basic spatial information.

A Specific Module for Geometric Information

In 1986, Ken Cheng published a paper which constituted a milestone in studies on spatial orientation. He demonstrated that rats were able to use the layout information to find a target after a disorientation procedure, and, on the contrary, they were unable to use landmark information. Cheng explained these findings by claiming the idea of a geometric module. This module is isolated (or encapsulated) and processes information independently by any other module. Therefore rats would not be able to integrate layout and landmark information.

The original version of the modular architecture of mind took place over the last forty years and suffered, on several occasions, the effect of attacks of opposite points of view (e.g. Shallice, 1984, 1988), and also the effect of substantial revisions (Fodor, 2000). The concept of modular mind is still present in debates about architecture of the mind, and this is due to its high epistemic contribution. The most effective version of modular architecture is by far the one proposed by Jerry Fodor (1983). In his book *The Modularity of Mind* (Fodor, 1983) Fodor proposed a particular version of the structure of the mind in which several high-specialized modules process information in a stereotyped and automatic way. Since we did not point out in this chapter the model proposed by Fodor, at least we want to share the thought of Barrett and Kurzban (2006), which said that this book has had a long-term impact on the cognitive approach to the study of the mind. In fact, it gave to psychological sciences a powerful tool for building a nearly infinite number of cognitive models assessed both in the behaviorist and in neuropsychological theoretical frames. On the other hand, the specificity of the model led most of the scholars (including Fodor himself, 2000) to believe that it might be able to account only for a small portion of the processes underlying the functioning of the mind. In this way, the modular hypothesis of Fodor appears to be a refined theoretical model but hard to generalize. Indeed, it has rarely found a direct correspondence with behavioral data, with the exception for recent contributions on the theory of mind (Baron-Cohen, 1995; Leslie, 1994; Scholl & Leslie, 1999), the encoding of numbers (Dehaene & Cohen, 1995), the mechanisms that regulate insights (Leslie, 1994; Spelke, Breinlinger, Macomber, & Jacobson, 1992), studies on fear, disgust, jealousy and other emotional responses (Buss, 1992; Öhman & Mineka, 2001; Rozin, Haidt, & McCauley, 2000), recognition of faces (Duchaine, Yovel, Butterworth, & Nakayama, 2004; Kanwisher, 2000). Finally, another important example is the geometric module. In the twenty years following the seminal work of Cheng (1986), the paradigm known as *reorientation* went through many revisions and developments, and it finally became a standard in studies on development of spatial abilities. Even today we can

find studies that employ the same structure of the former experiments and that look, exception made for different species-specific procedures, very similar to the task described at the beginning of this chapter. Nowadays, we can count a significant number of studies involving a wide range of species, from human adults and children to monkeys, from birds to fish (Cheng and Newcombe, 2005 for a review). But the widest dissemination of the paradigm is due to the studies proposed by Elizabeth Spelke and colleagues during the years ranging from 1994 to 2003. Spelke and colleagues showed that results obtained with rats could also be extended to children (Hermer and Spelke, 1994, 1996). In these works, they demonstrated that children under two years of age (but in a subsequent paper Hermer-Vasquez, Moffet and Mukholm, 2001 extended the result until the fourth year of age) showed a searching behavior comparable to that of adult rats: they ignored landmark information. The reorientation behavior acted by children can find its cause in the *encapsulation* of the geometric module. Results of the experiments are exceptionally consistent with each other. Fodor himself (2000) claimed for the geometric module to be one of the most persuasive evidence of the modular architecture of mind. Hermer and Spelke (1996) also showed that human adults were able to integrate efficiently layout and featural information, through a more flexible cognitive system. According to Spelke and colleagues, the integration of layout and featural information depends on the development of the linguistic module. In other words, the mediation of the linguistic module would be able to determine this kind of integration (Hermer, Spelke & Katsnelson, 1999).

Is Language Necessary for the Integration?

The popularity of the reorientation paradigm has been followed by both theoretical and methodological remarks, concerning in particular the concept of the integration of different spatial information. Initially, Spelke and Colleagues supported the idea of a close link between the development of the linguistic module and the integration of layout and featural information. Hermer-Vazquez, Spelke and Katsnelson (1999) reported the most striking evidence about the role of language. They argued that the language is the platform for combining spatial information. The authors found that adults, simultaneously performing a verbal shadowing task while searching for an object following disorientation, behave like children and rats, failing to use a colored wall to constrain searches in a rectangular room. Participants did, however, use the colored wall while simultaneously performing a nonverbal rhythm-clapping task. This result suggested that it was language rather than simple cognitive overload that impeded the ability to use featural information. Moreover, as suggested by Hermer-Vazquez et al. (2001), six-year-old children become able to use linguistic terms such as “right” and “left”. Consistently, they found a correlation between language production of these terms (or confidence with spatial relation grammar) and the use of non-geometric features in reorientation task. According to this point of view, we should expect that a suitably developed linguistic module might be able to mentally represent featural information of an environment. Consequently, it may facilitate the integration with layout information processed by geometric module in an automatic / stereotypical and unconscious way. The hypothesis of the role of language has been questioned by several studies. For instance, those with non-human animals (fish: Sovrano, Bisazza & Vallortigara, 2002; chickens: Vallortigara, Zanforlin & Pasti, 1990; rhesus monkeys: Gouteux, Thinus-Blanc & Vauclair,

2001; and pigeons: Kelly, Spetch & Heth, 1998 and more recently Chiandetti, Regolin, Sovrano & Vallortigara, 2007 and Sovrano & Vallortigara, 2006) demonstrated that several species, without linguistic skills, could use non-geometric information to reorient. Contrasting this proof, Hermer-Vazquez, et al. (2001) questioned that these results from non-human studies might be a reflection of the extensive training typically found in experiments with animals. In addition, it is possible that non-human and human reorientation systems are not completely analogous (e.g. Sovrano, 2004). In order to give some unquestionable proofs about the slightness of language role to deal with reorientation, Ratliff and Newcombe (2008) replicated Hermer-Vazquez et al. (1999) experiment. They found that verbal shadowing but also non verbal-spatial shadowing task had a reliable effect on the use of features to reorient. In addition, they underlined the role played by explicit instructions and practice trials. When participants were trained and informed on the nature of the task, the adverse effect of linguistic shadowing was removed. In conclusion, collected data by Ratliff and Newcombe (2008) suggest that language is not crucial in promoting interaction between geometric and non-geometric sources.

How Do Geometric and Non-Geometric Information Interact?

The concluding remarks of previous paragraph lead to answer that language does not seem required in order to integrate different spatial information. On the other hand, what do we know about other factors affecting spatial integration? There is accumulating evidence (e.g. Ratliff & Newcombe, 2008) suggesting that the degree to which spatial cues could be efficiently used varies as effect of a very large number of different variables and that language is not as relevant as Hermer and Spelke (1996) claimed. The aim of this paragraph is to review the literature showing factors promoting/restricting the integration between spatial cues. The most important empirical contributions to this claim regard: (a) *geometric characteristics of the environment*, (b) *non-geometric characteristics of the environment*, (c) *familiarity* and (d) *experimental setting and material*. A further issue will be developed regarding (e) *the degree of participants' awareness about environmental cues*.

Geometric characteristics of the environment. The integration between geometric and non geometric cues is affected by two main factors concerning the characteristics of the environment: the room size (e.g. Learmonth, Newcombe and Huttenlocher, 2001) and the shape of the environment (e.g. Hupbach & Nadel, 2005). The effect of room size has been demonstrated by Learmonth et al. (2001) and Learmonth, Nadel and Newcombe (2002). They pointed out that the dimension of the room, in which the children were tested, might play an important role in the use of featural cues. In particular, Learmonth et al. (2001) replicated Hermer and Spelke (1994, 1996) and found that children, as young as 18 months, were able to conjoin geometric and featural cues to accurately locate a hidden object if rectangular room was four times than that Hermer and Spelke's. A follow-up study by Learmonth et al. (2002) directly compared the use of geometric and featural cues by young children (36–59 months) within two different room sizes. One of the rooms was the same size as used by Hermer and Spelke and the other was the same size as the room used by Learmonth et al. (2001). The authors found that, children tested in a small room relied exclusively on geometry (supporting Hermer & Spelke's view), whereas children tested in a larger room were able to conjoin

geometric and featural cues (supporting Learmonth et al., 2001). The effect of size of experimental enclosure has been also found in studies involving adults. For instance, Ratliff and Newcombe (2007) demonstrated that adults used geometric information to a greater degree in a small room and relied more on landmark information in a large one. An important variable in explaining this effect is likely to be whether the feature was distal or proximal. Let us define as *proximal* a landmark that is positioned near to the participant (as it occurs in a small room), while *distal* is the landmark far from the participant (as it occurs in a large room). In a large environment, containing distal landmark, children could be able to use featural information because objects that are visible from further away tend to be large and salient (e.g. Vlasak, 2006). The effect of proximity of landmark has been found also in natural environment such as a parkland (Smith, Gilchrist, Cater, Ikram, Nott, & Hood, 2008). The authors found that children were able to use featural information such as mountains and fountains if they appeared as distal landmarks. Learmonth, Newcombe, Sheridan and Jones (2008) have recently offered a possible explanation for the *room size effect*. They evaluated whether restricted movements, typical of small environments, could affect the use of landmark cue. The experiment was conducted in a quite large rectangular enclosure; an inner smaller enclosure was placed in the centre of the room. Children between 3 and 5 years (exp. 3) performed reorientation task having their movement restricted in the inner small arena. Results showed that 3 year old children focused only on geometric information; conversely, 4 and 5 year old children were able to combine geometric and featural information demonstrating that the earlier ability to use featural information could be affected by restricted navigation. Taken together, these studies suggest that room size affects the recovery of correct landmark-target association.

As mentioned above, another important variable in cue-integration process is the shape of the environment. Almost all studies on reorientation behaviour recur to rectangular enclosures. However, a number of studies (e.g. Hupbach & Nadel 2005, Huttenlocher & Vasilyeva, 2003) have been conducted in differently shaped environments. For instance, Hupbach and Nadel (2005) implemented reorientation paradigm in a rhombic enclosure (exp. 2) in order to explore the way children used geometric information about angles and conjoined this information with featural cues. Within a rhombic room, however, the distinctiveness of geometry is provided by angular information instead of wall lengths. Authors studied reorientation behaviour in 4 groups of children (2, 3, 4 and 6 year old children) and found that, until the age of four, children searched randomly when no landmark was provided but, at the same age, they were able to reorient integrating geometric and non geometric cues. Thus, as soon as children were capable of using angular information they were able to conjoin it with non-geometric information. A possible explanation for this result is that when geometry is harder to judge as occur with angular information, landmarks become more salient and children can readily integrate spatial cues to reorient (Ratliff and Newcombe 2007). Recently, Nardini, Atkinson and Burgess (2008) implemented reorientation paradigm in a square room in order to demonstrate the ability of children to conjoin spatial cues. In particular, they assessed children's ability at integrating geometric information provided by left/right direction and featural colours. Square room, adopted in the experiment, had two-colored wall in opposite sides. Data revealed that disoriented children between 18-24 months were able to make location judgments based on left/right sense of the landmark. Authors explained their data pointing out that in the rectangular room with a blue wall (Hermer and Spelke, 1996), children are not able to integrate spatial cues because they

are naturally prone to incompletely explore the surrounding environment. (e.g. Etienne, Teroni, Hurni, & Portenier, 1990)

Non-geometric characteristics of the environment. Another variable affecting the way individuals use spatial information concerns landmark's characteristics. Two issues seem to be particularly relevant in this perspective: the association of landmark and target and the perceived stability of landmark.

A direct association between landmark and target implies that an object is located directly at the goal site, on the other hand, an indirect association requires subject to establish a spatial relation, such as distance and direction, between landmark and target. Direct association between landmark and target is supported by a *beacon* strategy (i.e. the opportunity to pick the target and landmark in a glance). The indirect one, on the other hand, requires a strategy known as *landmark piloting* (e.g. Kelly and Bishof, 2008). Studies involving adults demonstrated that the direct association between landmark and target allowed for a more accurate choice on respect with an indirect association (e.g. Bosco, Picucci, Caffò, Lancioni & Gyselinck, 2008; Kelly & Spetch, 2004a). Assessing this issue with a developmental approach, Hermer-Vazquez et al. (2001, exp. 1) found that children of 3 and 4 years of age consistently perceived and remembered the location of a blue wall and used its location to guide their search for the object when a direct association between landmark and target was provided. Conversely, children failed in the case of an indirect association. According to the authors, these findings suggested that children located the object not by a landmark piloting strategy, but by forming a direct association between the blue wall and the hidden object: a *snapshot* of the site (Nardini et al., 2008). Coherently, Lee, Shusterman and Spelke (2006), placing one red and two blue containers in an equilateral triangle configuration, found that when the hidden object was in the red container, children of 4 years of age readily found it, but when the object was hidden in one of the blue containers, they divided their choices equally between the two blue containers. Authors concluded that the red container was used as a beacon and not as a landmark. Children were able to employ it when target was hosted into, but they failed to adopt the red box as a point of reference to disambiguate the two blue boxes. Following the authors, this assumption should leave intact the conceptualization of a geometric module inaccessible to non-geometric cues. Recently, Newcombe, Jones and Shallcross (2007) contrasting Lee et al's (2007) view, pointed out that children might not have encoded the containers as landmarks because the containers were small and portable. Coherently, Newcombe et al. (2007) introduced a new experimental setting. They used an octagon with alternative short and long sides; when a red feature wall was added, 3 to 5 year old children were able to use the landmark to focus on the hiding location, even when the target corner was not adjacent to the feature wall. The results of Newcombe et al. (2007) demonstrated that children's reorientation system can correctly integrate geometric and both direct and indirect landmark information when landmark is perceived as permanent in the space as a boundary wall. Moreover, Learmonth et al. (2001) showed that young children could be able to use landmark information if they had never seen them move. This was not the case of Hermer and Spelke's studies. Indeed, children were involved in several play sessions with objects subsequently used as landmarks in the experimental phase. In conclusion, Learmonth et al. (2001) argued that the stability of landmark within the environment could affect the probability that they were employed efficiently as landmarks. In accordance to this claim Twyman, Friedman and Spetch (2007) suggested that when

landmark is perceived as a permanent object in the environment, children could readily use it to reorient. Hence, perceived stability of landmark is considered a crucial variable in promoting the ability to integrate spatial cues.

Familiarity. Several experiments (e.g. Twyman et al. 2007) have shown that flexibility in using spatial cues can be enriched providing an appropriate experience. The training effect has been found both in human and non-human animals (Moffat & Resnick 2002; Kelly & Spetch 2004a, 2004b). It also appears that the relative weight of geometric and non-geometric information for reorientation in children can be influenced by experience. Twyman et al. (2007) assessed whether 4 and 5 year old children could be able to conjoin geometric and featural information in a small rectangular enclosure following a pre-training experience. They evaluated children's performance in a room having same size of Hermer and Spelke's one. The pre-training was carried out in a small equilateral triangle-shaped room, which had no distinctive geometric information. Each of the sides of the training room was covered by different coloured fabrics so children were given practice using non-geometric cues to reorient. Following this training, children were tested in the small rectangular room with one distinctive landmark. Results showed that children, as young as 4 years, learned to correctly combining layout and landmark information. In a second experiment, practice and experimental enclosures were the same: children were able to conjoin geometric and non-geometric cues even after a relatively smaller number of trials than previous experiment. It appeared clearly that the use of featural information became accessible when it's catalysed by the experience. The role of experience has been proved also in adults. Recently, Ratliff and Newcombe (2008) demonstrated that the use of features increased if prior experience showed the usefulness of landmarks in reorientation. Coherently, Kelly and Bishof (2008) found that pre-training experience improve the ability to conjoin spatial cues in a two-dimensional schematic version of the reorientation task. Taken together these results suggest that learning experience could have a strong impact in the integration of spatial cues.

Experimental setting and material. The ability to combine geometric and non-geometric information could vary as effect of the nature of the environmental setting. Several studies investigated how the context of searching task helps to determine the degree to which spatial cues are combined. Gouteux, Vauclair and Thinus-Blanc (2001) examined the use of geometric and featural cues by adults and young children (3-4-5-year-olds) when searching for a hidden goal in a 3D physical model of a rectangular room (the so called manipulatory task). In their task, a child watched the research assistant hiding an attractive object in a box placed in one corner of the room, consequently the rectangular space was rotated while child remained blindfolded. Afterwards, the child was invited to retrieve the object. Author's finding revealed that 4 and 5 year old children were able to rely on the non-geometric cue to find the object. Nonetheless, children never reach the adults' ability in conjoining spatial information. Similarly, Hupback and Nadel (2005) compared a manipulatory to a typical navigation task (locomotor task) employing a rhombic environment. Data revealed that in the manipulatory task, 4 year old children used the landmark and ignored geometry while the integration ability was achieved at six. On the contrary, the combined use of spatial cues was already available at age of four, in the locomotor task. Examining these results, it seems that when task took place in a manipulatory space the ability to conjoin spatial information emerge later than in the locomotor space arranged in a real environment. Similarly,

implementing reorientation paradigm in a desktop virtual environment (VReor), Picucci, Bosco, Caffò, Soleti, D'Angelo, Lancioni and Di Masi (in press) found that children encountered more difficulties with respect to adults in the use of spatial cues. However, Picucci (2008; unpublished doctoral dissertation) showed that the ability to correctly conjoining spatial cues was suitably achieved at age of eight. In order to understand these differences in conjoining spatial cues as effect of different experimental settings, Lourenco and Huttenlocher (2006) pointed out the role of disorientation procedure. In particular, the observed delay in the encoding of spatial cues might depend on whether the task is based on the rotation of the observer (i.e. in real navigation) or of the environment itself (i.e. in 3D model or virtual environment, respectively). One could readily posit that these disorientation procedures do not match for vestibular contribution, given in observer rotation but absent in environmental one. However, Bosco et al. (2008), in a study involving adults in VReor, controlled for contribution of vestibular system to disorientation effect. Virtual disorientation was compared to a condition in which this disorientation procedure was accompanied by physical rotation. Participants were asked to face a learning room that was a rectangular environment containing, or not, a blue wall as a landmark. A target was visible in one of the four corners. After a retention interval (15 seconds), participants faced a testing room, identical to the previous one. The task required to find the hidden target in the testing room. The experimental manipulation occurred during the retention interval. Physical disorientation was obtained by rotating participants on a chair (with their eyes closed). Virtual disorientation was managed by computer program changing the facing position of the participants while passing from learning to testing room. The authors found that virtual disorientation gave the same results of physical rotation.

A possible explanation for these findings might be linked to the different number of spatial frame of references (SFoRs) activated in different tasks. Indeed, in real navigation the observer is surrounded by the environment with a unique SFoR. On the contrary, 2D, 3D and virtual navigation seemed to be characterized by multiple and conflicting SFoRs (Newcombe & Huttenlocher, 2000). In particular, children appeared to have a harder time realigning their spatial frames. (e.g. Sangwan & Chhikara, 2000). A slight dropping in performance have also been found with adults in both 2D (Kelly and Spetch, 2004a) and virtual environment (Bosco et al., 2008) compared with real navigation. Summarizing, these data reveal that the ability to integrate spatial cues by children and adults could depend upon the context provided by the task.

The degree of participants' awareness about environmental cues. According to Doeller, King and Burgess (2008), learning locations on the basis of the layout is supported by implicit processes. This claim is also supported by Fodor's (2000) modularity approach according to which geometric module, deputed to the encoding of spatial layout, underlies unconscious or implicit perception of the space. Featural information, on the contrary, is supposed to have a more clearly declarative status (e.g. Doeller et al, 2008). The implicit learning of geometric information in reorientation task has been formerly observed by Hermer and Spelke (1996). Following reorientation task, they asked participants what cues they had adopted in order to reorient. The authors found that participants systematically neglect geometric cues during post-experimental reports even when their performance suggested that they turned to this information. Thus, it seems that geometric information is not directly available to the consciousness. Picucci and Bosco (2006) manipulated the awareness of

geometric information presenting a series of desktop virtual rooms with different layouts. The authors compared the results of two experiments carried out with different experimental designs. In the first experiment, the shape of the room was manipulated as a within-subject variable, in the second experiment; instead, the same variable was manipulated as a between-subject variable. Participants, in the first experiment, faced both rectangular and square rooms. This sort of procedure allowed participants to increase the awareness concerning layout information, which normally remains at a low level of consciousness, by observing the difference between non-distinctive (square) and distinctive (rectangular) layout. In the second experiment, however, participants underwent only the tasks in square or rectangular rooms. In this way, participants could not take advantage by noticing the differences between layouts.

In the first experiment, the authors did not find differences in performance between square and rectangular rooms. On the contrary, in the second experiment, when participants were not allowed to directly compare the layouts, performance in rectangular rooms was significantly worse than that in square rooms. In other terms geometric information could interfere rather than support performance in reorientation task especially if geometric information is ambiguous. Indeed, as described in the very beginning of this chapter, the layout of a rectangular room without any distinctive landmark provided two equally correct solutions, that is, the corners on the same diagonal. This ambiguity might be nullified by the presence of a landmark. Sometimes this is not the case, the ambiguity of the layout persists inducing errors, especially if individuals remain substantially unaware of the environment's shape. This claim partially contrasts with the hypothesis of integration between spatial cues as formerly proposed by Spelke and Colleagues. Nonetheless, two theoretical frameworks support our findings. First, Cheng and Newcombe (2005) proposed a model with modular components: a memory box containing a metric frame deputed to coding only the geometric information. Featural information may be pasted onto the frame in addition. In this model featural information may fail to be input into memory. This failure can cause systematic errors. These are more frequent when individuals are not aware of the difference between square and rectangular environments (as in Picucci & Bosco, 2006, Exp. 2) since they cannot compare directly differences in layout. Second, the dichotomy of procedural and declarative memory systems (e.g. Schacter and Tulving 1994) might explain this pattern of results. Indeed, a searching task is characterized by action, thus geometric information seems to be promptly accessible in memory, in a partially aware manner. On the contrary, featural characteristics (like landmark information) have a more clearly declarative status; they are less promptly accessible in memory for action when geometric information is also present. However it is a completely efficient cue when layout information is absent. Finally, when square and rectangular layouts can be directly compared (as in Picucci & Bosco, 2006, Experiment 1), individuals tend to assemble geometric and featural cues avoiding errors. The integration of cues is achievable only under specific conditions. Otherwise geometric information tends to compete with featural characteristics of the environment in guiding spatial navigation tasks.

Neural Correlates of Spatial Reorientation

The last goal of this short essay on the integration between spatial cues is examining whether these cues are grasped by functionally distinct neuro-anatomical region. As already

argued along the chapter, reorientation paradigm research has focused the attention broadly on the relationship between two different sources of information: geometric cue, providing information about spatial layout and featural cue that is essentially guided by visual information regarding objects in the environment (e.g. landmark like a distinctive wall in a room). Seminal research on primate (e.g. Mishkin, Ungerleider & Macko, 1983) suggested that visual processing proceeds along two streams: a ventral pathway from occipital to temporal cortex involved in object recognition (i.e. What System) and a dorsal pathway from occipital to parietal cortex involved in the encoding of spatial relation between objects (Where System). Neuroimaging, particularly functional magnetic resonance imaging (fMRI), identified specific regions within the human ventral and dorsal pathways that likely subserve object recognition and object location. In the ventral pathway, the lateral occipital complex is a large bilateral region of occipito-temporal cortex that is activated by the visual presentation of objects (e.g. Malach, Reppas, Benson, Kwong, Jiang, Kennedy, Ledden, Brady, Rosen & Tootell, 1995). In the dorsal pathway, the anterior intra-parietal region reacts more strongly during the estimation of relative positions among objects (e.g. Binkofski, Dohle, Posse, Stephan, Hefter, Seitz & Freund 1998). There are significant experimental evidence supporting the existence of these two different pathways, however, multiple cortical connections have also been verified between them (Landau & Jackendoff, 1993). More recently, studies involving temporal or parietal damaged patients suggested a more specialized interpretation of the functions performed by the two visual pathways. According to Milner and Goodale (1995) and Goodale and Milner (2004) both ventral and dorsal pathways entail localization and encoding of spatial properties, but they are differently involved in different kind of spatial activities. In particular, Aguirre and D'Esposito (1997) demonstrated that individuals with ventral lesion had difficulty in recognizing and naming objects (for example, say that an object is a mug) while they performed normally if involved in actions with these objects (e.g. take the mug and drink). On the other hand, patients with dorsal impairment could verbally describe the characteristics of a visual stimulus (e.g. the orientation of a slit in a tablet), but failed when they had to perform an action based on this information (for example, rotating the wrist in an appropriate manner and introducing his hand into the slit). The connections between behavioural deficits and brain lesions fit the functional model proposed by Milner and Goodale: ventral lesions cause a disability to recognize salient landmark but leave intact the visuo-motor function; conversely, dorsal lesions impair the *perception for action* without hurt the *perception for recognition*.

In Milner and Goodale's view, ventral system processes spatial inputs slower than dorsal system and this latter is entrusted to detect those environmental features such as shape, size, and relationships between parts of objects, which remain stable even if an observer's movement occurs. The dorsal system processes spatial information rapidly. It is also involved in planning and controlling the action within the environment. Moreover, the dorsal system manages spatial information dealing with the relationship between the environment and the observer and between parts of the environment themselves (e.g. Levine, Warach, Farah, 1985). Consequently, geometric information would be processed by this system (e.g. Gallistel, 1990). In ventral /dorsal model a crucial question concerns whether the function of attention and visual awareness are differently connected to the two visual pathways. Milner and Goodale (1995) argued that information under ventral pathway's control was associated with high level of awareness. Dorsal pathway processed spatial information largely in absence of awareness. The most important implication is that information encoded by dorsal

and ventral pathways might selectively be managed with different levels of awareness. In a similar vein, Tulving (1985) suggested that declarative and procedural memory might be characterized by different levels of awareness. Broadly, declarative memory like declarative propositions, contain information about facts and events. Both its components (episodic memory and semantic memory) benefit from high levels of awareness. Thus, drawing and reworking traces from this kind of memory system is a largely conscious process. Non-declarative (procedural) memory is characterized by the storage of information about basic skills, like motor actions, verbal qualities, visual images, and emotions right for performing a specific assignment (Schacter & Tulving, 1994). Procedural memory involves tasks such as playing soccer, or driving a car. This memory drive at “*how to do it*” and organize altogether the actions required for performing correctly a task. Accordingly, procedural memory is essential for motor behaviours such as searching for an object through the space after being disoriented. Nonetheless, information used to find an object are often not all available to consciousness, indeed, people performing correctly the searching task often encounter troubles to verbalize simple components of their motor behaviour. From the neuro-functional point of view, Doeller, King & Burgess (2007) found a different learning role associated with the hippocampal and striatal systems. Data from fMRI showed that differential activity in the caudate nucleus and hippocampus corresponded to the acquisition and expression of information about locations derived from environmental landmarks or boundaries (e.g. the shape of the environment), respectively. Equally, it has been suggested that rapid encoding of events and their context (Tulving, 1983) specifically depends on the hippocampus (e.g. Rugg and Yonelinas 2003) as opposed to semantic knowledge acquired slowly over multiple exposures. In addition, Doeller, King & Burgess (2007) suggested that the hippocampus seemed to be specialized in processing environmental boundaries and appeared to operate through an incidental (procedural) learning rule. In our opinion, geometric information in reorientation paradigm might be processed by the *perception for action system* (dorsal pathway) and, mostly, in an incidental /procedural manner. Encoding geometry would be rapidly, automatically and therefore unavoidably acted (Doeller, King & Burgess, 2008). Two different theoretical views have been proposed in order to explain the way ambiguous geometric information is encoded: the integration between geometric and non-geometric cues (e.g. Ratliff and Newcombe, 2008) and competition between them (e.g. Miller and Shettleworth, 2008). In Picucci & Bosco (2006) a competition effect, between spatial cues, has been observed in rectangular room with a distinctive landmark. In this condition, both geometric and non-geometric information were presented concurrently but performance dropped on respect to the condition presenting only one cue (square room with a distinctive landmark). It seems that when one spatial cue provided redundant, even if ambiguous, information (i.e., the rectangular layout) this one tended to interfere with the other. In other terms, an *overshadowing effect* (Wilson & Alexander, 2008) emerges.

CONCLUSION

Remembering object locations in their surrounding is critical to all mobile creatures. Human and other animals adopt, generally, two methods in such kind of cognitive task: a *self referenced system* that relates a location to the position of the self and an *externally*

referenced system that relates a location to the external environment. However, if a self referenced system is degraded, human and animals resort to the use of external spatial cues to reorient. Two kinds of spatial cues might be used in this process of reorienting: geometric and non-geometric cues. Research over the past decades has revealed a remarkable sensitivity of young children (e.g., Hermer & Spelke, 1996) and rats (e.g., Cheng, 1986) to geometric properties of surroundings determined by metric (a long wall meets a short wall) and sense (left and right relations) information. Rats and children would be able to rely on geometric properties of the environment ignoring other salient features such as distinctive colors and textures. On the other hand, human adults are able to use non-geometric information as landmarks in order to reorient themselves. From these data, the fallacy in employing non-geometric information is overridden, in the course of development by use of linguistic spatial coding that allow integration of non-geometric and geometric information. Thus, children would acquire the ability to conjoin geometric and non-geometric information at around five-six years when became able to produce spatial terms such as “left and right” (e.g., Hermer-Vazquez et al. 2001). According to the modular approach, geometric and non-geometric information are processed separately by two dedicated modules, and the geometric module seems encapsulated and unable to accept functionally relevant information until the acquisition of spatial language. The evidence described above challenges the idea of an encapsulated geometric module and questions the proposition according to which geometric and non-geometric cues could interact only under the acquisition of language (Hermer & Spelke, 1994, 1996; Hermer-Vazquez et al., 1999).

It seems that several factors, such as geometric and non-geometric characteristics of the environment, familiarity, experimental setting and the degree of participants' awareness about environmental cues affect the integration between geometric and non-geometric cues. Recently Ratliff & Newcombe (2007) in order to explain this variability, proposed the *Adaptive Combination Model*. This approach states that there are multiple sources of spatial information and that those sources are either integrated using weighting mechanisms or hierarchically arranged in order of preference. Applying this model to a reorientation paradigm, they suggest that searching behavior is guided by a weighting mechanism combining both geometric and featural information weighted by the variance associated with each source. The weight associated with cues depends on the strength of each cue at encoding, their relative salience, reliability and familiarity. A weight is initially established for each kind of information during encoding, and these weights are then combined making any necessary adjustment given by current experiences. This model can explain why landmarks are more likely to be used during navigation when they are distal (Nadel & Hupbach, 2006). The objects that are visible from further away tend to be large and perceived as stable. These characteristics add weight to the object that became eligible to be a landmark. In this essay, moreover, we present a study (Picucci & Bosco, 2006) that seems to enrich the idea of adaptive combination, as occurs when a source of information is ignored or interferes, rather than being combined with the other according to its weight. As mentioned above, this form of cue interaction is called *overshadowing*. This effect occurred when the subject was presented with two cues, both of which predict the target. The subject may learn one or both lesser than if they were presented separately (e.g., Cheng and Newcombe, 2005). In Picucci and Bosco (2006) an overshadowing effect has been found with geometry overriding landmark. When the environment is presented with geometric and non-geometric information, performance is worse compared to that shown in an environment presenting only featural

information. A model accounting for these findings has been recently proposed by Miller and Shettleworth (2007). According to their *Operant Associative Model*, the distribution of subject's choices among different locations is determined by the total relative associative strengths of cues (both geometric and features) at those locations. The subject's choice reflects the relative attractiveness of cues that have gained or lost value by being experienced in close spatial proximity to reward (target) or not rewarded, respectively. In a rectangular enclosure, geometric information is always ambiguous; in fact, following the geometry led to rewards half of the time (Miller & Shettleworth, 2007). Consequently, the associative strength of geometric information is reduced since it produces frequently a loss of reward and becomes eligible to be ignored, in particular, if subjects improve their awareness about its influence. This model can account for the data in the Picucci and Bosco study (exp. 2, 2006): When geometric (ambiguous cue) and non-geometric information (unambiguous cue) co-occur. The former interferes with the latter and performance becomes poorer compared to a condition in which landmark information is presented alone. The authors also found that performance in both conditions reach a comparable level when awareness about geometric information is increased allowing participants to compare differently shaped rooms.

In the classic reorientation paradigm, geometric information is ambiguous and tends to be encoded automatically. Increasing awareness helps form a better integration between spatial cues; on the other hand, if it remains implicit, it tends to compete establishing interferences in the task solution. These results provide a deeper understanding of spatial knowledge after disorientation. Cue integration is not always confirmed and other processes, such as competition or independence between sources, need to be taken into account as effect of those variables described previously in the chapter. Geometric information does not automatically dominate features during reorientation, nonetheless it may worsen the reorientation performance particularly if it is ambiguous and remains implicitly learned and recovered. In our view, the nature of spatial navigation is best accounted for by a flexible approach understanding the interaction among different sources of environmental variability that have to be adaptively combined in order to reach most efficiently the rewarded goal.

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Chapter 5

PSYCHOSOCIAL MOTIVATIONS AND SELF-REGULATION PROCESSES THAT ACTIVATE ENVIRONMENTALLY RESPONSIBLE BEHAVIOR

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ABSTRACT

The main investigations of this study focus on explaining specific pro-environmental behaviors that have established their roots from a motivational perspective. As a result of growing interest in environmental psychology over recent years, an increasing number of researchers have attempted to identify the variables that predict environmentally responsible behavior (ERB). This chapter reflects on the different theoretical approaches – motives and self-regulatory processes – in the study of ERB motivation.

First, we will cover the motives landscape. When a person engages in a certain form of behavior purely for reasons of intrinsic satisfaction, the satisfaction produced is associated with personal interest in the behavior; they simply feel satisfied carrying out the action. Intrinsic motivation can be related to altruism in that these actions are freely engaged in by the person, entail a certain amount of sacrifice but provide high levels of personal satisfaction. Deci and Ryans' (2000) Theory of Self-Determination suggests these psychological needs relate to motivation. Extrinsic motivation refers to obtaining some kind of social reinforcement or recognition, such as economic success, a good image or popularity.

Second, we will cover the self-regulatory processes involved in ERB. Among the different self-regulating mechanisms, self-efficacy is the best predictor of actions and for which a greater level of personal effort is required. Self-efficacy can be defined as "the belief in one's own capacity to direct the courses of action required to cope with certain situations in the near future" (Bandura, 1997; 2002). Therefore, self-efficacy is a self-regulating mechanism that motivates the course of action required to mobilize high levels of effort, persistence in the face of adversity and achievement of expected results. However, self-efficacy does not act in isolation; motivation is explained by the relationship between this cognitive judgment of ability and the situation, emotional state and certain personality variables such as locus of control or values.

Third, after revising these motivational theories about ERB, this chapter presents the results of a study in which 1487 people in a southern province of Spain completed a questionnaire about their motivation to engage in certain behaviors to separate out rubbish in their home and the influence of self-regulation mechanisms.

INTRODUCTION

Getting individuals, groups, collectives and companies to develop environmentally responsible behavior (ERB) has become one of society's main priorities, as reflected in the support for actions at micro-levels (for example, buying energy efficient appliances) and proposals incorporated into major international political agreements (for example, the signing of the Kyoto Protocol). This interest is materialized in different ways, although in general the aim is to promote pro-environmental sensitivity and awareness in society as a whole. For example, it has helped to promote environmental education programs (Legault and Pelletier, 2000; Oskamp, 2002; Pooley and O'Connor, 2000) as well as a wide variety of social communication campaigns (Cortés, Aragonés, Sevillano and Amérigo, 2004; Cox, 2006; Pol, Vidal and Romeo, 2001).

On the basis of this interest over recent years, an increasing number of studies have attempted to identify variables that explain and predict ERB. The research generated has developed through a dual consideration: on the one hand, the need to improve pro-environmental interventions and on the other hand, through interest in optimizing explanations of this behavior.

Most pro-environmental interventions are grounded in principles taken from the functional analysis of behavior. This approach maintains that the consequences of an action motivate this action and analyzes the effect of using incentives and penalties to promote or change ERB (Geller, 1987; 1995). For example, it has been observed that reinforcement is an effective way of reducing consumption (Syme, Seligman, Kantola and MacPherson, 1987). The efficacy of this approach has also been noted in relation to saving water, recycling glass and other environmental protection behaviors (Corral-Verdugo, 2001).

However, research in this direction has revealed that even though incentives or punishments can be useful in generating ERB, their effects are practically void in terms of long-term change and when contingencies disappear, even when a design involving intermittent reinforcements is applied (Dwyer, Leeming, Cobern, Porter and Jackson, 1993). For example, in relation to programs designed to reinforce behaviors that help to keep a place clean, even though they have proved to be highly effective (Levit and Leventhal, 1986), it is not clear that these programs maintain their effects after reinforcement or that the effects are generalized to other situations or behaviors.

In this respect, Eisenberger and Cameron (1996) question the effectiveness of reinforcements as instigators of change. In fact, when behavioral changes are observed in conjunction with incentives, they can be explained through certain classic theories of social psychology such as the approaches that explain the role of over-justification of behavior or cognitive dissonance. So, we know that when a person has external reasons (incentives) to justify their behavioral change, it is less probable that a stable change will be generated. In other words, the person knows the reason that has led to the change and once the motive disappears, the change will not endure since merely carrying out the behavior has not

generated a change in attitude or any kind of cognitive dissonance. Furthermore, when an attempt is made to generate change through persuasion, it might actually have the opposite effect. In this respect, psychological reactance occurs when someone perceives that the emitter intends to modify their behavior, is trying to activate certain norms that favor helpful behavior or even perceives that their capacity to think and act freely is being limited (Rind and Kipnis, 1999). Furthermore, although procedures based on persuasive communication and obtaining commitment achieve good initial results, gradually they return to baseline levels (González, Aronson and Costanzo, 1988). The effects of reactance have also been observed during attempts to control littering through antecedent stimuli, warning signals and punishments such as fining offenders (Reich and Robertson, 1979).

Behind each effective intervention there must be a sufficiently organized theoretical explanation that incorporates various factors that precede the behavior and establishes a connection between them. In this respect, part of the research effort made in the field of environmental psychology has focused on optimizing the explanation of ERB. Corral (2001) reviewed the impact on pro-environmental behavior of variables such as economic status, rural or urban origin, level of information and environmental knowledge, the role of incentives and penalties, level of self-esteem, locus of control, perceived self-efficacy, beliefs and environmental attitudes and altruistic, sociocentric and ecocentric attitudes.

Hines, Hugenford and Tomera (1987) made one of the first attempts to systematize empirical approaches to predicting ERB using meta-analysis. According to their results, the decisive factors are environmental knowledge and the development of skills, as well as personal characteristics such as attitudes, locus of control and attribution of responsibility. Along these same lines, Bamberg and Möser (2007) conducted another meta-analysis on the basis of 47 research projects into ERB carried out after 1995, concluding that this behavior can be considered a consequence of a combination of self-interest and the influence of social motivations. According to these authors, the following factors act as predictors of ERB: a positive attitude towards the behavior, perception of control and the feeling of moral obligation or personal commitment.

In any case, most explanations of ERB agree on two elements: to consider pro-environmental behavior in terms of deliberate and intentional behavior and to incorporate some motivational content among the variables that act as antecedents of intention. Hence, some research is interested in particular and specific motivations linked with a specific behavior or problem, such as motivations to reduce threats (Homburg and Stolberg, 2006; Martens and Rost, 1998), reduce water consumption (Bustos, Herrera and Andrade, 2004), get involved in pro-environmental protection (Hernández, Suárez and Martínez-Torvisco, 1977) or volunteering organizations (Castro, 2002) and recycle metal and paper (Corral and Encinas-Norzagaray, 2001). In other words, they highlight the role of motivational content in relation to the environment and environmental conditions.

However, despite the importance of specifically motivational mechanisms (De Young, 2000; Ryan and Deci, 2000), little effort has been made to systematize and research the role they play in ERB. Taking motivational mechanisms into consideration in the explanation of ERB can help improve understanding of this behavior in at least two aspects. First, it could help us understand why it is frequently found that ERB is not a stable pattern of action, so that a significant prediction is only made in conditions of high situational and behavioral specificity (Hernández and Suárez, 2006; Thögersen, 2004). Second, the analysis of

motivational factors could help explain ERB regardless of the contingencies that reinforce or inhibit the behavior (Séguin, Pelletier and Hunsley, 1998).

This chapter examines different theoretical perspectives from which to study the relationship between motivational processes and environmental responsibility. Specifically, the first section offers a review of the motivational role of values, norms, attitudes and beliefs associated with the choice and maintenance of ERB, whereas the second section reviews the role of self-regulation processes generated when people decide to engage in ERB or not.

VALUES, NORMS, ATTITUDES AND BELIEFS AS MOTIVATIONS FOR ERB

In many of the conceptual models created to explain the genesis, maintenance and change in pro-environmental behavior it has been assumed, explicitly or implicitly, that the main psychosocial constructs are motivational in nature. Some of these approaches have generated a large volume of research in the area of environmental psychology. These theories incorporate into their explanations variables that motivate ERB, although they are not in themselves theories about motivational processes. Among the most relevant models in this field are the Schwartz Values Theory (1994), Schwartz Norm Activation Model (1977) and Fishbein and Ajzen's Theory of Reasoned Action (1975) and its derivation, the Theory of Planned Behavior (Ajzen, 1991).

Considering human values as desirable goals which define people's lifestyles and their unquestionable beliefs (Rokeach, 1973) involves attributing to human values a motivational dimension that has been taken into consideration when explaining ERB. Specifically, Schwartz (1994) developed his model for the structure of values, affirming that the latter constitutes the most abstract level of a system that includes beliefs and attitudes which antecede and modulate the relationship between values and behavior. Furthermore, values guide behavior, are ordered hierarchically and relatively and possess a general motivational function. The model defined by Schwartz identifies 10 types of values that are, in turn, structured into four dimensions (self-transcendence, self-enhancement, openness to change and conservatism). Based on this universal structure of human values, Stern and colleagues (Stern, Dietz and Kaloff, 1993; Stern and Dietz, 1994) reconceptualize the 10 original types into three "value orientations" related to the environment (self-centered, socio-altruistic and ecocentric or biospheric). The concept of value has been associated, both from the general perspective of Schwartz and the three-dimensional perspective of Stern and colleagues, with diverse pro-environmental behaviors including recycling, saving resources, environmentally responsible consumption and the acceptability of sustainable energy policies (for example, Dietz, Fitzgerald and Shwom, 2005; García-Mira, Real, Durán and Romay, 2003; Pato, Ros and Tamayo, 2005; Schultz and Zalesny, 1999; Stern, Dreijerink and Abrahamse, 2005).

In one approach linked with the above, altruism has been identified as one of the main motivations in explaining ERB. A significant volume of work has been developed in this direction based on the model of norm activation proposed by Schwartz (1970; 1977) which has highlighted the direct and indirect influence of altruism on behavior. According to this idea, it is assumed that pro-environmental behaviors are largely the product of an altruistic vision of people and the environment.

Schwartz (1970) proposed an activation model for the moral norm, according to which people are motivated to get involved in altruistic behaviors if two mechanisms take place. On the one hand, if they are aware that the behaviors in which they engage (or do not) have consequences that affect other people and, on the other hand, if they feel a capacity to control the situation and develop feelings of responsibility for the chosen action. However, the model also explains the circumstances in which altruistic behavior does not occur on the basis of the perception of inequity between costs and benefits, the negation of personal responsibility and/or the consequences of one's own behavior on others (Schwartz, 1977). This approach to altruism had immediate repercussions in psycho-environmental research (e.g., Stern, Dietz and Black, 1986; Vining and Ebreo, 1990).

The models proposed by the Reasoned Action Theory (Fishbein and Ajzen, 1975) and the Planned Behavior Theory (Ajzen, 1991) shape another of the most widespread approaches to explaining ERB (Vining and Ebreo, 2002; Herranz-Pascual, Proy-Rodríguez and Eguiguren-Garcia, 2009; Kaiser, Wolfing and Fuhrer, 1999). Having accepted the general explanatory outline with few modifications, ERB is considered a function of the intention to carry out significant positive actions for the environment, an intention that in turn depends on the individual's attitude towards the behavior itself and the subjective norm. Attitudes towards behavior are partly defined on the basis of beliefs about environmental consequences and the valuation of said consequences. The subjective norm is a function of beliefs about what others think should be done in relation to environmental problems (normative beliefs) and the personal motivation to be bound by these norms. The subsequent development of the Planned Behavior Theory incorporates the concept of perceived control (Ajzen, 1991; Aguilar, Monteoliva and Garcia, 2005).

The aforementioned approaches have been compared in terms of their predictive capacity. For example, Kaiser, Hübner and Bogner (2005) found that the effectiveness of the norm activation model when explaining ERB is similar to that of the model proposed in the Planned Behavior Theory. However, comparing the direct antecedent variables proposed in both models, they found that behavioral intention explains a higher percentage of variance observed in conservative behavior than personal norms.

In the architecture of socio-cognitive functioning reflected by the models discussed so far, there is an underlying idea of beliefs as a structural element. According to environmental psychology, beliefs that have been identified in relation with ERB differentiate between motivations grounded in ecocentric interests and those grounded in anthropocentric interests.

Anthropocentrism sees the human being as the dominant entity in nature, attributing a higher capacity to modify the environment in accordance with its needs and interests, either through particular social groups or as a species. The functional and utilitarian nature of the person–environment bond established by anthropocentrism has led this approach to be identified as the origin of practices that have caused the current global environmental crisis. But it has also been identified as a support for environmental interest insofar as it highlights the effects of environmental degradation on human health and quality of life (Nordlund and Garvill, 2003).

Ecocentrism views human beings as just another element within the ecological system. In terms of belief systems, the ecocentric perspective of the person–environment relationship emerges from the unavoidable consideration of the human being as a member of the Earth's living or biotic community.

Thompson and Barton (1994) found that only ecocentrism is linked positively with pro-environmental behavior. Anthropocentrism did not correlate with behavior aimed at looking after the environment. Hence, although anthropocentrism shapes some of the arguments for environmentalism, its influence on ERB is weak. Similar results were found by Nordlund and Garvill (2002) and Heath and Gifford (2006).

One possible explanation regarding the dual role of anthropocentrism in the relationship between beliefs and environmental behaviors has been proposed by certain authors (Corbett, 2005; Kalinowski, Lynne and Johnson, 2006), who consider that personal interest in engaging in environmental behavior is the key to explaining pro-environmental behavior. Furthermore, although it could be thought that people maintain their behaviors only until they satisfy their personal interests, Snyder and colleagues (Clary and Snyder, 1999; Omoto and Snyder, 1995; Snyder and Omoto, 1992) have demonstrated that people with inward oriented motivations (self-esteem, improvement, personal development) tend to retain their altruistic or voluntary behaviors for a longer period than those whose orientations are centered on the community or social values.

When a person engages in a certain behavior for its own sake, the latter is associated more with self-interest than ecocentric or anthropocentric interest. Kasser and Ryan (1996) analyze the content of the goals people set for themselves, differentiating between intrinsic and extrinsic motivations. The former directly seek to satisfy psychological needs of relationships, autonomy and competence, such as self-acceptance, affiliation or a feeling of community or health, whereas the latter refer to obtaining some kind of reinforcement or social recognition such as economic success, image and popularity. The intrinsic satisfaction people get when they feel competent to carry out a specific behavior was initially proposed by White (1959; 1971), who described this concept of competence or effectiveness on the basis of two components, one based on skill and the other on motivation.

De Young (2000) presented a review of articles that consider the intrinsic satisfaction experienced when carrying out ERB as a source of motivation. This review singled out three types of motivators: a) the satisfaction of having certain competences to carry out specific actions; b) the satisfaction of engaging in responsible consumption, even though it might not be long-lasting; and c) the satisfaction of maintaining a sense of community by helping maintain the environment. De Young points out that it should not be assumed that just because people know what to do they necessarily know why they should do it and how to develop the behavior. The key is that when a person feels capable of engaging in behavior they experience intrinsic satisfaction from their own judgment of competence that promotes the choice and generalization of new behaviors and personal development. Establishing a relationship with the review performed by De Young (2000), intrinsic motivation would be the satisfaction of having certain competences and engaging in responsible consumption, whereas extrinsic motivation would be based on the satisfaction of maintaining a sense of community. Both motivations can be activated depending on the types of activities or behaviors that make people focus their efforts on achieving a specific goal at a given time.

However, bearing in mind the context, Grouzet and co-workers (Grouzet, Kasser, Ahuvia, Fernández-Dols, Kim, Lau, Ryan, Saunders, Schmuck and Sheldon, 2005) suggested the need for a more complex model that adds another orthogonal dimension to the 'intrinsic-extrinsic' dimension, encompassing the values proposed by Schwartz (1992). Hence, a distinction is made between four types of goals. The first is based on the need to conform taken from the work of Asch (1951); according to this theory, all people adapt to the social

norms created by a (not necessarily broad) collective of people. The second goal is based on the need for security, to feel safe and know that survival is probable. The third goal is based on our need for hedonism and the fourth is based on spirituality. The last two could form an orthogonal dimension of self-transcendental expectations or goals versus physical goals that would complement the intrinsic–extrinsic dimension. Therefore, two dimensions are presented: intrinsic goals (acceptance, affiliation) vs. extrinsic goals (economic satisfaction, image) and self-transcendental goals (spirituality) vs. physical goals (hedonism). From this perspective, Tabernero and Hernández (2006) showed that most pro-environmental behaviors are carried out through intrinsic motivation and the desire to satisfy self-transcendental goals. Specifically, behaviors are based on the desire to contribute to the collective good (68%), having incorporated this behavior into a system of values (27%) and the mere fact of enjoying carrying them out (3.2%). Figure 1 below represents an adaptation of the circular model proposed by Grouzet and colleagues (2005) to analyze the motives given for engaging in recycling.

Bearing these approaches in mind, rather than examining ERB in relation to motivational elements with pro-environmental content (beliefs, values), explanatory capacity is gained if basic motivational mechanisms are taken into account. In this respect, the next section analyzes the self-regulation processes that influence the choice, perseverance or abandonment of ERB from the perspective of Social Cognitive Theory.

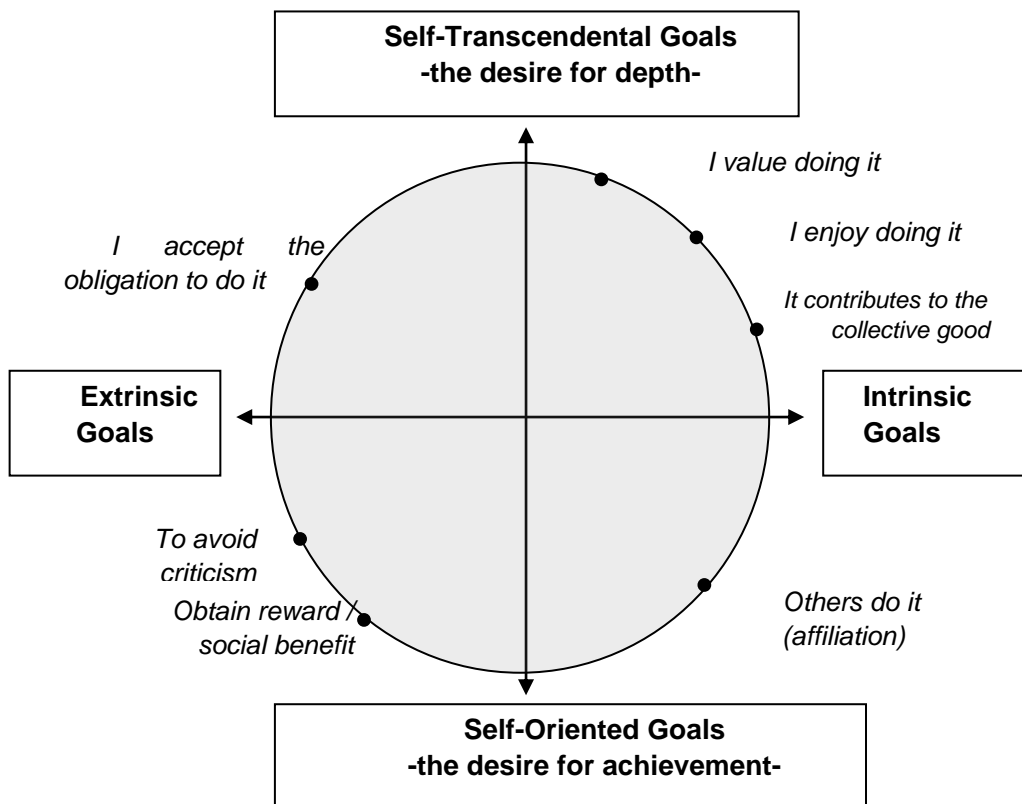


Figure 1. Representation of motives for engaging in ERB adapted from the model proposed by Grouzet et al. (2005) to represent the cross-cultural consistency of goals.

DETERMINANTS OF SELF-REGULATION PROCESSES IN PRO-ENVIRONMENTAL BEHAVIORS

Social Cognitive Theory provides an integrative framework for analyzing how people tackle challenging tasks and how personal and situational factors influence motivation, performance and learning (Bandura, 2001; Mischel and Shoda, 1998). This general theoretical framework explains human behavior by focusing on the cognitive and affective processes that influence how people react to different situations (new, complex and challenging tasks), such as how to establish a new recycling system in the home, modify energy consumption habits and modify mobility patterns.

According to the Social Cognitive Theory put forward by Bandura (1986; 1997), there are two basic processes in the acquisition of mechanisms that help us regulate our behavior, one is based on direct experience with reinforcements and punishments received with each of our actions, and the other is based on the role of modeling or vicarious learning. Learning through reinforcements or from mistakes is a long process because it requires an exhaustive analytical strategy and can be excessively costly if the mistakes made carry a high penalty. Furthermore, if there is no analytical strategy, the duration of the motivation is limited to the presence of the reinforcement or penalty. However, learning from others is a less costly and equally powerful process. Furthermore, when this learning process is used by different means of communication/education, it can have a direct effect on a larger number of people (Bandura, 2002).

Modeling or vicarious learning is a process based on the social comparison established when observing the behavior of others and ascertaining the effects this behavior generates (Bandura, 1997). When, in this comparison process, the observer identifies with the model, in other words, they feel a similarity, the observer perceives that they can carry out that same behavior with equally satisfactory results. Therefore, it is not necessary to carry out an action that is observed in others to feel capable of achieving the said action. Social models transmit values, knowledge, cognitive skills, coping styles, behavioral styles and lifestyle. They can also transmit emotional states towards others or towards the context when the emotional state experienced by the model when interacting with the surroundings is observed. The level of personal motivation, affective states and actions are grounded more in what people believe they can do than in what they can objectively do in a specific situation. Hence, Bandura (1997) claims that modeling is a motivation mechanism that can act at both a personal level, provoking personal development, and a collective level, generating social change.

Among the different behavior self-regulation mechanisms, Bandura (2002) maintains that self-efficacy is the best predictor of the actions in which we choose to involve ourselves and for which greater effort is required. Self-efficacy can be defined as "the belief in one's own capacity to organize and lead the courses of action required to tackle certain situations in the immediate future" (Bandura, 1997). From the perspective of the Social Cognitive Theory, self-efficacy is the most important cognitive-affective variable in understanding how personal and situational factors influence behavior. Various meta-analyses have examined the high predictive value of self-efficacy on performance in different domains and laboratory situations. Specifically, Hysong and Quiñones (1997) found a mean ratio for "self-efficacy/performance" of $r = 0.37$, which is similar to the value found by Stajkovic and Luthans (1997) with $r = 0.38$. The studies reviewed in both meta-analyses show that self-

efficacy judgments influence the goals people set for themselves and their affective reactions to the levels of performance attained in different contexts. Therefore, according to this theory, for a motivational process to appear, it is necessary to generate the perception of capacity in the individual, who must feel capable of carrying out the action at a certain time and to a specified level (for example, "I feel capable of using public transport to go to work every day").

But as well as the importance of effort and perseverance, it is also necessary to highlight the generative effect of self-efficacy. People who think they can carry out a task well generate high levels of perceived self-efficacy for similar tasks and circumstances. Given that judgments of self-efficacy or expectations of capacity come from a self-evaluation of past performance, there is a high correlation between past performance and self-efficacy. Hence, certain authors (Vancouver, Thompson and Williams, 2001) have suggested that self-efficacy is simply the product of past performance and, therefore, does not help to explain levels of motivation or performance in the future. However, the work of Eden (1992) shows that levels of self-efficacy can be manipulated and thereby influence motivation and the level of performance ultimately achieved. So, for example, a person who undergoes a training program about recycling in the home based on generating self-efficacy judgments increases their analytical strategies, skills and activities that would lead them to engage in ERB, even though they may have had low levels of performance in the past.

It should be pointed out that self-efficacy only has predictive power when the task selected is complex and requires significant effort. So, when a person perceives that they have the capacity required to organize and execute the courses of action to lead or manage specific situations in the immediate future, it is highly probable that they will carry out this action with an established degree of effort and to an expected level (Bandura, 1997). As well as effort and perseverance, there are other mechanisms through which self-efficacy has a direct effect. Self-efficacy helps individuals focus their attention and reduce surrounding distractions (Kanfer and Ackerman, 1996), influences the level of difficulty of the goals selected and the level of commitment made to them (Locke and Latham, 1990), encourages individuals to search for feedback to evaluate their own behavior (Tsui and Ashford, 1994) and facilitates the search for more efficient strategies (Wood, George-Falvy and Debowksi, 1999). Therefore, although there are other motivation mechanisms that could direct action, such as goals and incentives, if a person does not feel capable of carrying out a behavior, no matter how high the rewards, that individual will not carry it out or will feel unable to persevere in their effort in spite of the inconvenience it entails.

However, self-efficacy does not act in isolation; motivation is explained by the relationship between this cognitive judgment of capacity and the emotional state, as well as certain personality variables such as the locus of control. For example, in the model of dynamic cognitive, affective and personality motivation proposed by Mischel and Shoda (1995), the elements are activated (they change from a trait to a state) and interact according to the characteristics of the situation. Hence, a person with high environmental self-efficacy can modify their usual behavior when on holiday in another city or a recreational area. According to these authors, the situation activates that dynamic process through which a person feels capable of carrying out an action, feels satisfied, perceives that their action could help improve the environment, sets high goals or develops analytical strategies that permit them to maintain their behavior and evaluate its effects. Following years of debate about the power of self-efficacy versus the power of goals in the prediction of behavior, the research

has concluded that the difference resides in the level of difficulty of the behavior to be developed (Bandura and Locke, 2003); if the behavior is not that challenging, goals have a higher predictive power, but when the behavior requires greater effort, skills and commitment, self-efficacy presents a higher predictive power. Furthermore, when the behavior does not generate the expected results, maintaining a high judgment of self-efficacy encourages people to persevere in their efforts in contrast with those who feel frustrated and abandon the behavior. The common feature shared by expectations of perceived capacity or self-efficacy and the goals set is that they must be specific. This criterion gives greater support to the motivational process proposed by Mischel and Shoda (1995) that self-regulation mechanisms behave dynamically, only becoming activated in certain situations.

Figure 2 below, adapted from the models of Mischel and Shoda (1995), presents the theoretical framework to understand how personal and situational factors influence behavior. Wood and Tabernero (2000) presented this adaptation in which interaction between personal and contextual elements activates the self-regulation processes that determine analytical strategies (level of effort and perseverance) and, ultimately, performance. The figure shows how “environmental motives”, analyzed in the first part of this chapter, interact and activate self-regulation processes (self-efficacy, goals and emotional state), which determine the analytical strategies used to achieve efficient ERB.

In this model, the impact of the situation on behavior is explained as a function of how individuals perceive and construe the situation. Characteristics of the situation, such as the novelty, difficulty, challenge or complexity of the task, will have an influence on this codification process. Hence, people differ greatly in how they perceive situations and, for this reason, we do not always find a direct relationship and it is necessary to analyze the role of cognitive–affective mediators. For example, receiving a possible penalty for excessive environmental pollution by driving a vehicle could modify the behavior of a driver by causing them to slow down or not modify the behavior if the individual invests in a low consumption vehicle. Behavior will be mediated by the interpretation the individual makes of their situation, past experiences, culture, etc. and the analytical strategies applied to achieve change.

When the situation focuses on generating feelings of guilt in individuals because of the degraded conditions of the environment, this is another example of an analytical situation resulting from a process of codification. In fact, some people assuage their guilt by paying an economic compensation for the resources consumed. New web pages have been set up (www.terrapass.com, www.carbonfund.org/site/, www.nativeenergy.com, www.grist.org and www.self.org) aimed at raising money from individuals that compensate spending with an equivalent amount of free energy. From this perspective, the way in which people codify situations can affect their affective reactions when tackling them. Hence, the perceived characteristics of the situation activate the Cognitive–Affective Processing System. Therefore, the goals people set for themselves, their judgments of self-efficacy and their affective reactions to the task are influenced by how the situation is interpreted (Bandura, 1997; Mischel and Shoda, 1995).

To explain the influence of self-regulation mechanisms on ERB, this chapter presents the results of a study in which 1487 people in a southern province of Spain completed a questionnaire about their motivation to engage in certain behaviors to separate out rubbish in their home. The average age of the participants was 47.3 years. Women made up 72% of the sample and men the remaining 28%. In total, 10.9% of the participants had a university

education, 13.4% had completed secondary education, 59% had primary level education and the rest had not finished their education.

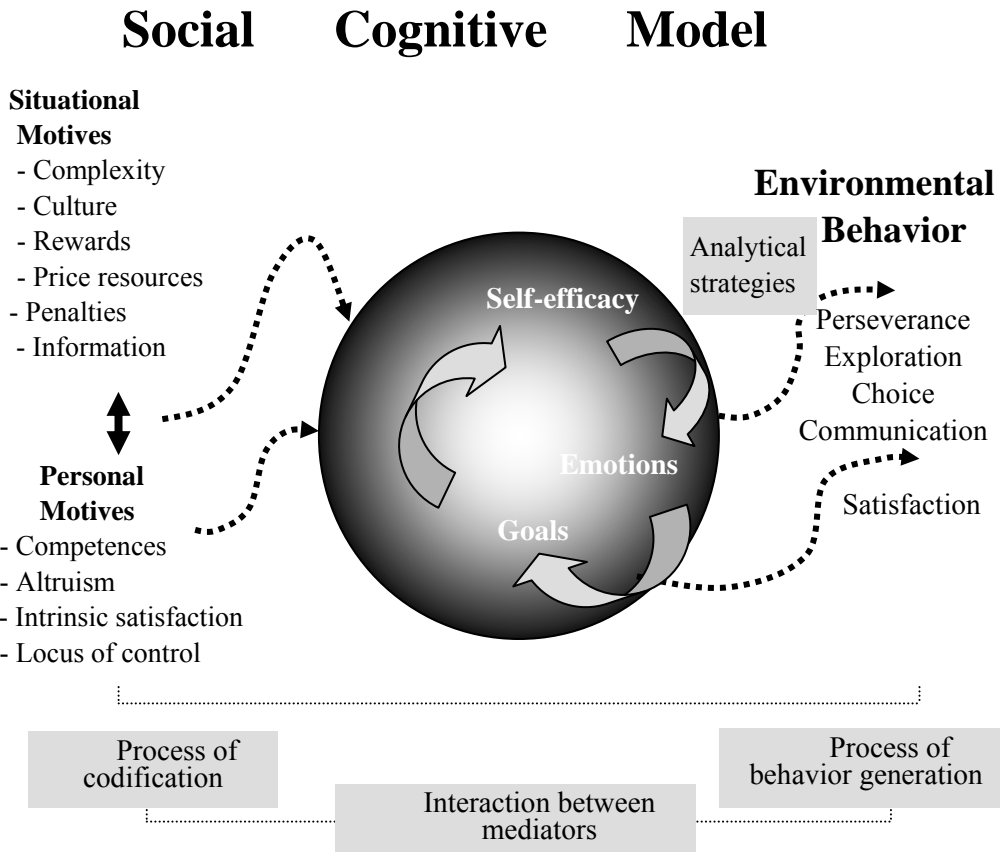


Figure 2. Adaptation of the Cognitive, Affective and Personality System proposed by Mischel and Shoda (1995, Figure 4, p. 254) to explain ERB.

Participants were asked about the extent to which they sorted their rubbish into different materials (paper, glass and packaging) and also about motivational factors for recycling. Specifically, three items evaluated the extent to which the participants recycled and nine items related to motivational variables. The motivational variables were: a) satisfaction, defined as an emotional state experienced by citizens when they engage in environmental behaviors (see Table 1); b) level of goals selected for the future, defined as that which citizens plan to do, their expectations (see Table 2); and c) self-efficacy, understood as a perceived capacity judgment to carry out different environmental behaviors (see Table 3). All these items were evaluated on a 10-point scale (where 1 = not at all, 5 = quite, 10 = totally).

The items that asked participants about the extent to which they felt satisfied with the ERB developed in the past and how they would feel in the future with a similar level of performance (Table 1) reflected a high level of reliability ($\alpha = 0.95$). The responses followed a normal distribution pattern and citizens presented fairly high levels of satisfaction ($M = 6.65$; $SD = 2.20$).

The items about goal expectations (Table 2) displayed a high level of reliability ($\alpha = 0.88$). The answers were distributed normally and citizens presented fairly high goal levels ($M = 7.29$; $SD = 1.95$).

The items that evaluated beliefs about the capacity to separate paper/cardboard, glass and packaging (self-efficacy) presented a reliability index of 0.91 (Table 3). The responses were distributed normally and citizens presented fairly high levels of self-efficacy ($M = 6.83$; $SD = 1.98$).

Table 1. Items to evaluate the participants' levels of satisfaction with their ERB.

Could you rate the following in relation to separating out rubbish in the home ...	Not at all		Not very		Quite		Fairly		Very or totally	
Do you feel satisfied with how much you recycle?	1	2	3	4	5	6	7	8	9	10
Would you feel satisfied doing the same in the future?	1	2	3	4	5	6	7	8	9	10

Table 2. Items to evaluate the level of goals participants set for themselves in relation to their ERB.

Could you rate the following in relation to separating out rubbish in the home ...	Not at all		Not very		Quite		Fairly		Very or totally	
How much would you like to make an effort to do it or do it better?	1	2	3	4	5	6	7	8	9	10
From 1 to 10, rate your current level of recycling?	1	2	3	4	5	6	7	8	9	10
Being realistic, what level would you try to achieve?	1	2	3	4	5	6	7	8	9	10
To what extent do you think you will try and maintain your habits in the future?	1	2	3	4	5	6	7	8	9	10

Table 3. Items to evaluate the level of self-efficacy to engage in ERB.

Could you rate the following in relation to separating out rubbish in the home ...	Not at all		Not very		Quite		Fairly		Very or totally	
To what extent do you feel capable of separating out ALL the paper and cardboard and taking it to the respective container?	1	2	3	4	5	6	7	8	9	10
To what extent do you feel capable of separating out ALL the glass and taking it to the respective container?	1	2	3	4	5	6	7	8	9	10
To what extent do you feel capable of separating out ALL the packaging (plastic, cans and cartons) and taking it to the respective container?	1	2	3	4	5	6	7	8	9	10

Table 4. Multiple regression analysis of the self-regulation variables related to ERB.

	β	t	sig.	Correlations			
				Zero order	Partial	Semi-partial	Tolerance
(Constant)	1.816	23.503	0.000				
Self-efficacy	0.237	13.587	0.000	0.613	0.333	0.267	0.323
Goals	-0.112	-4.688	0.000	0.594	-0.121	-0.092	0.185
Satisfaction	0.195	11.016	0.000	0.541	0.275	0.216	0.254

Analyzing the influence of the three self-regulation mechanisms studied in relation to the behavior of recycling glass, paper and plastics, a significant relationship was obtained with goals (0.54), satisfaction gained through recycling (0.59) and self-efficacy (0.61). A multiple regression analysis (Table 4) of these self-regulation variables explains 42% of the environmental behavior analyzed.

All the self-regulation variables considered contribute significantly to the prediction of ERB. However, the variable that contributes the most is self-efficacy. As regards the variable *goals*, looking at the negative value of β , it is worth pointing out that in addition to the specific contribution it makes, it could also help to enhance the effects of the variables *self-efficacy* and *satisfaction*.

Given that self-efficacy is a self-regulation mechanism – a motivator of behavior – and that, therefore, it acts as a predictor of the same, analysis reveals that people who feel a higher sense of self-efficacy recycle more. The results obtained confirm that citizens who feel a greater sense of self-efficacy recycle glass, paper and plastics. Perceived self-efficacy influences cognitive functioning through its effect on satisfaction with personal development and the level of the goals selected. Certain authors have demonstrated (Bandura and Schunk, 1981; Lent, Larkin and Brown, 1989) that people who start out doubting their capacity feel more dissatisfied with themselves and with their results, and will probably lose interest in the task. Similarly, it is highly probable that they will avoid change and stick to goals they can achieve without taking any risks. Therefore, the higher their perception of self-efficacy, the greater the changes established in the goals selected (Earley and Lituchy, 1991).

As regards future intentions or goals, according to the Goal Setting Theory (Locke and Latham, 1990; 2002), people motivate and guide their behavior through the goals, aspirations and challenges they set for themselves. For goals to be truly effective and change the direction of our endeavors, they must be realistic, assessable, specifically defined and established in the short-term. Hence, goals have a direct effect on behavior when they generate action plans and strategies to engage in the said behavior.

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Chapter 6

ENVIRONMENTAL LEARNING AND GENDER DIFFERENCES

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ABSTRACT

Several studies have attempted to clarify the different aspects of environmental learning. Literature first focused on various kinds of sources of environmental learning. Environmental sources are qualitatively different from one another and identify a different way in which the environment can be experienced. Resulting internal representations of the environment, as well as spatial orientation strategies and abilities, influence each other and, in turn, are all influenced by both visuo-spatial working memory and gender differences. All these aspects are discussed in five sections. The first section describes different sources of environmental learning. The second section illustrates the different types of spatial knowledge in relation to the different sources of environmental learning. Then, the third section shows the role of visuo-spatial working memory in environmental learning and in spatial orientation abilities: the higher the visuo-spatial working memory span the better the environmental learning. The last section discusses gender differences in environmental learning and in spatial orientation abilities. In particular, it shows that different environmental learning strategies are responsible for different spatial orientation abilities and produce a different representation of the environment. The thesis that males approach the environment from a global perspective whereas females focus on local features is illustrated.

1. DIFFERENT SOURCES OF ENVIRONMENTAL LEARNING

Real Environments

Spatial learning in real environments was studied in woods (Malinowski & Gillespie, 2001), buildings (Sadalla & Montello, 1989; Lawton, 1996; Lawton, Charleston, & Zieles, 1996), mazes (Schmitz, 1997) and university campuses (Kirasic, Allen, & Siegel, 1984;

Montello & Pick, 1993; Saucier et al., 2002). All these situations are quite ecological and were used especially for assessing spatial orientation.

In these cases, the environment is offered in a three-dimensional perspective within an intra-route view with visual, spatial and kinesthetic information simultaneously available. When viewing a large-scale world from their normal, within-environment perspective, people must move through the environment to obtain all the information required to develop their spatial knowledge. The process of developing spatial knowledge thus involves integrating the information contained in each visual scene with a range of viewpoint locations, directions and changes, which are controlled by eye, head, and body movements over time (Weatherford, 1985).

In addition, kinesthetic and vestibular information is also integrated with the visuo-spatial information. Some experimental evidence supports the role of the kinesthetic and vestibular information in environmental learning. For instance, Rieser, Lockman and Pick (1980) demonstrated that the mere kinesthetic and vestibular information are sufficient to structure in the mind a detailed spatial representation of the environment. In their experiment, blind people showed an accurate mental representation of a building, developing knowledge in terms of both intra-route view and bird's eye (map-like) perspective.

Kinesthetic and vestibular information constitutes the major limit of simulated environments, where the surroundings are replicated in a three-dimensional intra-route perspective with visual and spatial information. Nevertheless, such virtual situations allow us to control for a variety of disturbing variables and, for this reason, they are preferred by experimental researchers.

Simulated Environments

Some examples of spatial orientation in a simulated environment are 3-D computer simulations (Moffat, Hampson, & Hatzipantelis, 1998; Waller, Knapp, & Hunt, 2001; Lawton & Morrin, 1999; Sandstrom, Kaufman, & Huettel, 1998), video recording (O'Laughlin & Brubaker, 1998) and slide sequences (Holding & Holding, 1989).

Within simulated environments, it is possible to distinguish between situations that allow interaction with the environment (3-D computer simulations) and others that do not (slides and video recordings). In the first one, "active learning", participants can move themselves and actively decide where to go (Ruddle, Payne, & Jones, 1997). In the second one, "passive learning", they are passively shown a static (slides sequence) or dynamic (video recordings) environment.

Apart from kinesthetic and vestibular information, other qualitative and quantitative differences between real and simulated environmental learning exist. Environmental complexity cannot be accurately reproduced in a virtual environment, especially in terms of visual details. For example, the materials of the virtual buildings and the type of terrain the subject is walking on are not assessable easily and the shape of the landmarks is regularized (Ruddle, Payne, & Jones, 1997). Indeed, all these cues are necessary to build a mental representation of the environment. In addition, hardware distortions and cost limitations typically restrict the field of view in virtual environments to 60–100° at best. Operating with a restricted field of view increases the number of times and the angle to which users must rotate their heads to notice what they are walking past. The lack of peripheral vision has been shown

to be important when learning the spatial layout of a room (Alfano & Michel, 1990). In desktop virtual environments, movements are controlled by an abstract interface (mouse, keyboard, etc.) and the information that may be acquired from any single view is affected by the field of view and the presence of and type of cues that facilitate position and direction judgments.

Spatial knowledge formed in a Virtual Environment could be different from one that is formed in the real world. In desktop Virtual Environments, users receive feedback on their rotational and translational movements, which respectively cause changes of direction and position, solely from visual changes in the scene displayed. Visual continuity during these changes in view direction is achieved by constraining the rate at which the view direction is allowed to change.

As already said, even if the environment could be offered in a three-dimensional perspective with all the visual details accurately represented, kinesthetic information is missing. No vestibular or kinesthetic feedback is provided when users change their view direction, since eye, head, and body rotations are simulated using an abstract interface. Translational movements are also typically controlled by using an abstract interface, and, therefore, users experience no physical locomotion.

Other studies have shown that people make significantly greater errors in directional judgments when imagining their body has been rotated than when physically rotating it (Presson & Montello, 1994; Rieser, 1989).

In sum, simulated sources of spatial learning are less ecological than real environments. Nevertheless, some experimental evidence supports the fact that virtual environments still can offer a good representation of the real world.

Ruddle, Payne and Jones (1997) investigated differences between real and virtual indoor environmental learning. Participants learned the layout of large-scale "virtual buildings" through extended navigational experience, using the "desk-top" (i.e., non-immersive) virtual environments. Results showed that users who navigate large-scale virtual buildings develop route-finding abilities and some map-like spatial knowledge (direction judgments and relative straight-line distance judgments), which are as accurate as those abilities and spatial knowledge developed by people who work in real buildings.

Rossano, West, Robertson, Wayne and Chase (1999) investigated the nature of the spatial knowledge obtained from a computer model of a campus environment. A series of tests were administered to assess the spatial knowledge of subjects who learned a campus environment from a computer model or from direct experience. Though the "computer model" experimental group had never been on the campus before, 70% of "computer model" subjects were flawless in their ability to navigate from one specific location to another. Computer experience can be equally effective in larger and more open environments. Indeed, many of the computer subjects reported feeling very confident in their ability to find their way around the campus, and indicated a sense of familiarity (as if they had 'been there before') when tested in the actual environment.

Verbal Descriptions

Many studies (Bryant, Tversky, & Franklin, 1992; Denis, 1996; Pazzaglia, Cornoldi, & Longoni, 1994; Perrig & Kintsch, 1985; Taylor & Tversky, 1992a) have found that

participants spontaneously construct a spatial mental model as a result of listening to or reading the description of spatial patterns and environments.

The literature on spatial descriptions shows that the description of an environment can assume two different main perspectives: intra-route view or bird's eye (map-like) view (Tversky, 1981).

The intra-route descriptions assume the point of view of a person who is moving through the environment. They are characterized by the use of an intrinsic frame of reference and egocentric terms, such as right, left, front, and back, and have a linear organization, given by the sequence of landmarks encountered along the route itself.

The map-like descriptions provide an overview of the spatial layout, sometimes with a strong hierarchical organization (Taylor & Tversky, 1992b). An extrinsic frame of reference and canonical terms such as north, south, east, and west are used. In this case, participants are initially provided with the general configuration of the environment and, successively, single items are mentioned and allocated therein. Thus, the comprehension process starts from a more global, visual structure, which is successively filled by local substructures.

By contrast, the intra-route descriptions are usually characterized by a linear organization with the order of items given in the order in which they are encountered along the route. Comprehension of the descriptions requires the implementation of a sequential process, characterized by continuous changes of perspective as a function of proceeding along the route.

The type of verbal description of an environment can affect the subsequent mental representation of the environment itself.

In Sardone, Bosco, Scalisi and Longoni (1995) participants learned a fictitious environment for 5 or 10 minutes, by reading the verbal description with either an intra-route view or a bird's eye view. Then, subjects were asked to operate some spatial inferences concerning landmarks into the learned environment, starting from some premises. Such premises could be offered with an intra-route view or with a bird's eye view. Therefore, they could be with the same view of the learned environment (congruent) or with a view different from the original environmental description (incongruent).

Results showed that in some cases, response times were slower for incongruent than for congruent inferences. Unfortunately, this effect did not emerge for all the conditions and for long time of learning (10 minutes). However, the results demonstrated that the type of spatial description of the environment affects its consequent mental representation.

Maps

Environmental learning can also occur by means of an apposite tool: the map (Galea & Kimura, 1993; McGuinness & Sparks, 1983; Ward, Newcombe, & Overton, 1986; O'Laughlin & Brubaker, 1998; Dabbs, Chang, & Strong, 1998; Brown, Lahar, & Mosley, 1998; Miller & Santoni, 1986; Coluccia & Martello, 2004; Coluccia, 2008; Coluccia, Bosco, & Brandimonte, 2007; Coluccia, Iosue, & Brandimonte 2007). According to Rossano & Moak (1998), map learning is a simple and fast way to acquire many details about the environment.

Thorndyke and Hayes-Roth (1982) found that subjects who studied a map of a building had an optimal performance in a *Euclidean distance task* and in an *object location task*.

Similarly, Hirtle and Hudson (1991) found that subjects who learned the environment from a map are very accurate in straight-line distance and in pointing tasks. They also preferred giving verbal descriptions in terms of cardinal points (for ex. "I go towards the North") and Euclidean distances (for ex. "I turn to right after 300 meters!"). Indeed, individuals who learn from a map, represent the environment in a configurational manner, according to a "bird's eye" perspective (Taylor & Tversky, 1996). Next chapter is going to discuss further the map learning issue.

2. LEARNING FROM MAPS

In everyday life, when we move within familiar environments, we usually know the names and the positions of the nearby objects. In unfamiliar environments, maps can help us to acquire familiarity with the surroundings, as they depict the information that we need to move through the environment.

All streets, pathways, objects and landmarks are considered elements (Thorndyke & Stasz, 1980). Explicit knowledge is referred to labels, shapes and locations of elements in the environment. Implicit knowledge is referred to the information about the spatial relationship between elements like reciprocal positions and distances. All information (both explicit and implicit) is represented in a map in a concise and symbolic manner. A map could be also defined as a symbolic bidimensional representation of an area enough extended to allow a person to move within (Thorndyke & Stasz, 1980). People usually need to memorize map to find a route, to move from one place to another, to understand the features of an area or finally to know the distances between two objects. Map learning is a constructive process that produces in Long Term Memory a mental representation of the environment depicted (Thorndyke & Stasz, 1980).

A typical characteristic of map learning is the presentation of different stimuli all at once. In fact, the to-be-learned information is simultaneously presented on a map (Thorndyke & Stasz, 1980). A map is also quite complex to study, because it requires the learning of many locations, verbal labels, shapes, dimensions, absolute and relative positions of objects, links, routes and colors. For example, a simple red line representing a highway contains information about dimensions, shape, distance, direction, the elements that the road connects and other roads crossing it. Many cognitive processes are implicated in map learning and usually learners need to utilize some strategies in order to integrate the spatial and visual information altogether.

Many studies demonstrated that map information could be as a mental image (Kosslyn, Ball, & Reiser, 1978, Rossano & Warren, 1989). Otherwise, information acquired from maps could be represented in a semantic manner (McNamara, Halpin, & Hardy, 1992). For instance, associative links between map elements or spatial categories may be better stored in memory as semantic notions (McNamara, Halpin, & Hardy, 1992). It is not appropriate entering in this long-lasting debated issue here. Probably, both the representational systems (imaginative and semantic) are fundamental in order to elaborate different aspects of the same map (Rossano & Hodgson, 1994).

Recall of elements is better performed by semantic strategies, while learning of locations is better performed by visuo-spatial strategies and imaginative systems. Then, different types

of map information can rely on different mental representation (semantic or imaginative): when imaginative learning is adopted, a mental image is stored in memory; on the contrary, when verbal learning is used, semantics rules about map elements are stored (Rossano & Hodgson, 1994).

Kulhavy, Schwartz, and Shaha (1983) found that memory for a map can be improved by the presence of boundary, edges or networks of streets. Such elements give to the map a spatial structure that can help to form in mind a kind of “mental grid” (Kulhavy et al., 1983). Such a grid, in turn, facilitates the learning of the map, as it offers an overall organization that eases the scanning and the partitioning of the map and the positioning of elements. Rossano and Morrison (1996) used an experimental map of a university campus. This map included a main central road and marked perimeter, which were meant to facilitate an “interpretative framework”. Results showed that both the peripheral landmarks and the landmark on the main road were better recalled and better positioned. In sum, both the salient landmarks and a structured framework of roads facilitate the organization and consequently the learning of the map.

Alignment Effect and Orientation Specificity

When people study a map, they never change their point of view. As opposed to a representation deriving from a direct experience, map information depends on orientation and it is considered an allocentric representation, since the observer is not directly involved (Levine, Marchon, & Hanley, 1984). Presson and Hazelrigg (1984) make a distinction between spatial information that depends on perspective at the moment of acquisition (orientation specific) and spatial information that can be used within different points of view (orientation free).

Many studies (Presson, De Lange, & Hazelrigg, 1989; Presson & Hazelrigg, 1984; Rossano & Warren, 1989; Giraudo & Pailhous, 1994) confirmed that in map learning information of spatial relations is stored in a specific orientation perspective. This “orientation specificity effect” can be easily demonstrated using a *pointing task*. In this task, subjects are instructed to indicate the direction of a target landmark using judgments in terms of angular degrees starting from a hypothetical 0° in front of them. In the “aligned condition”, the starting point (0° in front of you) is aligned to the north of the map. In this condition, subjects are requested to imagine their position in the same perspective respective to the studied map. On the contrary, in the “misaligned condition” the 0° starting point is misaligned to the north of the map (for ex. 45° degree). In this condition subject are requested to imagine their position in a different perspective respect to studied map.

Rossano and Warren (1989) found a strong alignment effect in the “map learning group”, while no significant differences emerged in the “virtual reality group” (“real navigation-like” perspective). Levine et al. (1984) found similar effects in “you-are-here” maps. A “you-are-here” aligned map was positioned in the same direction as real location, while a “you-are-here” contraligned map was positioned at 180° respecting to the real surroundings. Target location performance was seriously affected by contraligned map in terms of accuracy and time taken.

Consistently with these results, Evans and Pezdek (1980) suggested that spatial information from map leads to an orientation-specific representation and spatial information

from real navigation or virtual tour (Rossano & Warren, 1989) lead to an orientation- free representation.

Distortions in Representation of Maps

Spatial knowledge is not immune to distortions in representation and “mental shortcut” (heuristics). For example, the sentences “London is further south than Berlin” and “Rome is further north than Washington” are correct, but they probably disagree with our mental representation. This happens as we normally use heuristics in order to organize our spatial knowledge. Then, our mental representations do not mirror perfectly the spatial relation between objects in the real environment. The particular heuristics in the above example is called “part-whole”. It is the bias not to estimate spatial relation directly comparing two elements, but basing on their high-order hierarchy. For example, we think that London is further north than Berlin, because, on the whole, England is further north than Germany, but in reality London is further south than Berlin.

Tversky (1981) claimed the existence of at least two different kinds of heuristics in map learning: “rotation” and “alignment”. Rotation heuristic is the tendency to rotate the position of target object towards the main reference axis (vertical and horizontal). This phenomenon is due to a spontaneous bias to move the real position of object toward the cardinal points. For example, Italy is thought to extend from north to south, while the real direction is from South-East to North-West.

Alignment heuristic is one’s tendency to align the objects position one to each other in order to organize a regular structure in the mental representation. Similarly, Glickson and Avnon (1997) found a bias amongst American people in recalling their own continent in a very regular way. These two heuristics give the impression to be similar but, in rotation heuristic, the whole configuration is translated toward absolute coordinates, while, in alignment heuristic, single map elements are aligned one to each other.

Many other biases have been found in map learning. Streets containing many landmarks are considered longer (Briggs, 1973). Number of turns in a route proportionally affected the estimation of route length (Allen, 1981; Sadalla & Magel, 1980). Very curved paths are estimated to be longer than linear paths (Byrne, 1979). Finally, Tversky (1981) demonstrated that corner formed by two crossing ways are rectified towards 90°.

3. DIFFERENT TYPES OF SPATIAL KNOWLEDGE

Some research (Siegel, Herman, Allen, & Kirasic, 1978; Thorndyke & Stasz, 1980) demonstrated that, when we learn by real navigation, the kind of spatial knowledge changes depending on the familiarity with environment. These different types of spatial knowledge can be considered a qualitative development in the spatial representation of the environment, starting from knowledge about routes as far as to an abstract map-similar knowledge (Siegel et al., 1978).

Siegel (1981) proposed a developmental model of spatial knowledge. The “landmark knowledge” is the first one to be acquired. Landmark knowledge is the ability to identify

salient points of reference. Then you can develop to “route knowledge”, the knowledge of landmarks and turns in a temporal sequence about routes. Route knowledge is necessary to reach the most advanced kind of spatial knowledge: “survey knowledge”. Survey knowledge is a global understanding of the environment and interrelation between map elements. Such developmental sequence suggests that different types of knowledge are strictly linked. Landmark knowledge predicts route knowledge, which, in turn, is a good predictor of survey knowledge (Anooshian & Young, 1981; Cousins, Siegel, & Maxwell, 1983).

Similar theoretical distinction between procedural descriptions and configurational knowledge can be made. Procedural descriptions are referred to knowledge about routes. Such knowledge is likely to emerge by real navigation. Information is sequentially coded and deals with starting point, arrival point, and internal-to- route landmarks (Thorndyke & Hayes-Roth 1982). Such sequence of actions is a whole of stimuli and rules of actions (Thorndyke, 1981). Procedural knowledge has many others information, like the sensation of covered distance, the knowledge about time of walking, straight-line location of starting point and particular details of objects met during navigation (Thorndyke & Hayes-Roth 1982).

Exhaustive definition about route and survey knowledge can be found in Bosco and Longoni (1995). According to the authors, route knowledge is concerned with complex structures of spatial relations that are acquired and stored in a sequential manner. We can use this knowledge to know how to get from a starting point to an arrival point in the environment and to estimate route distances between landmarks. Survey (or configurational) knowledge is concerned with an immediate representation of the whole environment and reciprocal spatial relation between landmarks. This information is easily acquired from bird’s eye viewpoint or from maps. We can use this knowledge, to point to an unseen object in the environment and to estimate Euclidean distances between landmarks (Bosco & Longoni, 1995).

Moreover, Pazzaglia, Cornoldi and De Beni (2000) give an additional description: “the survey representation is explicitly offered when a place is observed from the bird’s eye perspective (i.e. flying on an area) or from a map. The route representation is explicitly offered when sequentially navigating through a maze or path”. Landmark knowledge comes from the familiarization with a reference point. Only the mere position of such reference point is known, but the relative positions between landmarks and the interconnections between landmarks are not. Route knowledge relates to the knowledge of the connections between the landmarks, but nothing is known about the relative positions of the landmarks. In other words, route knowledge allows navigating from a reference point to another one, without knowing the relative positions between the landmarks. Then, the survey (or configurational) knowledge refers to a cognitive map, which implies the knowledge of the reciprocal interrelations between of the landmarks positions.

According to the Siegel and White (1975)’s model, the survey knowledge is the most complete. Indeed, from this knowledge information concerning landmarks positions and information concerning routes can be deduced. Initially, Siegel and White (1975) and Siegel (1981) based their studies on the considerations of Piaget concerning the development of the reasoning in children. Hence, the three steps of the evolution of the spatial knowledge were meant to be associated to the development of the human reasoning and, in effect, first experimental evidence confirmed that children progressively developed their spatial representation according to the three types of spatial knowledge (Herman & Siegel, 1978; Cousins et al., 1983).

However, next research showed that this model could be applied also in the adult life when referring to the acquisition of new spatial information. Hence, when individuals explore a new environment, their spatial knowledge starts from the landmark knowledge, then it progresses to the route knowledge and, finally, terminates with the survey knowledge. The stages for acquiring new spatial knowledge in adults mimic the stages of the development of spatial representation in children.

Such a sequential and progressive development of spatial knowledge was criticized by Anooshian (1996). The author asserts that the three types of spatial knowledge are not necessarily in a sequential and progressive order of development. According to the author, the survey knowledge does not necessarily require the route knowledge, which in turn does not essentially require the formation of the landmark knowledge. All these three types of spatial knowledge are alternative and independent from each other.

Indeed, Anooshian (1996) found no correlation between the survey and route components of the spatial knowledge, showing their reciprocal independency. People with very good configurational knowledge did not necessarily show good route knowledge and vice versa. According to Anooshian (1996), information concerning the turns or the sequence of elements along the route can be codified and organized independently from the information concerning positions.

Furthermore, Anooshian and Kromer (1986) reported that the well-localized landmarks were different from the landmarks in which the distance estimation was good. In other words, an accurate distance judgment between two landmarks does not necessarily imply the knowledge of the position of these landmarks.

In summary, results demonstrate the existence of qualitatively different and independent types of spatial knowledge, that is, Landmark, Route and Survey knowledge. Such a distinction is valid both for children's development of spatial knowledge and for adults' learning of new environments. The formation of the type of knowledge can be influenced by the source of environmental learning. For instance, a map supports the formation of the survey knowledge, while the real navigation supports the formation of the route knowledge. Survey knowledge seems to be the most complete knowledge as it contains information about absolute and relative landmarks positions and routes.

Switching from one type of knowledge to another one is possible but it does not happen spontaneously, and it requires a cognitive effort and intentional processes.

Relations between the Type of Environmental Source and the Type of Spatial Knowledge

Different types of spatial knowledge can also depend on different sources of environmental learning. Thorndyke and Hayes-Roth (1982) compared subjects with more than two years of direct experience of working in a building contrasted to subjects studying a map of the same building. "Map-subjects" performed better than "direct experience subjects" on Euclidean distance tasks and object location task.

Map-subjects are thought to pay particular attention to configurational aspects and to construct an allocentric (= object location in relation to the environment) perspective of the surroundings using cardinal points (e.g. "I go towards the North") and/or Euclidean distances (e.g. "I turn to right after 300 meters!").

On the contrary, “direct experience subjects” performed better in route distance estimation. They are thought to construct an egocentric (=object location in relation to my own body) perspective of the environment (for ex. “I turn to my right, then to my left”).

Many results confirmed these findings. Moeser (1988) compared the spatial knowledge of subjects learning a map and subjects with two years of real navigation. The author found that participants with more than two years experience in a building had well-developed route knowledge, but their survey knowledge was less accurate than participants without any direct experience but who studied a map of the same building.

Similarly, Lloyd (1989) found that, in landmarks-localization task, subjects with 10 years direct experience in an environment were slower and less accurate than subjects who learned the same environment studying a map for 5 minutes. According to Lloyd (1989), real navigation-participants were slower and less accurate because, in order to complete the landmarks-localization task, they needed to transform their route knowledge (spontaneously formed from real navigation) in survey knowledge.

Taylor and Tversky (1996) demonstrated that individual learning a map can give verbal descriptions of the environment using both a “route perspective” and a “bird’s eye” perspective. When they learned from real navigation, verbal descriptions of the environment were only in a “route perspective”.

In Hirtle and Hudson (1991), subjects who learned the environment from a map were more accurate in straight-line distance and pointing tasks than subjects who learned the environment in a route perspective from a slide sequence. In route distance judgment, significant differences did not emerge between the two groups.

In the same way, Giraudo and Pailhous (1994) found that participants with direct experience of navigation did not improve their performance in repeating an object location task. On the contrary, the more the task was repeated the more the participants with map experience were accurate and fast. In other words, learning from maps yields a significant improvement in locating elements, while no improvement is given by real navigation.

Conversely, when the spatial information is acquired by means of real navigation, the formation of route knowledge is promoted (Thorndyke & Hayes-Roth, 1982; Rossano et al., 1999). In Rossano et al. (1999)’s study, participants who learned the environment from direct navigation demonstrated an accurate knowledge concerning how to go from a place to another one and concerning distances estimation in terms of route. Nevertheless, they do not have knowledge about the whole environmental structure. On the contrary, individuals who learn from a map show a good knowledge about the configuration of the environment, but they are less able to use the routes (Rossano et al., 1999).

4. THE ROLE OF VSWM IN ENVIRONMENTAL LEARNING AND IN ORIENTATION ABILITIES

Previous research on Working Memory showed its important role in different cognitive processes. Verbal Working memory and the elaboration of linguistic information has been extensively studied in the last 30 years. Verbal Working memory was demonstrated to play an essential role in mathematical tasks (Logie & Baddeley, 1987; Logie, Gilhooly, & Wynn, 1994), in text reading and comprehension (Baddeley, Lewis, Eldridge, & Thomson, 1984), in

problem solving (Gilhooly, Logie, Wetherick, & Wynn, 1993; Saariluoma, 1991) and in learning a new language (Baddeley, Papagno, & Vallar, 1988; Gathercole & Baddeley, 1989).

Only recently, researchers directed their attention to the functions that Visuo-Spatial Working Memory (VSWM) can play in everyday cognitive tasks.

According to Baddeley (1990), VSWM is important for the geographical orientation and for planning spatial tasks. A similar hypothesis was also formulated by Kirasic (1991). Indeed, the author claimed that VSWM can be considered essential for environmental learning.

A body of indirect evidence and direct studies support the hypothesis of an involvement of VSWM in environmental learning.

Indirect Evidence

Some correlational studies hint a relationship between VSWM and environmental learning skills. From a factorial analysis, Allen, Kirasic, Dobson, Long, and Beck (1996) extracted a factor called "Spatial Sequential Memory" and a factor called "Topological Environmental Knowledge".

The factor "Spatial Sequential Memory" is derived from the performance on a *Maze Learning Task* and a *Maze Reversal Task*. In these tasks, subjects are instructed to learn for 15" a pathway. In test phase, they are asked to reproduce the same pathway beginning either from the starting point (Maze Learning Task) or from the ending point (Maze Reversal Task). Even if these two tasks are not properly VSWM span tests, they could be considered as approximately measuring VSWM.

The "Topological Environmental Knowledge" is the factorial result of some "environmental learning tasks" performed after the navigation in a real environment, by means of a walk, which occurred through a small city.

The environmental learning tasks loading on the "Topological Environmental Knowledge" factor were: "Route Reversal Task", "Scene Recognition and Scene Sequencing Tasks", "Intra-Route Distance Judgment Task" and "Map Placement Task".

In the *Route Reversal Task*, participants were asked to retrace the walk they had originally taken, starting at the endpoint and finishing at the point of origin.

In the *Scene Recognition task* participants had to recognize photographic scenes from the original walk.

The *Scene Sequencing task* was designed to assess participants' temporal-spatial knowledge of the original route. Participants were provided with randomly ordered photographic prints showing scenes from the walk, and were instructed to arrange them in proper temporal sequence starting with the beginning point of the walk.

The *Intra-route Distance Judgment task* was designed to assess participants' knowledge of metric distances along the original route. The same photographs used in the *Scene Sequencing* task were employed, with the order produced by the participant in the *Scene Sequencing* task preserved. Participants produced distance estimates between adjacent scenes.

Finally, the *Map Placement Task* was designed to assess participants' configurational knowledge of the area through which the original walk passed. Task materials consisted of the same photographs used in the previous two tasks and a street map of the area in which the

route was situated. Participants were shown the photographs one at a time and instructed to mark on the street map with a pencil the exact location depicted in the scene.

Allen et al. (1996) found that the “Spatial Sequential Memory” predicted the “Topological Environmental Knowledge”. This study suggests that learning of a new environment is supported by VSWM.

It is worth noting that neither the “*Euclidean Distance Judgment*” nor the “*Direction Judgment*” loaded on the “Topological Environmental Knowledge”. In the *Euclidean Distance Judgment* and in the *Direction Judgment*, participants were instructed to provide Euclidean distances and direction estimates from one viewpoint to a series of six unseen target Locations along the walk.

What is more, these two tasks were not predicted by the Spatial Sequential Memory, showing correlation near to zero between the two *Maze Tasks* and the *Euclidean Distance Judgment*. This result suggests that on the one hand the “Spatial Sequential Memory” is scarcely involved in the learning of the reciprocal interrelations between the landmarks positions (*relative positions*). On the other hand, “Spatial Sequential Memory” predicts the “Route Knowledge” (“Route Reversal Task” and “Intra-Route Distance Judgment Task”) and some aspects of the survey knowledge like the “*absolute positions*”, namely the position of an object with respect to a structured system of coordinates (“Map Placement Task”).

The involvement of VSWM in route knowledge was also strongly supported by Pazzaglia and Cornoldi (1999). The authors found that subjects with higher score in the Corsi Block Test had better memory for the verbal description of a route.

Twenty-two students differentiated for their spatial ability, served as participants. They had been chosen from a sample of 34 undergraduate students. Measures of individual differences in spatial ability were collected using Corsi’s block test (Milner, 1971), in which participants have to retain a sequence of targeted movements performed by an experimenter. Participants were defined as “low spatial ability” individuals if they had a score equal to or lower than 5 in the Corsi block test and as “high spatial ability” if they had a score higher than or equal to 7 in the Corsi block test. A verbal digit span test was also administered and the two groups were matched for verbal span. Next, a spatial text containing the description of an Italian city was given to the participants. The text described how to go from one part of the city to another. During a group session, participants were required to read the written description for no more than two minutes.

As soon as they had finished reading, they had to write all the relevant information they could remember: they were allowed to recall the information in any order on condition that the correct spatial information was preserved.

Results showed that performance for the “high spatial ability” group was significantly better than that for the “low spatial ability” group. This result suggests a role of VSWM in learning and processing of new routes, even if the environment is presented in a verbal modality.

Conte, Cornoldi, Pazzaglia, and Sanavio (1995) found similar results. In their study, children with higher score in VSWM tests, as measured by the task of “reproducing the exact position of some cells in a matrix” and the task of “following a pathway in a matrix”, also were better in a spatial orientation task, which consisted in learning to move, blindfolded, within a room. Results hint to a relationship between environmental learning skills and working memory. Finally, Vanetti and Allen (1988), in a study looking at the communication

of environmental knowledge, found that high spatial ability subjects were significantly better at producing effective route descriptions.

A body of studies using dual task methodology, showed the implication of VSWM in memory for movements and spatial navigation. Smyth and Scholey (1994) found that the memory for a sequence of observed arm movements to a series of random block on a tabletop was disrupted by asking volunteers to perform unrelated arm movements during presentation. These results indicate an overlap in the cognitive resources required for movement memory and those required for movement execution. Some other studies have indicated that these cognitive resources also might be involved in spatial learning.

Pazzaglia and Cornoldi (1999), using a selective-interference paradigm, demonstrated that the spatial WM plays an essential role in the processing of route descriptions. Route memory performance was found to be selectively disrupted by a concurrent spatial-sequential task. In their study, two types of matched descriptions of the same environment were made up: descriptions from a route perspective and descriptions that focused on the visual features of the same environments (visual descriptions). The descriptions regarded four different environments: two enclosed environments (a zoo and a sports centre) and two open ones (a farm and a tourist centre). Two concurrent tasks, one visual and one spatial were arranged. For the visual concurrent task, layouts of figures were projected on a computer screen. The layout was either the same as in the previous presentation, or it differed by one figure. The participants' task consisted in detecting when a figure had been changed with respect to the layout immediately preceding it. In the spatial- sequential version of the task, a series of five figures was projected on a computer screen. In the next presentation, either the figures were presented in the same order, or the order of presentation changed by reversing two figures. The visual and route descriptions of the environment were auditorily presented to the participants, who were also required to perform the visual or spatial-sequential concurrent task. A free recall task was required at the end of each description.

Results showed a significant interaction between the type of description and the version of concurrent task: A selective interference pattern emerged, with route descriptions more disrupted by the concurrent spatial-sequential task than by the visual task. Visual descriptions of the same environment were equally disrupted by the two concurrent tasks. These results suggest that the spatial-sequential components of Working Memory are particularly involved in memory for routes.

Finally, in a study by Smyth and Waller (1998), professional climbers were trained on two routes of a climbing wall, one vertical and one horizontal. After training, subjects imagined climbing the routes under control or concurrent spatial tapping conditions. *Spatial tapping*, which is supposed to impair the VSWM processing, impaired the performance on "mental climbing" for both routes. Indeed, to complete mentally the routes, subjects under tapping conditions took more time than subjects under control condition did. This result suggests that VSWM supports planning and execution of a route.

All the above results suggest the existence of a link between VSWM and learning or representation of the environments.

Direct Evidence

More direct evidence supporting the hypothesis of the involvement of VSWM in environmental learning stems from map learning studies.

Recently, Garden, Cornoldi and Logie (2002) have investigated the role of VSWM in route learning in two experiments. The authors, using a dual task methodology, found that *Spatial tapping* disrupted route recognition more than *articulatory suppression*.

In the first experiment, participants learned either route segments from map or non-sense words. The learning phase could include either a concurrent *spatial tapping* task or a concurrent *articulatory suppression* task.

For the *route-learning task*, two routes were chosen from the map of a real city (Padova). All subjects were told that routes would be presented as a sequence of individual segments and that they must try to remember them. Following presentation of the segments there was a blank interval of 90 seconds. After the retention interval, subjects were given a recognition test in which they were shown the segments in the same order as before, but this time for each segment the map showed a choice of two or three alternative directions. Subjects were asked to indicate rapidly by pointing to what they thought was the correct segment. Immediately after the subject's response, a new segment was presented.

For the *Nonsense word learning task*, two lists of nonsense words were prepared for the presentation phase. These words were characteristically not easily associable to existing words in Italian. The letters of each nonsense word were then rearranged to form three similar nonsense words, which acted as alternative choices in the recognition phase. Two booklets were constructed for the recognition phase, one for each list. An example of nonsense word from list one was DILUFO and the corresponding recognition set for the word was FOLIDU, LIDUFO, DULIFO, DILUFO. The *nonsense word task* followed the same procedure as employed for route-learning. Following a retention interval of 90 seconds, subjects were shown a series of sheets each containing four items, one of which was identical to an item seen previously (see example above). The task of the subjects was to point to the word that they thought had been seen previously. The sequence of items followed the same order as used at presentation.

One visuo-spatial and one verbal concurrent task were arranged.

The *articulatory suppression* task involved using a sequence of syllables selected on the basis of being fully monosyllabic when pronounced by Italian speakers: "Ba/Be/Bi/Bo/Bu/Ca/Ce/Ci/Co/Cu". The subjects were instructed to say aloud the sequence of syllables at a rate of one syllable per second.

The *spatial tapping* (visuo-spatial concurrent task) involved a custom-made keypad comprising a matrix of 3 x 3 square, black, wooden keys. The subjects were instructed to tap the nine keys at a rate of one tap per second in a specified pattern, which had a forward movement from the top-left square to the bottom-right square, followed by the same sequence of movements in reverse.

From the map learning task emerged that *spatial tapping* impaired the route recognition performance more than *articulatory suppression*. On the contrary, from the non-sense words learning task emerged that *articulatory suppression* impaired the words recognition task performance more than *spatial tapping*.

The effects of *articulatory suppression* on the nonsense word learning confirm previous evidence showing that the articulatory loop is particularly critical in learning new languages

and nonsense words (Papagno, Valentine, & Baddeley, 1991). In the recognition task, the distractors had a similar global form and included the same letters in a different order. The nature of the recognition task required that the subject encoded the phonological-articulatory features of the target words and then, during the recognition test, examined the phonological-articulatory features of the proposed alternatives. However, in the route-learning task the opposite pattern was found, suggesting that a different component of the working memory system, namely VSWM, may be involved in decisions about different route segments, to a larger extent than the articulatory component.

In a correlational study by Bosco, Longoni, and Vecchi (2004), participants were required to study the map of a real environment and to perform a battery of tasks requiring the knowledge of the studied map (map-knowledge tasks).

The authors found that VSWM predicted performance in some map-knowledge tasks (landmark recognition task, landmark's surrounding recognition task, map completion task and route recognition task). Eight map-knowledge tasks and four VSWM span tests were arranged for their study.

Map-knowledge tasks: A battery of 8 tests based on a map-learning procedure was designed. A simplified map of the Roman Palatino, an archaeological site open to visitors, was prepared. The map was colored and included sixteen landmarks. After map-learning phase, participants were asked to perform the 8 map-knowledge tasks, which were built up accordingly to the Siegel and White (1975)'s model of different types of spatial knowledge.

To measure the *landmark knowledge*, the "Landmark recognition" and the "Landmark surrounding recognition" tasks were made up. *Landmark recognition:* each landmark was presented together with two alternatives modified for small visual details and participants had to identify the correct picture. *Landmark surrounding recognition:* each landmark and its surrounding area of the map were presented together with two alternatives in which only the surroundings were incorrect. Participants had to identify the correct picture.

To measure *route knowledge*, the "Route recognition", the "Wayfinding" and the "Route distance judgment" tasks were arranged. *Route recognition:* Participants had to identify the correct pathways between two designated landmarks. *Wayfinding:* participants were asked to follow a pathway and finally to indicate the arrival point. *Route distance judgment:* Participants had to identify the longest route-distances between a designated landmark and three alternatives.

To measure *survey knowledge*, the "Map completion task", the "Map section rotation" and the "Euclidean Distance Judgment" were made up. *Map completion task:* participants had to locate all the sixteen landmarks in an empty map. *Map section rotation:* Eight experimental stimuli showing the spatial relations among three landmarks were designed. Within each trial, four alternatives were presented each including the same three landmarks in different spatial relations. Performance was evaluated in terms of number of correct trials. *Euclidean Distance Judgment:* Participants had to identify the longest distances between a designated landmark and three alternatives.

Four VSWM span tasks tapping the simultaneous/sequential and the active/passive aspects of VSWM were arranged.

In the "Jigsaw Puzzle task" (Richardson & Vecchi, 2002) subjects were simultaneously presented with numbered fragments of a picture of a stated object. Participants had to solve the puzzle, not by moving the pieces but by writing down the corresponding numbers in the

correct positions on a response grid. This task is supposed to tap the active and simultaneous components of the VSWM.

In the “Mental Pathway task” (Vecchi & Cornoldi, 1999) participants had to follow pathways made of statements of direction (e.g. left, right, forward, and backward) in matrices of different complexity. This task was considered by the authors as an active and sequential task.

In the “Visual Pattern test” (Della Sala, Gray, Baddeley, & Wilson, 1997) participants were presented with a matrix filled by random black squares only for two seconds and then were asked to reproduce the shown pattern of black squares on a completely blank matrix. This task is supposed to tap the passive and simultaneous components of VSWM.

Finally, in the “Corsi span test” (Milner, 1971), a passive and sequential task, the subjects had to reproduce the sequence of positions previously shown by the experimenter on a wooden board comprising nine blocks arranged in random positions.

After a 10 minutes session of map-study, each participant was tested on the eight map-knowledge tasks. In a separated session, the subjects’ VSWM span was tested using the four tasks previously described.

Multiple regression analyses showed that the VSWM span significantly predicted overall map learning. Namely, the involvement of VSWM was more evident for the two active tasks (Jigsaw Puzzle task and Mental Pathway task) than for the passive tasks (Visual Pattern test and Corsi span test). Moreover, considering each map-knowledge task separately, it emerged that half of the map tasks (*Landmark Recognition*, *Landmark Surrounding Recognition*, *Route Recognition* and *Map Completion Task*) were predicted by the VSWM task. It is worth noting that, three out of the four tasks, which were not predicted by the VSWM task, were tasks about distance estimation (*Euclidean Distance Judgment* and *Route distance judgment*) and, more in general, tasks requiring the knowledge of the reciprocal landmarks’ locations (*Map section rotation*).

These results mimic Allen et al. (1996)’s results in which learning of the *relative positions* (*Euclidean Distance Judgment* and *Direction Judgment* tasks) was unrelated to VSWM.

Coluccia and Martello (2004) studied the relation between VSWM and map learning extending previous results by Bosco et al. (2004) to different types of maps. Indeed, two structurally different maps were compared on the same map knowledge tasks and on the same VSWM span tasks used by Bosco et al. (2004).

In Experiment I, participants studied a map with irregular and complex structure, while in Experiment II the same participants studied a map with a regular and ordered structure. VSWM was found to predict the orientation abilities for both maps.

In accordance with Bosco et al. (2004), VSWM predicted the overall map learning. Particularly, the two *landmark knowledge tasks* and the *Map completion task* were predicted by the active and simultaneous components of VSWM (*Jigsaw Puzzle*) while the *Route recognition task* was predicted by the passive and sequential components of VSWM (*Corsi span test*). Again, the *Euclidean Distance Judgment* and the *Map section rotation* were unrelated to the VSWM span.

To sum up, all the previously described studies point toward a specific involvement of VSWM in the learning of new environments. Nevertheless, such a relationship, which is much more evident in map learning, seems to depend on the type of spatial knowledge.

Coluccia, Bosco, and Brandimonte (2007) investigated the role of VSWM in map learning using a map drawing paradigm. In their first study, a dual task methodology was used. Results showed that map drawing was selectively impaired by a spatial tapping task that was executed during the map learning phase, hence supporting the hypothesis that VSWM plays an essential role in learning from maps. In the second study, using a correlational methodology, it was shown that performance in simultaneous VSWM tasks, but not in sequential VSWM tasks, predicted map drawing skills. These skills “in turn” correlated with map learning abilities.

Finally, in Coluccia (2008), participants, while learning a map, were asked to either perform or abstain from a secondary spatial interference task. Learning of the map was assessed by means of three different tasks (landmark positioning, pointing, route finding), each tapping a different type of spatial knowledge, namely, relative position knowledge, absolute position knowledge and route knowledge.

Results showed that VSWM supports learning of absolute landmark positions but not learning of relative landmark positions. Moreover, VSWM appeared to be highly involved in route learning.

5. GENDER DIFFERENCES IN ENVIRONMENTAL LEARNING AND IN SPATIAL ORIENTATION ABILITIES

According to a review by Coluccia and Iosue (2004) on gender differences in spatial orientation, generally, males outperform females. In particular, the percentage of cases favoring males is higher in virtual and real environments than in maps. The authors hypothesize that it could be related to the fact that virtual and real environments offer a route perspective, while maps offer a survey perspective. Indeed, in maps it is found the lowest percentage of cases in which males outperform females. There are even some cases in which females perform better than males. It is possible that females take more advantage than males from a situation in which the survey perspective, which is more complete than the route one, is already offered. Females might not easily form the survey representation but, when the survey perspective is already offered, gender differences are leveled off. In line with this hypothesis, Montello, Lovelace, Golledge, and Self (1999) found that males outperform females on tests of spatial knowledge of places from direct experience rather than tests of map-derived knowledge. In real and virtual environments, it is possible to assume that males are successful in switching from a route perspective to a survey one, whereas females are more constrained by the kind of given perspective (Sandstrom et al., 1998).

On the one hand, in some typical Wayfinding tasks as route learning (Schmitz, 1997; Saucier et al., 2002), arrival point finding tasks (Devlin & Bernstein, 1995; Moffat et al., 1998; Sandstrom et al., 1998; Coluccia & Martello, 2004), route reversal (Lawton et al., 1996) and orienteering (Malinowski & Gillespie, 2001) males outperform females. On the other hand, in Sketch map tasks (McGuinness & Sparks, 1983; Taylor & Tversky, 1992b; O’Laughlin & Brubaker, 1998) females outperform males.

This phenomenon could be related to the advantage that females have mentioned above when directly using a survey representation. In fact, every case in which females perform better than males occurs in a map study. However, it is interesting to note that in the sketch

map tasks males are particularly aware of routes and connectors while females appear more sensitive to landmarks (McGuinness & Sparks, 1983).

When giving verbal description of a route (Miller & Santoni, 1986; Ward et al., 1986; Schmitz, 1997; Brown et al., 1998; Dabbs et al., 1998), males pay a greater attention to configurational aspects, using terms indicating cardinal points (i.e. “you must go towards the North”) and distances (i.e. “you must turn to the right after 300 meters”) in their verbal indications. Conversely, females show to use more frequently terms indicating landmarks (i.e. “you must turn to the right near the restaurant”).

In Self-report questionnaires for strategies (Lawton, 1994, 1996; O’Laughlin & Brubaker, 1998; Pazzaglia, Cornoldi, & De Beni, 2000), it emerges that males maintain a survey perspective when they imagine moving in the environment, preferentially relying on the visuo-spatial properties of the environment and on configurational, orientation strategies.

On the other hand, females maintain a route perspective; rely on landmarks and on procedural “route” strategies involving route’s knowledge.

Finally, with regard to self-evaluation questionnaires on orientation skills (Lawton, 1994, 1996; Lawton et al., 1996; Schmitz, 1997; Pazzaglia et al., 2000), a homogeneous pattern emerges in the results: males estimate themselves to be more able in orientation and they show greater confidence in their own ability than females. On the contrary, females report a higher level of spatial anxiety than males, related to the fear of getting lost.

Interpretation of Gender Differences in Spatial Abilities

Biological Theories

Biological explanations were proposed which considered sex differences in rats in maze-learning tasks (Foreman, 1985; Margeules & Gallistel, 1988; Williams, Barnett, & Meck, 1990).

Biological hypotheses are based on the assumption that sexual hormones influence cognitive development. In fact, hormone manipulation affects not only sexual behavior but also some aspects of cognition, in particular spatial memory (Williams et al., 1990). Dawson, Cheung, and Lau (1975), for example, report that the administration of testosterone to female rats during the prenatal period, improves performance in maze learning. On the other hand, castration at birth of male rats impairs the accuracy to choose the right direction in a radial maze.

In addition, several studies (Suzuki, Augerinos, & Black, 1980; Foreman, 1985; Margeules & Gallistel, 1988) showed that male rats, while running in a maze, usually ignore landmarks and show an orientation behavior based on the “Euclidean properties” of the room containing the maze (e.g. the shape of the room or the metric relation between the long wall and the short wall of the room). Williams et al. (1990) found that male rats, when instructed to learn a maze, rely on geometrical or configurational cues. Such cues are also called extra-maze cues and depend on the geometry of the room (e.g. the maze is enclosed in a room with circular or rectangular contours). Male rats performance is impaired if the geometry of the room changes, but it is unaffected if landmarks are modified. On the other hand, female rats’ performance is always poor in both landmark and room-geometry conditions and it is significantly lower than male rats’ performance. However, it is not clear

how much of the sex differences present in rats can be extended to humans. It seems likely that, among humans, biological effects interact with experiential factors.

Kimura and Hampson (1994) found that in some tasks of verbal fluency women improve their performances up to 10%, just during the periods of high concentration of estrogen (about 5–10 days before menstruation). In spatial ability tests, however, women perform well when hormones levels are low (when menstrual cycle starts). Otherwise, male performance in spatial tasks seems to fluctuate in during the day, in accordance with natural variations of testosterone levels: when concentration of male hormones is high, performance increases; when concentration is low, performance decreases (Moffat & Hampson, 1996). Furthermore, it was found that administration of androgen to females could significantly reduce verbal ability and enhances spatial performance, whereas deprivation of androgen has the opposite effects on males (Van Goozen, Cohen-Kettenis, Gooren, Frijda, & Van De Poll, 1995). All together these results are consistent with the hypothesis of hormonal levels.

According to Annett (1992), a cerebral pattern strongly left-hemisphere-dominant for language has a negative influence on spatial ability development. Females, in particular, seem more disadvantaged than males in spatial ability, because they have an advantage in early development of the left-hemisphere for language.

Because of this early left hemisphere advantage, females spontaneously prefer verbal strategies for solving problems and they are more likely to be at risk for poor spatial ability. All the previously discussed results are in favor of the presence of some biological basis (hormonal levels and cerebral pattern) for sex differences. Nevertheless, there are environmental factors (society, culture, race, etc.) that can strongly modify the differences between males and females.

Environmental Factors

Gaulin and Hoffman (1988) conclude in their review that gender differences in spatial abilities, allowing for a biological basis, are strongly modulated by experience and learning. A positive correlation between spatial performance and participation to high-spatial activities emerges in Baenninger and Newcombe (1989)'s meta-analysis.

The different levels of spatial ability could be due to the different time spent in spatial activities by males and females. Usually males have more experience in activities that enhance the development of spatial skills (Lawton & Morrin, 1999). Males, in fact, since early childhood, play games with high spatial components, like exploratory games, team sports, LEGO-construction (Goldberg & Lewis, 1969; Baenninger & Newcombe, 1989) and videogames (Barnett, Vitaglione, Harper, et al., 1997), being exposed to a higher "spatial experience" than females. In addition, boys are allowed more frequently than girls to explore new environments (Webley, 1981).

Interactionist Theories

The interactionist approach asserts that gender differences are caused by a continuous interaction between environmental factors (experienced-based) and biological factors (natural predispositions).

According to Sherman (1978)'s bent twig theory, the innate predisposition to particular abilities influences the choice of particular activities. Consequently males, naturally interested in spatial activities, actively search for high-spatial experiences and spend much more time in

them than females. Such activities, in turn, enhance the development of spatial abilities, increasing the initial differences between males and females.

Casey (1996) hypothesizes that male's innate predisposition for spatial abilities depends on their particular pattern of cerebral organization, characterized by low hemispheric lateralization.

In fact, such cerebral organization seems to be more frequent in men (Annett, 1992). Consequently, individuals having this particular pattern and, at the same time, high exposition to spatial experience can excel in spatial abilities compared to individuals having the same spatial exposition but different cerebral patterns. Individuals with this particular pattern of cerebral organization and low exposition to spatial experience are not likely to develop their spatial abilities.

Evolutionistic Theories

Following an evolutionistic approach, Silverman and Eals (1992) hypothesized that, during the course of time, women developed a highly specialized memory system for object location. Since prehistoric age, landmark positions have been more useful for females than males. Females spent long time in caverns taking care of their children, while males needed to know Euclidean and configurational properties of their hunting-area, exploring extended and unfamiliar environments in search of food.

Differences in Strategies

This hypothesis is suggested by some differences between males and females regarding the strategies used in orientation tasks. Males seem to rely on global reference points and configurational or "survey strategies" (e.g. maintaining a sense of their own position in relation to compass directions, keeping in mind the position of the sun in the sky, cardinal points, town centre, starting point, etc.). Females, indeed, show use of landmarks and apply procedural or "route strategies", attending to instructions on how to get from place to place (Lawton, 1994; Galea & Kimura, 1993; Lawton, 1996; Lawton et al., 1996; O'Laughlin & Brubaker, 1998).

According to Saucier et al. (2002), the different performances between males and females are not due to better orientation abilities in males rather than in females, but they are due to the different strategies employed. Males are likely to use survey strategies, which are usually more efficient than others. In the Saucier et al. (2002)'s experiment participants are requested to navigate to four unknown destinations. The location of each destination is determined by following some instructions. "Euclidean-based" instructions indicate the directions (e.g. north or west) and metric distances (e.g. 100 m). "Landmark-based" instructions indicate the salient landmark (e.g. the purple doors) and egocentric (right or left) turn directions. An error was scored when the participant took five or more steps in the wrong direction. The authors found that men perform best in navigational tasks when provided with Euclidean information, whereas women perform best when provided with landmark information. In fact, when instructions are "Euclidean-based", females make more errors than males for reaching the arrival point. When instructions are "landmark-based", males and females have similar performances.

In Sandstrom et al. (1998), when geometrical-configurational cues are available, males are faster than females at reaching a hidden target. When landmark cues only are available, no sex differences emerge. However, even if males prefer configurational strategies, they can use landmarks, when required. It seems that males can swap strategies if necessary, adapting dynamically their strategies to the information available in the environment. Females, on the other hand, are more landmark-centered and have more difficulties in swapping strategies. Thus males perform better in spatial orientation, because they spontaneously prefer configurational strategies (more complete than other strategies) and because they can swap easily their strategies, in line with to available information.

Personality Factors

Another possible interpretation comes from psychological studies of personality. According to Lawton (1996) and Kozloski and Bryant (1977), males are more confident than females about their skills in finding a way and about their own sense of direction. Similarly, self-evaluating questionnaires reveal that females are more anxious than males when navigating (Lawton, 1994).

The “spatial anxiety” (Lawton, 1994, 1996) or “fear to get lost” (Kozloski & Bryant, 1977) can reduce the ability to focus on cues essential to maintain geographical orientation. Many studies find that stress impairs the ability to memorize spatial locations (Mackintosh, West, & Saegert, 1975; Evans, Skorpanich, Gärling, Bryant, & Bresolin, 1984; Sunanda, Rao, & Raju, 2000). In Schmitz (1997), spatial anxiety and fear of the dark negatively correlate with speed in walking through a maze: subjects with high anxiety levels are the slowest. Anxiety about getting lost is likely to inhibit the exploration of unfamiliar places, having a negative impact on self-confidence and on motivation to navigate in new environments (Bryant, 1982, 1991). Therefore, females with fewer navigational experiences than males, have fewer opportunities to increase their spatial orientation skills.

Moreover, some studies demonstrate a relationship between spatial anxiety, kinds of strategy and orientation performance. In Schmitz (1997), males show low levels of anxiety and prefer to include more directional elements (configurational strategy) in verbal descriptions of a maze; they also perform better than females when running through a maze. Contrary to this, females show high levels of anxiety and include few directional elements and many landmarks in their descriptions. In agreement with these results, Lawton (1994) finds that the use of survey (configurational) strategies correlates negatively with the level of spatial anxiety. People with high level of spatial anxiety generally do not use this kind of strategy. These individuals are not able to maintain a sense of direction and/or self-position with respect to the surrounding environment (survey strategy). They tend to get lost, confused and anxious.

According to Coluccia and Iosue (2004) Gender differences in orientation emerge when tasks are “difficult”.

From the previously analyzed literature, it is possible to claim that when gender differences appear, they often favor the males. This tendency and the oscillation marked-differences/no-differences suggested to us that the difference in orientation performance could be “masked” by task-cognitive demands as follows: orientation tasks high in cognitive demands are accompanied by gender difference, orientation tasks low in cognitive demands

are not. In order to support the present hypothesis some examples grouped on the basis of tasks are shown.

Verbal descriptions: Brown et al. (1998) found no differences between males and females in time spent to study a map and in errors giving verbal descriptions of a route within the map. Authors asserted that the absence of differences was due to the experimental paradigm used. It was a map-present paradigm, generating a low-memory load situation, since the map was always visible, when orientation tasks were executed. Similarly, Ward et al. (1986) found no gender differences in verbal descriptions of a route, when the map was present during task execution (easy task). Differences indeed emerged when the map was not visible, increasing the memory load of the tasks.

Map drawings Taylor and Tversky (1992b) found no gender differences in map drawings and in verbal descriptions. It is author's opinion that mean percentage of errors was very low for all subjects, both in map drawings and in verbal descriptions. It is possible to hypothesize that gender differences were "masked" or leveled-off by the low difficulty of the task. Again high performance can be ascribed to the experimental paradigm. Each participant studied twice the same verbally described environment, from two different viewpoints, a route perspective and a survey perspective. Furthermore, participants were free to study each perspective, for as long as they wanted and up to four times. This kind of procedure could generate an over-learned situation.

Pointing: On the basis of significant differences in angular errors produced by all subjects when performing a pointing task, the Kirasic et al. (1984) identified "easy-to-locate" and "difficult-to-locate" landmarks. Post hoc analyses for each landmark showed significant differences in accuracy for locating the target. Some locations (difficult-to-locate landmarks) resulted in greater angular error than did others (easy-to-locate landmarks). Results showed that males located difficult landmarks with a lower angular error than females, and that gender differences disappeared when easy landmarks had to be located. In Montello and Pick (1993), Sadalla and Montello (1989), and Kirasic et al. (1984) gender differences between males and females did not emerge in "real test pointing". These results can appear completely incompatible if participants' familiarity with the environment is not considered. In all these studies, in fact, participants were students and the environments were familiar buildings in campus. It is reasonable to suggest that the absence of gender differences might be due to the high familiarity of the subjects with the environment. In particular, Kirasic et al. (1984) chose their landmarks for the pointing task, just basing on familiarity data from a previous study (Herman, Kail, & Siegel, 1979).

Distance estimation: Both in Galea and Kimura (1993) and in Coluccia and Martello (2004), gender differences for straight-line judgment tasks did not emerge. These results are inconsistent with the well-known males' superiority in all Euclidean tasks. Usually Euclidean tasks require estimating the absolute distance between two or more objects (Miller & Santoni, 1986; Geary, 1995; Dabbs et al., 1998). The absence of gender differences in Galea and Kimura (1993) and in Coluccia and Martello (2004)'s study could depend on the type of task. In both these studies participants were not required to produce metrical estimations, but to make a comparison between two (Galea & Kimura, 1993) or three (Coluccia & Martello, 2004) positions (i.e. "Starting from landmark A, which landmark is more distant? B or C?"). Making a qualitative distance comparison is easier than making a quantitative distance estimation (i.e. "How meter/miles far is A from B?"). Gender differences again dissolve in low demanding tasks.

Wayfinding: Lawton et al. (1996) did not find gender differences in the route-reversal task. Participants were instructed to walk in a real indoor environment, retracing backward a route from the end to the starting point. Differences did not arise both in time spent and in number of errors. Lawton et al. (1996) suggested that gender differences in wayfinding could be found in an environment characterized by a more complex structure than the used one. In fact, Lawton et al. (1996) admitted that in the environmental structure of their research there were only a few routes that could be taken to go back to the starting point, spending a short time. Lawton et al. (1996) concluded that, in order to obtain gender differences in wayfinding, it is necessary to use environments that are more complex.

Various tasks: In Coluccia and Martello (2004), two different maps were used: the first was characterized by a regular pattern of routes with straight, perpendicular and parallel streets, square-shaped zones and landmarks with similar features. The second map was characterized by an irregular pattern of routes with dissimilar and curvilinear streets and different types of landmarks. Following map learning subjects were required to perform 8 orientation tasks: Landmark Recognition; Landmark with Surrounding Recognition; Map Completion; Map Section Rotation; Euclidean Distance Judgment; Route Recognition; Wayfinding; Route Distance Judgment. It was found that subjects showed greater overall orientation performance in the irregular map than in the regular one. Significant gender differences emerged with the regular (more difficult) map, but not with the irregular (easy-to-learn) map. Some tasks in particular showed marked gender differences: Landmark with Surrounding Recognition; Map Completion; Route Recognition; Wayfinding; Route Distance Judgment (see Bosco, Longoni, & Vecchi, 2004 for an exhaustive description of the tasks).

A last hint comes from spatial ability literature. In the meta-analysis by Linn and Petersen (1985), the largest difference between males and females was found in the Mental Rotation Tests. This kind of task is supposed to be the most difficult in comparison to the other two types found by the authors (Spatial Visualization Tests and Spatial Perception Tests). All the three spatial ability tasks require the production of a mental image, but the Mental Rotation Tests need an additional process, because three- or two-dimensional objects have to be rotated in imagination.

The Difficulty of the Task Depends on Its Working Memory Load

When analyzing gender differences, an important factor is the working memory load. According to Thorndyke and Hayes-Roth (1982) and Rossano and Moak (1998), a real test has a lower cognitive load than a simulated test.

In a simulated test, participants are required to make a consistent imagination effort. The cognitive load, in fact, increases depending on the number of interacting elements to be maintained simultaneously in working memory (Marcus, Cooper, & Sweller, 1996).

In a real pointing task, for instance, subjects are positioned in a specific point at the environment, facing a specific direction. Then, they are asked to point at some landmarks direction. In a simulated test, on the other hand, subjects are set down in front of a desk, facing up a wall of the room. Then they are asked to imagine staying in a different location, with his/her face towards a specified direction and to point at some landmarks.

In simulated tasks, females often show lower performance than males. In real tasks, their performance is similar to male ones (Rossano & Moak, 1998). Brown et al. (1998) found that

gender differences disappeared, when the memory load is low (map present condition). Similarly, Ward et al. (1986) did not find gender differences in map present condition (low memory load). Males performed better than females when the map was absent (high memory load).

According to Garden, Cornoldi, and Logie (2002), the memory load implied in wayfinding processes is not a generic cognitive load, but it is a specific load of (VSWM). Consequently, gender differences could arise in spatial orientation tasks that require a consistent load of VSWM. Using dual task methodology, Garden et al. (2002) showed that spatial tapping (VSWM interference tasks) impaired performance in a route-recognition task significantly more than articulatory suppression (Verbal Working Memory interference task) did. These results reveal the direct implication of VSWM in orientation abilities.

Other studies are also consistent with these conclusions. Conte, Cornoldi, Pazzaglia, and Sanavio (1995) found that, when moving through a room, blind boys with high working memory perform better than girls do. Pazzaglia and Cornoldi (1999) found that participants with high scores in the Corsi test have an optimal memory for route descriptions. Then, Bosco et al. (2004), using the multiple regression approach, found that some VSWM tasks predict orientation performance.

Is it possible to hypothesize that gender differences emerge only in high-VSWM-load tasks because women's VSWM are less efficient? In fact, many studies found that females have a lower VSWM span than males (Richardson, 1991; Halpern, 1992; Lawton & Morrin, 1999). These span differences are particularly marked in active tasks, where participants are required to elaborate, integrate and transform the visual imagined material (Vecchi & Cornoldi, 1998; Vecchi & Girelli, 1998).

CONCLUSION

It seems that marked gender differences in VSWM can account for some differences in the orientation abilities. In particular, gender differences in orientation emerge only when tasks require a high load of VSWM. Consequently, the VSWM load could be a determinant factor, able to increase or level off individual differences in orientation abilities. Males would show better orientation performance, because of their larger VSWM span. When the orientation task does not involve a high load in VSWM, gender differences would disappear.

Two recent studies would shed more light on such an interpretation.

The study by Coluccia, Iosue, and Brandimonte (2007) examines the relationship between map drawing skills and spatial orientation abilities. Ninety-six students (48 males and 48 females) from the University of Rome "La Sapienza" studied an adapted map of the archeological site of the Palatine Hill. Then, participants were asked to draw a map and to perform some spatial orientation tasks tapping landmark, route and survey knowledge. Results showed a strong relationship among various map drawing skills and spatial orientation abilities. However, such a relationship was more marked in males than in females. In addition, males needed less time to learn the map, were more accurate than females in map drawing, and showed higher levels of performance on road drawing. Overall, these gender differences can be interpreted as deriving from the use of different map learning strategies: males approach the map from a global perspective, whereas females focus on local features.

Such an interpretation is supported by Duffy (2000). Indeed, in her work entitled: “Sex differences in global-local perceptual bias: A matter of perception or attention?”, she investigated sex differences in visuo-spatial abilities by examining participants’ reaction times to *Global* and *Local* levels of visual hierarchical stimuli. She focused on the fact that research supports a male advantage in certain abilities associated with the right hemisphere, and a female advantage in certain abilities associated with the left hemisphere. It is thought that the left hemisphere is specialized for processing at the *Local* level while the right hemisphere is specialized for processing at the *Global* level. Thus, it was hypothesized that there would be a *Gender* by cognitive style (Global/Local) interaction and that males would exhibit a more pronounced “right hemisphere” pattern when responding to visual hierarchical stimuli, while females would exhibit a more pronounced “left hemisphere” pattern.

The interpretation here offered is not expected to be exhaustive, since it does not explain the origin of the gender differences. More simply, the present chapter wants only to offer a hypothesis helpful in the understanding of the overall findings, trying to cast more light on the large variability of the results that emerged. Spatial orientation is a healthily multi-disciplinary area: the collaboration between psychologists and geographers is crucial for the development of spatial orientation studies. As stated by Kitchin, Blades, and Golledge (1997): “both psychologists and geographers have much to offer each other, in terms of ideas, theory, and methodologies”. In order to understand more fully our behavior in space, the integration of environmental psychology and behavioral geography is essential (Kitchin et al., 1997).

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Chapter 7

PSYCHOLOGICAL HOME IN THE INTERFACE BETWEEN INDIVIDUAL VARIABLES AND STRUCTURAL CHARACTERISTICS OF THE HOUSE BUILDING: TWO EMPIRICAL STUDIES

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ABSTRACT

The concept of “Psychological Home” (PH) was introduced to describe “an underlying motive that is driven by an individual’s need to identify a sense of self with a physical locale”(Sigmon, Whitcomb & Snyder, 2002). PH includes cognitive (attributions about our selves in relation to the environment), affective (emotions and feelings associated with the establishment and maintenance of psychological home, e.g. security, warmth, attachment) and behavioural components (actions taken to make a physical location more home-like). Psychological Home is understood as an individual variable, with positive consequences for individuals’ identity and well being. Research studies support the positive effects of PH: individuals scoring higher report more positive psychological functioning and spend more time and effort in attempting to make a place their own (Sigmon et al., 2002).

This chapter will present the results of two studies aimed at investigating Psychological Home (PH) in the Italian context.

The first study was conducted in order to test the Italian version of the Psychological Home scale developed by Sigmon et al. (2002) on a sample of 251 adults. Differences according to socio-demographic variables, and relationships with Life Satisfaction were assessed. Results indicated that PH is higher among women, among home owners and in individuals living in detached houses. PH positively contributes to Life Satisfaction.

The second study involved 313 individuals and was aimed at further testing the PH scale, by examining differences according to sociodemographic variables and structural characteristics of the house building, and to assess its role in explaining individuals’ behavioral intentions concerning a particular type of dwelling: sustainable (or ecological) houses. Results confirmed the differences in PH according to sociodemographic variables; however, PH is not related to the intentions to buy a sustainable house.

INTRODUCTION

Psychological Home

In the psychological literature on the relationship between individuals and their residential environment, considerable attention has been devoted to the study of individuals' bonding relationships with their home places (Sixsmith, 1986; Després, 1991; Moore, 2000). The term "home" is generally used to refer to a variety of physical locations including the house, the neighbourhood, the city, the country of birth (Cuba & Hammon, 1993; Hidalgo & Hernandez, 2001; Manzo, 2003). Research studies on the concept of "home" have found that the term is associated with different meanings; for example, home is perceived as a place that satisfies basic psychological needs, such as safety, comfort, sense of control and home ownership, feelings of territoriality. It is described as a "heaven" from the outside world, a retreat from daily life and a source of psychological comfort. Continuity of residency and the opportunity to develop and cultivate social relationships over time are elements that contribute to the construction of a sense of home, by enhancing sense of belonging and rootedness, identification with a place and place attachment.

In the attempt to capture the motivational dimensions of the relationship with the home environment, Sigmon, Whitcomb & Snyder (2002) introduced the concept of "Psychological Home" (PH), defined as "an underlying motive that is driven by an individual's need to identify a sense of self with a physical locale" (p. 33). According to the authors' conceptualisation, PH includes cognitive (attributions about our selves in relation to the environment), affective (emotions and feelings associated with the establishment and maintenance of psychological home, e.g. security, warmth, attachment) and behavioural components (actions taken to make a physical location more home-like). The concept of PH helps to explain the need of individuals to modify their home place as well as other locales in which they spend their everyday life (e.g., by adorning them with personal objects, their design choices, etc.) so as to express their own self and represent who they are as individuals. In order to measure Psychological Home the authors developed a specific instrument, the "Psychological Home Scale" (cf. Sigmon et al., 2002).

Psychological Home is understood as an individual variable, with positive consequences for individuals' identity and well being. "Creating a psychological home offers a psychological refuge that provides security, safety, protection and assurance. An individual's home can come to represent a haven from the stresses of the external world. Such a home can reduce anxiety and help us cope with change" (Sigmon et al., 2002, p. 34). Research studies support the positive effects of PH on psychological well being: individuals scoring higher report more positive psychological functioning and spend more time and effort in attempting to make a place their own (Sigmon et al., 2002).

PH is considered by the authors as an individual-level (motivational) construct, relatively independent from the physical structure of the house building. For example, individuals can construct a sense of psychological home also with reference to other places, such as the office or the workplace, and a sense of ownership toward a place can be found even among the homeless (e.g., with reference to the place where they find refuge). However, to the extent that characteristics of the building can satisfy some of the motivational needs implicit in the PH construct (e.g., the need for individuality and separateness, which could be satisfied more

by detached houses than by apartments or row houses, where people live closer), we may expect differences according to the home type.

Moreover, the need to project ones' identity and personality over the house, implicit in the PH construct, can be expected to vary depending on home ownership: owners do not experience external limitations to their wish to transform their living environment, contrary to individuals on rent.

Information on the differences in PH according to socio-demographic characteristics of home owners are limited. Sigmon et al. (2002) found higher scores of PH among females. Age is generally related to the amount of time spent at home (which usually increases in the elderly and in the retired) and to residential mobility (generally higher in young adulthood and declining with age); time at home and residential stability might favour individuals' attachment and investment on their house. As regards socio-economic status, on the one hand, a higher SES is generally associated with better living conditions, including owning a larger and independent house. However, in the literature it has been found a stronger dependence on the residential environment among individuals with lower environmental competence (mostly elderly and low SES individuals).

In this chapter we will describe two studies conducted in order to investigate the concept of Psychological Home among Italian adults. In particular, the aims were to assess the role of some sociodemographic variables of home residents and of some structural characteristics of the house building in influencing PH; moreover, the impact of PH on subjective well being and its role in explaining behavioural intentions toward a particular type of house – i.e. ecological (or sustainable) house - were investigated.

FIRST STUDY. INDIVIDUALS' PSYCHOLOGICAL RELATIONSHIP WITH HOME: A PRELIMINARY TEST OF THE PSYCHOLOGICAL HOME SCALE IN THE ITALIAN CONTEXT

This study is the first attempt to assess Psychological Home (PH) in a sample of Italian adults. Specific aims were the following:

- (a) to test the Psychological Home scale developed by Sigmon et al. (2002) by assessing the differences in scores according to participants' age, gender, socio-economic status (education and occupation) and home ownership;
- (b) to assess the relationship between PH and structural characteristics of the house (home type);
- (c) to assess the relationship between PH and Life Satisfaction.

We expected higher scores of PH in female participants vs. males (cf. Sigmon et al., 2002) and among participants with lower SES. We also expected that PH would increase with age and would be higher in home owners and in participants who live in detached houses (vs. apartments or row houses). Finally, we expected that PH would be positively correlated with Life Satisfaction (cf. Sigmon et al., 2002).

Method

Participants

The sample includes 251 individuals between the ages of 20 and 85 years ($M = 43$ years; $SD = 13.83$ years). 115 were male and 136 females. 12% lived in a small apartment (< 60 square metres), 53.6% in a medium-large apartment (> 60 square metres), 10.4% in a row house, and 24% in a detached house. 65.7% were home owners, 21.9% lived with their parents, who owned the house, and 12.4% were on rent. As regards socio-economic status, most participants had a medium-low SES. As for education, 26.7% completed compulsory schooling, 55% had a diploma and the remaining 18.3% a university degree. Occupations have been grouped into four categories: the first one included students, housewives and retired (21.1%), the second one manual workers (26.7%), the third one employees (27.1%) and the last one professionals and managers (25.1%). Chi square tests indicated the presence of significant differences between education and occupation ($\chi^2(6) = 41.23$, $p < .001$): participants with a higher level of education had more qualified occupations. Home owners were more prevalent among participants with compulsory schooling, whereas participants with higher education were more prevalent among those who lived in a house owned by their parents or on rent ($\chi^2(4) = 12.29$, $p < .05$). As to occupation, home owners were more prevalent among professionals and managers, compared with other occupations, even though the difference was only marginally significant ($\chi^2(6) = 11.98$, $p = .06$).

Instrument

A questionnaire was submitted, including the following:

- (a) *Sociodemographic characteristics*. Information was collected on age, gender, level of education, occupation, home type and home ownership.
- (b) *Psychological Home*. PH was measured using the translated version of the scale devised by Sigmon et al. (2002), including 8 items, with response alternatives on a Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).
- (c) *Life Satisfaction*. The SWLS Scale by Diener, Emmons, Larsen & Griffin (1985) was used, including 5 items with a response scale ranging from 1 = *completely disagree* to 7 = *completely agree*. Cronbach α was .89.

Results

Psychological home

Table 1 reports descriptives for the PH scale. Factor analysis confirmed the unidimensionality of the scale. Item-total correlations were all above .30. Cronbach α was .80. Mean score of PH was calculated by averaging across the eight items.

Age positively correlated with scores in PH ($r = .14$, $p < .05$): Psychological Home increased with age, even though the coefficient was low.

Table 1. Psychological Home Scale: descriptive statistics

Items	<i>M</i>	<i>SD</i>
I have grown attached to many of the places I have lived	5.14	1.36
I put a lot of time and effort into making a place my own	4.94	1.73
I feel more relaxed when I'm at home	5.77	1.24
I surround myself with things that highlight my personality	5.37	1.32
I get a sense of security from having a place of my own	6.07	1.17
I add personal touches to the place where I live	5.76	1.13
I take pride in the place where I live	5.74	1.27
I work at making a place my own	5.43	1.32

Differences in the total score of PH according to socio-demographic variables and characteristics of the house were tested by T-test and ANOVA. A significant difference according to gender was found ($t(229) = 5.06, p < .001$): female participants scored higher ($M = 5.76, SD = .76$) than males ($M = 5.23, SD = .87$).

As regards home type, ANOVA showed that participants living in detached houses obtained the highest scores ($M = 5.75, SD = .87$), followed by those who lived in a medium-large apartment ($M = 5.58, SD = .76$); the lowest scores were obtained by participants living in a small apartment ($M = 5.22, SD = .85$) and in row houses ($M = 5.07, SD = 1.04$) ($F(3,249) = 5.466, p < .001$); the latter means do not significantly differ according to post-hoc (Duncan) tests.

Psychological Home was lower among participants with a university degree ($M = 5.19, DS = .86$) compared with participants with a high school diploma ($M = 5.57, DS = .87$) and compulsory schooling ($M = 5.65, DS = .77$) ($F(2,250) = 4.49, p < .05$). No significant differences emerged according to occupation.

Finally, differences in PH were tested according to home ownership. ANOVA confirmed that scores of PH consistently decreased from home owners ($M = 5.63, SD = .61$), to participants living with parents who own the house ($M = 5.38, SD = .91$) to individuals on rent ($M = 5.18, SD = .88$) ($F(2,250) = 4.634, p < .05$).

Psychological Home positively correlated with Life Satisfaction ($r = .33, p < .001$), confirming the important role of the relationship with home in enhancing individuals' subjective well being.

Discussion

This first study confirmed that the Psychological Home Scale is a sufficiently sound instrument also in the Italian context.

Results add to the scant existing research literature on this concept supporting previous findings by Sigmon et al. (2002) for what concerns gender differences. Moreover, they showed a positive correlation with age. These findings can be explained considering the degree of investment in the house, which is typically higher among women (who are traditionally in charge of domestic responsibilities) and increase with age. Results concerning home ownership were consistent with expectations: PH was higher among home owners, who do not experience limitations to the possibility of acting on their house.

As regards indicators of SES, the only significant difference emerged for education, suggesting that the psychological relationship with the home is more important for

individuals with lower education. This confirms the literature indicating that the psychological dependence from the home is higher among individuals with lower resources and spatial competence. As expected, PH was higher in participants who lived in detached houses, suggesting that the need to “make a space home” is affected by structural characteristics of the house building. It is not possible to establish the direction of the relationship between the two aspects: living in a particular type of building might influence residents’ experience and behaviours; however, individuals with a strong motivation to act on their living environment might prefer certain types of houses.

Finally, results confirmed the positive association of PH with Life Satisfaction, consistently with results obtained by Sigmon et al. (2002).

SECOND STUDY. ATTITUDES AND BEHAVIOURAL INTENTIONS TOWARD SUSTAINABLE HOUSING: THE ROLE OF PSYCHOLOGICAL HOME AND PRO-ENVIRONMENTAL ATTITUDES AND BEHAVIOURS

Introduction

Within the psychosocial and environmental literature a growing attention has been devoted to the study of psychological and psychosocial factors influencing pro-environmental (or ecological) attitudes and behaviours (e.g., Stern & Oskamp, 1987; Dietz, Stern, & Guagnano, 1998; Vining & Ebreo, 2002; Bonnes, Carrus, & Passafaro, 2006). Researchers have attempted to understand and predict a range of environmentally relevant behaviours, with a view to promote a greater awareness and concern for the natural environment and for the negative impact of several human activities for the environment. A prominent psychosocial theoretical model that has been used in this context is the Theory of Planned Behaviour (TPB) (Ajzen, 1991), focused on the role of beliefs and attitudes in influencing actual behaviours, which has been successful in explaining different behaviours such as recycling (e.g., Cheung, Chan, & Wong, 1995), energy use (Harland, Staats, & Wilke, 1999), water conservation (Hartland et al., 1999), environmental activism (Fielding, McDonald, & Louis, 2008).

As the research evidence on the psychosocial predictors of ecological behaviours cumulated, it became evident that, despite the high levels of concern for the environment, people differ greatly in their willingness to invest time and energy in behaviours aimed at preserving the environment (Seguin et al., 1998). As a consequence, it has been emphasised that clearer typologies of ecological behaviours and their specific predictors are needed.

In this context, we focus on a peculiar type of pro-environmental (or ecological) behaviour: the decision to buy and live in an “ecological” or “sustainable” (or “green”) home.

The concept of “sustainability” and “sustainable development” have been defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). As a key component of the built environment, housing plays a crucial role in the sustainable development of cities. Houses are considered “sustainable” when they are designed, built and operated with low environmental impacts while enhancing the health, welfare and quality of life for the people that live in them. Such homes take advantage of

nature's processes in order to use less energy, consume less water and produce less waste. Insulations, orientation towards light, air circulation, energy efficient appliances and lighting are all considered.

In the scientific literature, limited information is available on individuals' knowledge, beliefs and attitudes toward this home type, as well as on the variables influencing the decision to buy and live in it. Such decision is undoubtedly more personally involving as compared with the adoption of other types of ecological behaviours, also because the costs of such buildings is currently higher than traditional houses.

Considering the relevance of issues of sustainability in housing, it is increasingly important (from both a theoretical and applied perspective) to attempt to understand and explain the intention to buy and live in a ecological house by making reference also to psychosocial concepts and models. In this context, we will focus on the role of attitudes toward the environment and actual pro-environmental behaviours as possible explanatory variables. Moreover, considering the peculiarity of this ecological behaviour, we also considered the potential role of the psychological relationship with the home (e.g., Psychological Home). In fact, individuals' decisions about the type of house where they want to live should also reflect more subjective and emotional-motivational psychological needs.

Aims and Hypotheses

The aim of the second study was to investigate the role of individuals' psychological relationship with the home and environmental attitudes and behaviours in explaining their behavioural intentions toward sustainable housing. Moreover, the role of sociodemographic (age, gender, education, occupation, marital status and having children) and residential variables (type of house, home ownership, number of relocations) was assessed.

We expected that opinions toward sustainable houses and behavioral intentions would be more positive:

- among participants with more favourable attitudes toward the environment and who already practiced pro-environmental behaviours, particularly more personally involving actions (e.g., environmental activism);
- among participants with a stronger relationship with the home (Psychological Home).

As regards differences according to socio-demographic variables, opinions and behavioral intentions toward sustainable houses were expected to be more positive among middle-age participants and among more educated individuals. Psychological home was expected to be higher among women and to increase with age; moreover, it would be higher among married individuals (vs. unmarried) and with children, since forming a family implies moving to an independent house, and this event may be expected to increase the bonding relationship with the house (Sigmon & Whitcomb, 2002). PH was expected to be higher among participants who reported no relocations (or a lower number of relocations) during their life, consistently with results of Buttimer (1978) and Relph (1976).

As regards pro-environmental attitudes and behaviors, consistently with the literature, we expected more positive attitudes among women, compared to men (Eisler, Eisler, & Yoshida, 2003; Van Liere & Dunlap, 1980), that they increased with age; among individuals with a

higher level of education (Hines, Hungerford, & Tomera; 1986/87; Dietz, Stern, & Guagnano, 1998; Fransson & Garling, 1999).

Method

Participants

Participants were 313 adults, 55.9% (175) female and 43.5% (136) male. Mean age was 34 years ($SD = 6.735$) and ranged from 20 to 50 years. 32.3% of participants were between 20 to 30 years old, 47.6% between 31 to 40 years old and 19.2% between 41 to 50 years old.

47.3% were single, 48.2% were married or cohabiting, 3.8% divorced and 0.6% widowed. 38.3% had children. As regards education, 18.8% of the sample completed compulsory schooling, 51.4% had a high school diploma, 28.1% a university degree. Considering occupation, most represented professions were employees (31.3%), workers (12.5%) and students (8.3%). 57.1% lived in an apartment, and 42.9% in a detached house. 45.4% were home owners, 43.1% lived with their parents, who owned the house, and 11.5% were on rent. 20.5% never relocated, 47.1% relocated 1-2 times and 32.4% 3 or more times.

Instrument

A questionnaire was submitted, including different sections.

- a) *Sociodemographic characteristics*. Information was collected on age, gender, education, occupation, marital status and number of children, number of relocations. Moreover, home type and home ownership were assessed.
- b) The second section assessed participants' *psychological relationship with the home*. Two scales were used. The first one is the Psychological Home scale, by Sigmon et al. (2002), including 8 items, with response alternatives on a Likert (1 = *strongly disagree*, 7 = *strongly agree*). Secondly, we measured Sense of place referred to the house, using five items of the Jorgensen e Stedman (2001) "Sense of place" scale, adapted to the "house". Response alternatives range from from 1 (= *completely disagree*) to 7 (= *completely agree*).
- c) The third section of the instrument measured *Opinions and behaviours toward environmental issues*. Opinions were assessed by two scales. The first one was constructed ad hoc for this research, and included 8 items describing different opinions, positive and negative (e.g., "*interfering with nature produces negative consequences*"). Responses were provided on a 5-point Likert scale (from 0 = *completely disagree* to 4 = *completely agree*). The second scale was the NEP scale ("New Environmental Paradigm", Dunlap & Van Liere, 1978); it is the most widely used instrument in the literature to assess interest towards the environment and pro-environmental attitudes. For this research we used a version of the scale including ten items; response alternatives were provided on a Likert scale (from 0 = *completely disagree* to 4 = *completely agree*). *Pro-environmental behaviours* were measured by two scales ad hoc developed for this study. The first one included 15 items describing several pro-environmental behaviors (e.g., *recycling*, *car sharing*, etc.). The second one included 5 items measuring environmental activism (e.g., *boycott*,

signing pro-environmental petitions, participating to protests, etc.). In both cases participants were asked to specify the frequency with which they adopted each behaviour using a four-point Likert scale (1 = *never*; 4 = *regularly*).

- d) *Knowledge, opinions and behavioural intentions concerning sustainable housing.* After a preliminary question aimed at assessing knowledge about sustainable housing (*yes/no*), a further question asked about the sources of information (having seen it, having read about it, having a relative or acquaintance living in this type of house, actually living or having lived in this house) (*yes/no*). Opinions were measured by a list of adjectives describing characteristics of this type of house (safe, expensive, comfortable, healthy, warm, solid, durable, clean); participants were asked to compare, on each of them, sustainable houses with traditional houses. Responses were provided on a five-point scale (1 = *much less*; 2 = *somewhat less*; 3 = *the same*; 4 = *somewhat more*; 5 = *much more*). The last question measured participants' intentions to buy a sustainable house in the future ("Would you buy a sustainable house?") (*yes/no*).

Procedure

Data were collected in 2008. Participants were approached in different public places by two trained researchers and were asked to collaborate to the study by filling the questionnaire (anonymous). No incentive was provided, but they were informed that they could receive information on the results if they wanted. Of the 350 questionnaire distributed 32 were not returned and 5 were discarded as incomplete.

Table 2. Psychological Home and Sense of Place referred to the home: descriptive statistics

Psychological Home	<i>M (SD)</i>
I have grown attached to many of the places I have lived	5.30 (1.57)
I put a lot of time and effort into making a place my own	5.24 (1.62)
I feel more relaxed when I'm at home	6.11 (1.05)
I surround myself with things that highlight my personality	5.45 (1.25)
I get a sense of security from having a place of my own	6.20 (0.99)
I add personal touches to the place where I live	5.83 (1.21)
I take pride in the place where I live	5.78 (1.17)
I work at making a place my own	5.57 (1.20)
Sense of place referred to the home	
My home is the best place for doing the things that I enjoy most.	5.35 (1.23)
I feel happiest when I am at home	5.00 (1.25)
I feel that I can really be myself at home	5.30 (1.46)
My home is my favourite place to be.	5.00 (1.32)
I really miss my home when I am away from it for too long.	5.22 (1.32)

1 = strongly disagree, 7 = strongly agree

Table 3. Psychological Home and Sense of place referred to the home: mean scores and correlations

	α	$M (SD)$	<i>Correlations</i>
Psychological Home	.75	5.68 (.78)	.50 ($p < .001$)
Sense of place (home)	.85	5.18 (1.04)	

1 = strongly disagree, 7 = strongly agree

Table 4. Psychological Home: differences according to Home type and Home ownership (M and SD)

	House type		Home ownership		
	Apartment	Detached house	Owners	Parents owners	On rent
Psychological Home	5.59 (.78)	5.78* (.77)	5.78 (.72)	5.69 (.76)	5.35** (.90)

** $p < .01$ * $p < .05$

1 = strongly disagree, 7 = strongly agree

Results

Psychological relationship with the home

Table 1 shows the descriptive statistics for the items of the Psychological Home scale and the scale of Sense of place referred to the home.

The sample obtained high scores on all the items, confirming the importance of the emotional relationship with the home. Factor analysis showed the expected one-dimensional structure for the items of the Psychological Home scale and for Sense of place referred to the home. We therefore calculated the mean score for each scale by averaging across the items.

The two scales were positively correlated indicating that a higher Psychological home score is associated with a stronger sense of place.

Differences according to sociodemographic variables were assessed. As regards PH, significant differences according to gender were found ($t(309) = -3.00, p < .01$): as expected, women ($M = 5.79, SD = .77$) scored higher than men ($M = 5.53; SD = .76$). Contrary to expectations, no differences were found according to age and marital status. The number of relocations was significantly associated with scores of PH ($F(2,311) = 2.94, p < .05$): participants who had relocated 3 or more times in their life scored lower ($M = 5.54; SD = .92$) than those who never changed home ($M = 5.79; SD = .67$). Significant differences in PH were found according to home type: in particular, PH was stronger for those who lived in detached houses vs. in apartments ($t(301) = -2.06, p < .05$) (Table 4). Moreover, the relationship with home was stronger for participants who owned their house (or whose parents owned it) compared to those who were on rent ($F(2,303) = 4.28, p < .05$).

No differences according to sociodemographic variables were found for Sense of place referred to the home.

Pro-environmental attitudes and behaviours

Overall, the sample appeared sensitive to environmental issues: mean scores on the items were generally high (Table 5).

Table 5. Attitudes toward environmental issues: descriptive statistics

	<i>M (SD)</i>
Interfering with nature produces negative consequences	3.16 (1.10)
Modern technology can solve environmental problems	2.50 (.02)
Present economic problems are more important than future environment	1.90 (1.28)
Most activities in modern life are harmful to the environment	2.52 (1.03)
People are too concerned that economic growth will damage the environment	1.53 (1.26)
One person cannot do much for the environment	1.62 (1.45)
Environmental issues are presented in an exaggeratedly negative way	1.06 (1.15)
Public authorities should punish industries that are polluting the environment	3.54 (.83)

0 = completely disagree to 4 = completely agree

Factor analysis on the items of the scale indicated the presence of two interpretable factors. The first one included four items expressing a position of minimisation of environmental problems (e.g., “*Present economic problems are more important than future environment*”, “*People are too concerned that economic growth will damage the environment*”, “*One person cannot do much for the environment*”) (“Minimisation of environmental problems”, Expl. Var. 27.29%). The second factor included two items corresponding to the idea that human activities interfere with the environment (“*Interfering with nature produces negative consequences*” and “*Most activities in modern life are harmful to the environment*”) (“Concern for environmental problems”; Expl. Var. 23.06%).

Analyses conducted to test the differences in the scores of the two factors according to sociodemographic variables indicated that women, more than men, think that human activities interfere with the environment ($t(308) = -3.23, p < .001$). Such position was also shared by older participants, compared with younger ones ($F(2,308) = 4.79, p < .01$); by married participants vs. unmarried ($t(296) = -2.01, p < .05$), and by participants having children ($t(309) = 2.64, p < .01$) (Table 6). Significant differences according to level of education were found in the opinion “Minimisation of environmental problems”: the agreement decreased with higher level of education (compulsory education: $M = 1.94, SD = .77$; high school diploma: $M = 1.53, SD = .84$; university degree: $M = 1.24, SD = .70$) ($F(2,306) = 13.65, p < .001$).

On the items of the NEP scale an overall score was calculated ($M = 3.65, SD = .38$), after preliminarily reversing the scores of the negative items, so that higher scores indicated greater concern for the environment. Cronbach α was .63. Significant differences in NEP scores were found according to level of education ($F(2,306) = 3.37, p < .05$). Participants who completed compulsory education scored lower ($M = 3.24, SD = .47$), than those with high school diploma ($M = 3.65, SD = .38$), and university degree ($M = 3.40, SD = .31$).

Pro-environmental behaviours

Table 7 shows the mean scores of the items concerning pro-environmental behaviours. As can be seen, most frequently adopted behaviours are: recycling, ecological behaviours allowing also an economic advantage, such as turning the lights off when they are not necessary. Less practiced behaviours are those involving the use of means of transportation, such as car sharing and car pooling.

Table 6. Concern for environmental problems: differences according to the variables (*M* and *SD*)

	Gender		Age			Marital status		Children	
	M	F	20-30	31-40	41-50	Married	Single	Y	N
Concern for environmental problems	2.67 (.93)	2.98 (.77)***	2.79 (.88)	2.77 (.89)	3.16 (.65)***	2.94 (.83)	2.73 (.89)*	3.01 (.81)	2.75 (.87)**

0 = completely disagree to 4 = completely agree

Table 7. Ecological behaviours: descriptive statistics

	<i>M (DS)</i>
Recycling	3.36 (.84)
Organic purchasing	2.63 (.80)
Buy low consumption light bulbs	3.26 (.76)
Check the contents of the products at the supermarket	3.02 (.88)
Avoid the use of unnecessary packaging	2.42 (1.01)
Installing water-saving showerhead	2.04 (1.18)
Turn off the light in the room when you are not in	3.34 (.88)
Change the pattern of household equipment use (e.g, in the evening)	2.45 (1.11)
Buy low consumption household equipment	3.12 (.98)
Avoid the use of plastic bags at the supermarket	1.99 (1.05)
Use public transportation instead of the private car	1.74 (.97)
Reducing water consumption	3.05 (.91)
Reading pro-environmental informative materials	2.53 (.93)
Car pooling	1.94 (1.12)
Car sharing	1.47 (.82)

1 = never, 4 = regularly

An overall score of pro-environmental behaviours was calculated by averaging across the specific items. Cronbach α is .78.

Significant differences were found according to age ($F(2,308) = 7.73, p < .001$). Pro-environmental behaviours are less frequent among younger participants ($M = 2.42, SD = .47$) than among older ones (31-40 yr-olds: $M = 2.62, SD = .44$; 41-50 yr-olds: $M = 2.68, SD = .50$).

Significant differences in ecological behaviours were found according to marital status and having children. Married participants scored higher ($M = 2.70, SD = .45$) than unmarried ($M = 2.40, SD = .45$) ($t(296) = -5.59, p < .001$). Moreover, participants having children were more respectful of environmental behaviours ($M = 2.71, SD = .49$) than those without children ($M = 2.47, SD = .44$) ($t(309) = 4.36, p < .001$). Ecological behaviours were more frequent also among participants who owned their house ($M = 2.65, SD = .45$) than among those who were on rent ($M = 2.41, SD = .50$) ($F(2,302) = 4.86, p < .01$).

Considering environmental activism, mean scores were lower indicating that the sample was not very active. Most frequent behaviours were signing petitions and sustaining public policies in favour of the environment, whereas less than a quarter of the sample participated

to demonstrations and protests on environmental issues. We calculated an overall score of environmental activism ($\alpha = 0.73$, $M = 1.65$, $SD = .59$). Significant differences emerged in environmental activism according to age ($F(2,307) = 3.51$, $p < .05$): activism was higher among older participants ($M = 1.80$, $SD = .66$) than among younger ($M = 1.54$, $SD = .63$). Environmental activism was also higher among married participants ($M = 1.72$, $SD = .59$) than among single ($M = 1.58$, $SD = .58$) ($t(295) = -2.05$, $p < .05$). Level of education also discriminated in environmental activism: participants with lower level of education scored lower ($M = 1.41$, $SD = .50$) than participants with a diploma ($M = 1.68$, $SD = .59$) or a university degree ($M = 1.78$, $SD = .71$) ($F(2,305) = 7.39$, $p < .001$).

Table 8 displays correlations among pro-environmental attitudes and behaviours.

As can be seen from Table 8, attitudes towards environmental problems were correlated in the expected way; moreover, environmental activism scores correlated with attitudes toward the environment. Contrary to expectations, everyday pro-environmental behaviours were not correlated with general attitudes toward the environment (with the exception of a low correlation with concerns for environmental problems), suggesting that other motivations are relevant in explaining everyday ecological behaviours. Pro-environmental behaviours and environmental activism are strongly correlated.

Sustainable house

Knowledge and experience

181 participants (57.8% of the total sample) indicated that they were knowledgeable about sustainable houses. 27.2% declared that they had seen a sustainable house, 1.6% had inhabited such a house, 12% knew someone who lived in it and 47% had read informative materials.

Some differences according to sociodemographic variables were found. In particular, men, more than women, declared that they had seen a sustainable house (34.9% vs. 25.2%, $\chi^2(1) = 3.23$, $p < .05$), and that they knew someone who lived in it (17.7% vs. 9.6%, $\chi^2(1) = 4.10$, $p < .05$). Participants who had seen a sustainable house were more prevalent among married (35.7%) vs. single (24.3%) ($\chi^2(1) = 4.30$, $p < .05$).

Having read informative materials on sustainable houses differed according to level of education: 63.5% of participants with a university degree (vs. 48.3% with a high school diploma and 38.9% with compulsory schooling) declared that they received information by informative materials ($\chi^2(2) = 8.93$, $p < .05$).

Table 8. Correlations among pro-environmental attitudes and behaviours

	1	2	3	4
1.NEP	-			
2.Minimisation of environmental problems	-.30***	-		
3.Concern for environmental problems	.29***	.06	-	
4.Pro-environmental behaviours	.07	-.12*	.07	-
5. Environmental activism	.22***	-.24***	.09	.45***

*** $p < .001$ ** $p < .01$ * $p < .05$

Opinions

Participants considered the “sustainable house” safer than traditional houses (70.6%), but also more expensive (66.5%); moreover, they evaluated this house as similar to the traditional one on characteristics such as healthy (51.4%), comfortable (49.5%), warm (44%), solid (58%), durable (44.7%) and clean (54%).

Women, more than men, considered such house type healthier than traditional houses ($\chi^2(1) = 10.31, p < .001$). For the purpose of further analyses, an overall score of favourableness toward sustainable houses vs. traditional ones was constructed, by averaging across the different items, after reversing the negative ones. Cronbach alpha was .80.

Opinions toward sustainable houses were more favourable among participants who had actually seen them ($r = .26, p < .001$) and who had read informative materials ($r = .18, p < .01$).

Intentions to buy a sustainable house

70.9% of the sample declared that they would be willing to buy a sustainable house. The percentage was higher among more educated individuals: 50.9% of participants had a high school diploma, 33.5% a university degree and only 15.6% completed compulsory schooling ($\chi^2(2) = 8.84, p < .05$).

Who would buy a sustainable house?

Table 9 shows the correlations between intentions to buy a sustainable house and the other variables considered as potential predictors.

As displayed in Table 9, significant correlates of intentions to buy a sustainable house in the future were pro-environmental attitudes (particularly minimisation of environmental problems), environmental activism and opinions toward sustainable houses. Psychological Home and Sense of place referred to the home were not related to this behaviour.

To assess which variables significantly predicted participants' intentions to buy a sustainable house, a Logistic Regression was conducted, including as predictors age, gender, level of education, attitudes toward environmental issues, pro-environmental behaviours, environmental activism and opinions toward sustainable houses. Results indicated, as significant predictors, the opinion “minimisation of environmental problems”, environmental activism and attitudes toward sustainable houses ($\chi^2(9) = 55.15, p < .001$) (Table 10).

Table 9. Correlations between intentions to buy a sustainable house and the other variables

	Intentions (1 = Y; 0 = N)
Psychological Home	-.00
Sense of place referred to the home	-.04
Minimisation of environmental problems	-.27***
Concern for environmental problems	.14*
NEP	.15*
Pro-environmental behaviours	.13*
Environmental activism	.28***
Opinions toward sustainable houses	.32***

*** $p < .001$ ** $p < .01$ * $p < .05$

Table 10. Predictors of intentions to buy a sustainable house: logistic regression

	Beta
Age	-.05
Gender	-.38
Education	.30
NEP	-.37
Minimisation of environmental problems	-.76*
Concern for environmental problems	.42
Pro-environmental behaviours	.40
Environmental activism	1.64**
Attitudes toward sustainable houses	2.82***

*** $p < .001$ ** $p < .01$ * $p < .05$

Discussion

This second study investigated Psychological Home as a potential predictor of individuals' intentions to buy a sustainable house.

Results confirmed the importance of the emotional relationship with the home for all participants. As expected, and consistently with the first study, women scored higher than men in PH. No differences were found according to age and marital status. The lack of age differences could be explained by the reduced age range of the sample in the second study (20-50 yrs-old) compared with the first one, in which also elderly people were included. The number of relocations was significantly associated with scores of PH: participants who had relocated three or more times in their life scored lower than those ones who had never changed home. This confirms the findings of other authors (Relph, 1976; Buttimer, 1980), who found a lower attachment to places and to the home among individuals who had relocated more times.

Significant differences in PH were found according to home type, further supporting the results of the first study: in particular, PH was stronger for those who lived in detached houses vs. in apartments. Moreover, also in the second study, the relationship with home was stronger for participants who owned their house (or parents are owners) compared to those who were on rent. This result can be explained by the higher motivation to spend time and energy in the house, by home owners.

So, from both studies provide consistent findings for what concerns differences in PH according sociodemographic variables and characteristics of the house building.

Considering environmental attitudes and behaviours, overall, the sample appeared sensitive to environmental issues. Women, more than men, thought that human activities interfered with the environment, confirming the hypotheses of a more positive attitude toward the environment among women (Eisler, Eisler, & Yoshida, 2003; Van Liere & Dunlap, 1980). Such position was also shared by older participants, compared with younger ones; by married participants vs. unmarried, and by participants having children. Significant differences according to level of education were found in the opinion "Minimisation of environmental problems": the agreement decreased with higher level of education, confirming previous findings in the literature (Hines, Hungerford, & Tomera; 1986/87; Dietz, Stern, & Guagnano, 1998; Fransson & Garling, 1999). All the sample agreed with the belief that there are limits to

human action and that there is a need to find a balance between man and nature to safeguard the survival of both. No differences emerged according to sociodemographic variables.

Pro-environmental behaviours were less frequent among younger participants than among older ones. Significant differences in ecological behaviours were found according to marital status and having children. Married participants scored higher than single ones. Moreover, participants having children were more respectful of environmental behaviours than those without children. Ecological behaviours were more frequent also among home owners than among those who were on rent. Considering environmental activism, mean scores were lower indicating that the sample was not very active. Participation was higher in the older group than among younger participants. Environmental activism was also higher among married participants than amongst single. Level of education also discriminated in environmental activism: participants with lower level of education scored lower than participants with a diploma or a university degree.

Contrary to expectations, everyday pro-environmental behaviours were not correlated with general attitudes toward the environment, in accordance with part of the literature (Seguin et al., 1998), suggesting that other motivations are relevant in explaining everyday ecological behaviours.

Considering predictors of intentions to buy a sustainable house, results of regression analysis indicated that only pro-environmental attitudes and activism and opinions toward sustainable homes played a predictive role. The psychological relationship with the home as a place – even though it was associated with the house type (e.g., higher scores among those who live in independent houses) - was not relevant in explaining the behavioural intentions toward sustainable houses.

CONCLUSION

Summarizing the results emerged from the two studies, we can conclude that the Psychological Home construct appears interesting for explaining individuals' bonding relationships with their house. The scale developed by Sigmon et al. (2002) was found to be sufficiently good also in the Italian version, and the findings of the two studies indicated that PH differs according to both sociodemographic variables (age, gender, education, home ownership, number of relocations) and characteristics of the home type (e.g., detached house vs. apartment). Secondly, findings from the first study indicate that a positive relationship with the home and a high PH (including the need to personalize the spaces to make them more congruent with one's personality) positively enhance subjective well being (Sigmon et al., 2002; Rioux, 2005). Feeling good at home is an important component of overall well being. Results from the second study indicate that Psychological relationship with the home is not associated with individuals' decision to buy a sustainable home.

Further research is needed to better understand this concept and its potential implications for other psychological phenomena and behaviours.

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Chapter 8

PSYCHOPATHOLOGIES AS WORK-RELATED DISORDERS

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ABSTRACT

Purpose

To describe the characteristics and conditions of working environments that can lead to the onset of mental disorders and to report the clinical evolution of some cases of work-related psychopathology after a time span of at least twelve months from initial diagnosis.

Materials and Methods

Between 2004 to 2008 more than 300 workers attended our Occupational Medicine centre, most suffering from mental disorders which they ascribed to negative working conditions. All patients had an initial consultation session with an occupational physician which focused on the environmental and relational characteristics of their place of work. A second consultation with a psychologist provided a clinical evaluation and various psychological tests were administered, such as the Minnesota Multiphasic Personality Inventory (MMPI-2), the Wartegg test and the General Health Questionnaire. Some of the patients who had been diagnosed as displaying symptoms of psychological / psychiatric disorders related to bullying were interviewed again after at least 12 months

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from diagnosis for an update on their current clinical condition as well as on their working condition.

Results

Our data provide evidence that a significant number of workers actually develop mental disorders that are to be regarded as work-related. Psychological support and improvements in the working environment bring notable benefits to these workers. Many of the patients diagnosed with psychological / psychiatric disorders related to bullying, when re-interviewed 12 months later, reported improvements both in the quality of conditions at work and in terms of mental health.

Conclusions

The frequency of psychopathological disorders related to occupational conditions is increasing in many industrialised countries. Improvements in work organisation together with psychological support can lead to promising results in terms of tackling these disorders from a clinical point of view.

INTRODUCTION

Major psychiatric diseases still represent a subject of study where a great deal is still unknown. Most advanced etiologic models of adult mental illness include not only factors related to the work environment but also information regarding genetic vulnerability, developmental and neurobiological aspects, childhood experiences, life events, chronic situations (such as a stressful home life) and the presence of other disorders. The relative importance of each of these factors and how they interact is not yet understood (Dewa 2007).

Considering the role that a workforce plays in industrialized societies, it is not surprising that in many countries activities related to Occupational Psychiatry have increased significantly. In April 2008 an entire issue of the *Journal of Occupational and Environmental Medicine* dealt with major depressive disorders and the work environment. The main questions that were addressed regarded the nature and dimension of the problem, what is currently being done to resolve it and what can be done in the future.

In the last 15-20 years, more attention has been paid to work-related psychopathologies thanks to an increase in the number of studies carried out regarding bullying at work.

Brousse et al. (2008) reported the presence of neurosis in more than half of the bullying victims that they examined, as well as a variety of psychiatric disorders such as depression and anxiety.

Between 2004 and 2008, about 2500 reports of psychic illness which were considered to be related to the work environment and in particular to bullying, came to the attention of the Italian National Institute for Accident Insurance (INAIL). These insurance claims were probably only a small proportion of the actual number of cases since generally only those which are more likely to lead to occupational disease are reported.

In the United Kingdom work-related mental disorders are much more frequent: Cherry et al. (2006) reported results from a study involving close scientific cooperation between occupational physicians and psychiatrists where information regarding 8000 cases reported between 1996-2001 was collected.

In Italy, as in most other countries, most traditional problems in the area of occupational medicine are normally dealt with by qualified personnel in the occupational health services, while major mental disorders (such as psychosis and schizophrenia) are generally treated by psychiatrists. Until now, mental disorders defined as minor (such as slight forms of depression or anxiety and functional disorders) have not been of primary interest, either for psychiatric services or occupational physicians. In consequence, very little attention is paid to therapeutic treatment unless the condition of the patient deteriorates and psychological or psychiatric support is required. An improvement in communications between occupational physicians and psychiatrists/psychologists would lead to better diagnostic and therapeutic definitions for this growing group of patients.

In this study, we selected patients with mental disorders who had come to our Occupational Medicine centre because they perceived themselves to be victims of negative working conditions. An in depth analysis of their working conditions led us to the conclusion that these disorders were to be attributed to the workplace. Only one third of the patients were cases of bullying at work, while the others had not experienced any explicit form of moral harassment, even if they suffered from work-related mental disorders.

MATERIAL AND METHODS

Between 2004 and 2008, 303 workers requested medical consultation complaining of a work situation consistent with bullying which had lasted at least six months, or reporting a previous history consistent with bullying that had ceased less than three months before the time of the consultation.

In order to define the nature and degree of the negative conditions at work and the psychological consequences, workers underwent consultation with an occupational physician and a clinical psychologist. 273 patients were considered to be suffering from a work-related psychopathology: 164 were women (60%), with an average age of 43.3 and 109 were men (40%), average age 45.3. 53% were married, 26% single, 11% separated/divorced and the remaining 10% had common law partners, were widowed or had been married more than once.

The majority of the workers examined had a relatively high standard of education: 19 % had a university degree, 52 % a senior school diploma; 26 % had completed middle school and 3 % primary school.

Most subjects (63%) worked in private companies of varying types and sizes (from very small to large businesses) and 37% were employed in the public sector. The distribution in terms of sector was as follows: manufacturing and skilled manual work 21%, wholesale and retail trade 15%, public administration 14%, health services 13%, education 8%, transport 7%, other 22%.

Assessment Methods

Each patient had a consultation session with an occupational physician and a clinical psychologist.

The occupational physician collected general information regarding family history, and the patient's pathological, physiological and occupational case history. The working environment, the quality of communication with colleagues and employer, the exact time when the problems at work had begun and the type of harassment (e.g. insult, threat, unreasonable transfers etc.) were established by means of a semi-structured interview. This type of interview is based on a short list of questions and a certain amount of direct questioning, depending on what the physician deems important and what other information is required. We were thus able to reduce the type of false positive responses that may occur using traditional questionnaires. The Val. Mob scale questionnaire was also used to evaluate working conditions. This recently validated tool is useful not only to assess bullying, but also to determine the presence and intensity of certain "predictive" facets of this phenomenon on individual and organisational levels (Aiello et al. 2008). As part of the consultation, diagnoses were also acquired from psychologists and psychiatrists.

In order to evaluate psychic distress, we administered the GHQ -12 questionnaire (Goldberg's General Health Questionnaire) which is composed of 12 items (6 positive and 6 negative) dealing with psychic health over the previous 2 weeks. GHQ - 12 seems to be effective in terms of identifying and quantifying mental disorders which are not psychotic (minor psychiatric disorders) and is used for both the general population and psychiatric patients (Piccinelli et al 1993, Goldberg et al. 1997).

The aim of the clinical psychologist was to identify possible outside work factors that could generate or worsen symptoms, to verify general feelings of uneasiness and to establish that there were no serious mental conditions which would affect the patient's ability to provide reliable information.

In a second phase, patients underwent psychological tests (the MMPI-2 and the Wartegg test).

At the end of the diagnostic evaluation, an individual report concerning the relationship between workplace conditions and mental disorders was drawn up for each worker.

Various working conditions were identified: personal bullying, task-related bullying, work distress, sexual harassment and non -specific discomfort.

These conditions have been given various interpretations in literature. Their chief characteristics are reported as follows:

Bullying is defined as negative treatment on the part of one or more persons in the workplace, in a situation in which victims have difficulty in defending themselves; in general it lasts at least six months;

- (a) *Task-related bullying* refers to hostile actions specifically related to tasks, e.g. the imposition of unreasonable deadlines, unmanageable workloads, the assignment of meaningless tasks or no tasks, excessive monitoring of work, withholding of information or other actions making the work situation hard to bear. In task-related bullying, evident hostile behaviour against one's own image and in relationships are not relevant;

- (b) *Personal bullying*, on the other hand, is primarily considered to be person-related and arises when victims are subjected to insulting remarks, excessive teasing, gossip and rumours, persistent criticism, practical jokes, intimidation, social isolation and exclusion;

Work distress is a negative condition caused by organisational disorder in terms of work context (i.e. organisational abilities, rules in the place of work, career progression, autonomy in decisions, interpersonal relations at work and the balance between work and home life) and work content (workplace environment, task planning, work overload and hours of work);

Non-specific work discomfort indicates the presence of significant levels of uneasiness experienced at work which can be of various origins. These may even be linked to personal convictions (for example, unfulfilled job expectations, dissatisfaction at work, task changes etc.). In the case of interpersonal conflict, persecutory intent is not present.

At our centre, workers suffering from these disorders usually receive psychological support and, if necessary, psychiatric treatment. We also act to improve negative workplace conditions in various ways and to provide legal consultation.

The state of health of victims of bullying with related clinical conditions is periodically evaluated and their working conditions assessed. This starts from at least 12 months after the first observation and is aimed at verifying the effectiveness of the work carried out at our centre. Telephone interviews and questionnaires are used for periodic checks.

Up to now, a small number of workers (n. 61) who have been victims of bullying have been examined: they include 37 women (60.6%) and 24 men (39.4%) aged between 22 and 63 who had experienced prolonged personal bullying (n. 43) or task-related bullying (n. 18) for a period of more than 6 months. The average age of the group was 44.9 years; most of them worked in private businesses (n. 37), while the rest of them worked in the public sector (n. 24). The GHQ 12 questionnaire was administered during the interview and information was collected regarding how the situation had developed, the patient's state of health, any improvements or changes that had been made in working conditions and any psychotherapeutical treatment that had been carried out.

RESULTS

Our results showed that the working condition most frequently associated with psychopathology was bullying (Table 1).

A total of 135 patients were victims of bullying at work: 38.1% of the patients (n. 104) suffering from psychiatric disorders reported personal bullying and 11.3% (n. 31) reported task-related bullying. 27.5% of the workers had experienced work-related distress, 22% reported non-specific discomfort and 3 patients cited sexual harassment.

Psychopathologies in workers who had experienced negative working conditions were represented by various reactive neuroses, in particular, mixed anxiety and depressive disorder (51.6%), adjustment disorder (16.9%), depression disorder (17.9%), anxiety disorder (12.1%), post-traumatic stress disorder (PTSD) (1.5%).

As shown in table 1, more than half of the cases of mixed anxiety and depressive disorder were associated with personal bullying; PTSD was diagnosed in 2 workers as a consequence

of personal bullying and in 2 others workers respectively for task-related bullying and work-related distress.

Table 1. Mental disorders found in the patients in our study associated with negative working conditions.

Mental disorders		Personal bullying		task related bullying		Non-specific work discomfort		sexual harassment		work-related distress		TOTAL	
		n.	%	n.	%	n.	%	n.	%	n.	%	n.	%
Adjustment disorders	n.	25	24.0	5	16.1	6	10.0	1	33.3	9	12.0	46	16.9
	%	54.3		10.9		13.0		2.2		19.6		100	
PTSD	n.	2	1.9	1	3.2	0		0		1	1.3	4	1.5
	%	50		25						25		100	
Depression	n.	14	13.5	7	22.6	11	18.3	1	33.3	16	21.3	49	17.9
	%	28.6		14.3		22.4		2.0		32.7		100	
Anxiety and depressive disorders	n.	55	52.9	13	41.9	31	50.0	1	33.3	41	54.7	141	51.6
	%	39.0		9.2		22.0		0.7		29.1		100	
Anxiety disorders	n.	8	7.7	5	16.2	12	17.7	0		8	10.7	33	12.1
	%	24.2		15.1		36.4				24.2		100	
TOTAL	n.	104	100	31	100	60	100	3	100	75	100	273	100
	%	38.1		11.3		22.0		1.1		27.5		100	

Table 2. Field of work where working conditions led to the development of mental disorders

Field of work		Personal bullying	task related bullying	Non specific discomfort	sexual harassment	Work distress	TOTAL
Manufacturing and skilled manual work	n.	27	6	12	1	13	59
	%	45.8	10.2	20.3	1.7	22	100
Electricity, gas and water supply	n.	1	1	1	0	1	4
	%	25	25	25	0	25	100
Wholesale and retail trade	n.	17	3	7	1	14	42
	%	42.5	7.5	17.5	2.5	30	100
Hotels and restaurants	n.	5	0	1	0	3	9
	%	55.6	0	11.1	0	33.3	100
Transport, storage and communications	n.	5	0	4	1	9	19
	%	26.3	0	21.1	5.3	47.3	100
Financial services	n.	4	0	2	0	4	10
	%	40	0	20	0	40	100
Public administration	n.	10	8	11	0	11	40
	%	25.6	20.5	25.7	0	28.2	100
Education	n.	8	0	9	0	5	22
	%	36.4	0	40.9	0	22.7	100
Health and social work	n.	16	5	6	0	8	35
	%	45.7	14.3	17.1	0	22.9	100
Social and personal services	n.	1	4	1	0	1	7
	%	14.3	57.1	14.3	0	14.3	100
Other	n.	10	4	8	0	8	30
	%	34.5	13.8	24.1	0	27.6	100

Mixed anxiety and depressive disorders were also frequently caused by work distress and occasionally by non-specific work discomfort. Depression and more complex psychopath-

ologies were prevalent in work distress and anxiety disorders in non-specific work discomfort. Depressive disorders and/or mixed anxiety and depressive disorders were found to be the most frequent, although there were slight differences in symptoms.

According to our study, there was no significant statistical differences between genders. Of the workers suffering from psychiatric disorders, 59 were employed in manufacturing industries, 42 in wholesale and retail trades, 40 in public administration, 35 in health and social work, 22 in education and 19 in transport and communication (Table 2). Bullying was especially linked to the manufacturing industry, the wholesale and retail trades, the health service and public administration, while task-related bullying was associated more frequently with jobs in public administration. Work distress was associated with the manufacturing industry, the wholesale and retail trades, public administration, the health service and transport.

Table 3 reports the percentages of principal somatoform disorders that workers complained of. As can be seen, sleep disorders affected many patients. About half of them suffered from gastrointestinal disorders and/or eating disorders. 41.9% suffered from both sleep disorders and gastrointestinal disorders, while sleep and eating disorders were associated in 40% of cases. 57 people (20.9%) suffered from sleep and gastro-intestinal disorders together with cardiovascular disorders. The same percentage involved patients with a triple association of sleep, gastro-intestinal and eating disorders.

The gravity of the psychopathological condition had induced 87 patients (31.9%) to seek psychological support and psychiatric treatment: 81 of them had sought psycho-therapeutical support solely due to problems at work. Only 6 had received treatment due to work-related difficulties or other problems. Our psychologists' evaluation emphasised the advisability of psychological support for most of the patients.

61% of our patients (n. 167) were using psychotropic drugs when they came to our attention; 7.7% (n. 21) had used psychotropic drugs in the past. Only 75 patients (27.5%) had never used psychotropic drugs.

In Figure 1, the MMPI-2 personality profiles of patients with work-related psychopathologies are reported. As shown, the personality traits of patients complaining of a history consistent with bullying (task-related bullying and personal bullying), stress at work and non-specific work discomfort are very similar to those described in literature by various authors on the subject of victims of bullying at work. (Gandolfo 1995, Balducci et al. 2009, Matthiesen and Einarsen 2001). The patients presented elevated T-scores (above 65) for Hypochondria (Hs), Depression (D), Hysteria (Hy) and Paranoia (scale Pa); lower level profiles (but T-score still higher than 65) in four clinical scales (on average) were found in workers with experience of non-specific discomfort at work.

Table 3. Percentage of disorders complained of by patients examined

Sleep disorders (insomnia, recurrent waking, recurrent nightmares and association of disorders)	84.8
Gastrointestinal disorders (gastro-esophagitis, irritable bowel, gastro-esophageal reflux disease ...)	45.5
Eating disorders (lack of appetite, loss or gain in weight, bulimia, anorexia)	44.0
Cardio-vascular disorders (precordialgia, tachycardia, palpitation...)	39.4
Muscular and skeletal disorders (muscle spasms and cramps, cervical or low back pain...)	15.9

Table 3. (Continued)

Sexual dysfunction (impotence, decline in libido ...)	15.5
Skin disorders (itching, dermatitis ...)	5.8
Gynecological disorders (mestrual pain, menstrual disorders ...)	5.8

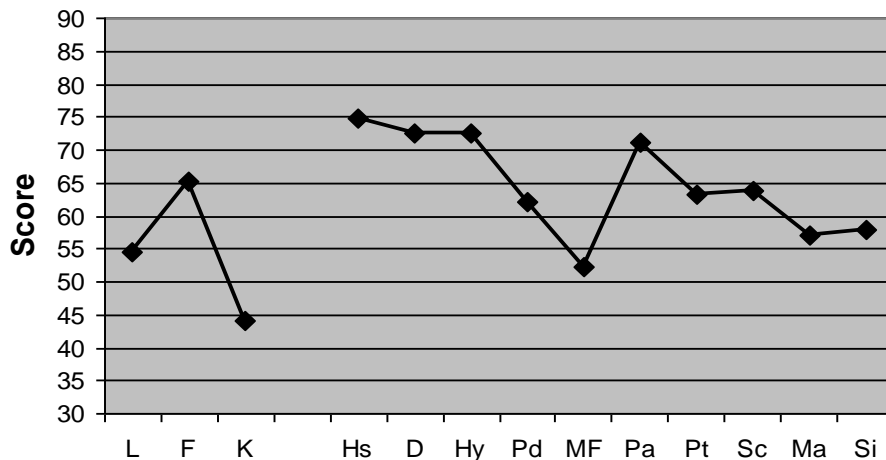


Figure 1. MMPI-2 personality profiles of patients with work-related psychopathologies: L Scale, F Scale, K Scale, Hs=Hypochondriasis, D=Depression, Hy=Hysteria, Pd= Psychopathic Deviate, Mf= Masculinity-Femininity, Pa=Paranoia, Pt=Psychasthenia, SC=Schizophrenia, Ma=Hypomania Si=Social Introversion.

An evaluation of the mental health of the patients, carried out by means of the G.H.Q-12 questionnaire during the first medical examination, highlighted an average value of 10.1 and a median of 11, without significant differences between genders (triangles in Figure 2).

61 patients were contacted by phone about 12 months after the first examination and the results of the G.H.Q-12 questionnaire administered were very different from those recorded previously.

This second evaluation confirmed positive developments in the clinical picture due to improved conditions at work or the cessation of negative conditions. In the first evaluation, they all had scores of over 4 (the limit for high risk of disorders involving anxiety or depression). The G.H.Q.-12 results reported in Figure 2 (circles) demonstrate that the number and intensity of disorders had considerably reduced: 44% of workers had a score higher than 4 and 56% lower than 4 or exactly 4 with a media of 4.75 and a median of 3.5. The workers who had a score lower than 4 all reported that the negative work situation had improved or been resolved.

The telephone interview also provided other information. 15% of those interviewed had left their previous job and the working condition had improved. 45% had stayed in the same job at the same company, had succeeded in obtaining better working conditions and thus many of their disorders had improved. For 27% of those interviewed, conditions at work had remained unchanged and for 13% of them conditions had worsened.

Workers reported improvements in their work situation and mental health due to awareness and action taken in the workplace by various professional figures (e.g.

occupational physician, harassment adviser). Legal recourse led to improvement in working conditions only in a few cases: this type of case more frequently tended to worsen.

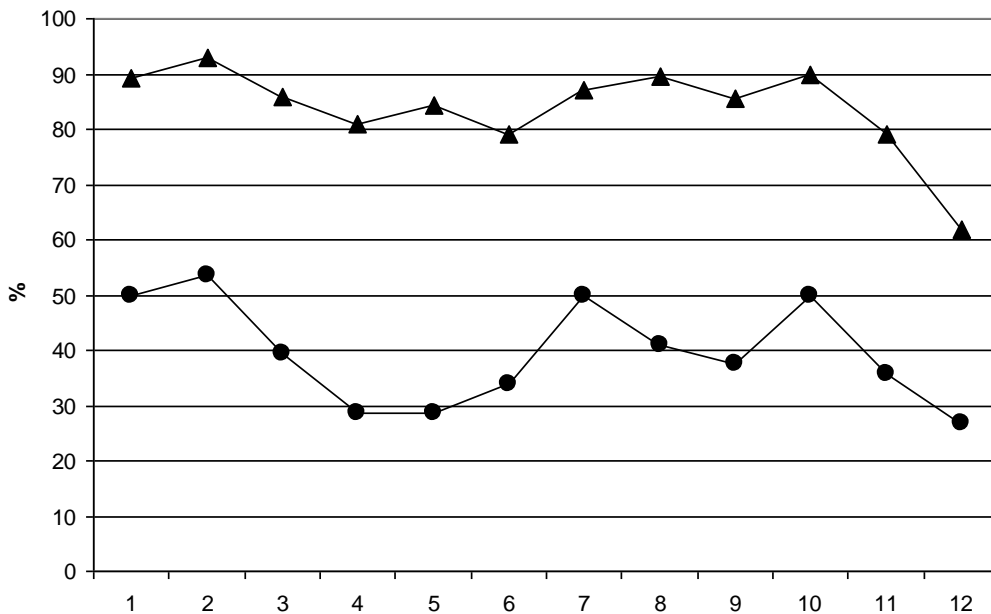


Figure 2. Results obtained by means of G.H.Q-12 in patients with work-related psychopathologies at the first medical examination (triangles) compared with those obtained in 56 patient contacted by phone about 12 months later (circles). Items: 1 - Been able to concentrate on whatever you are doing? 2 - Lost much sleep over worry? 3 - Felt you were playing a useful part in things? 4 - Felt capable of making decisions about things? 5 - Felt constantly under strain? 6 - Felt that you couldn't overcome your difficulties? 7 - Been able to enjoy your normal day-to-day activities? 8 - Been able to face up to your problems? 9 - Been feeling unhappy and depressed? 10 - Been losing self confidence in yourself? 11 - Been thinking of yourself as a worthless person? 12 - Been feeling reasonably happy, all things considered?

DISCUSSION

Studies conducted over the last 15-20 years on the subject of bullying at work have provided a major contribution to current knowledge regarding work related pathologies.

Bullying has become such a serious problem since the 1980s due to its severe effects on mental and physical health, as well as on society and industry, that in 2001 the European Parliament decided to focus on the necessity to adapt regulations regarding harassment at work.

Research carried out since the 1980s has revealed that prolonged psychological oppression in the workplace causes repercussions on health such as somatoform disorders, depression, anxiety, obsessive-compulsive disorders, sense of impotence, anger, despair, social isolation and general maladjustment. It has been demonstrated that these symptoms may lead to serious diseases, suicide or suicidal intent (Leymann 1990 e 1996, Björkqvist et al. 1994; Cassitto, 2002; Einarsen e Mikkelsen, 2003; Leymann, 1996; Mikkelsen e Einarsen 2002; Quine, 1999; Vartia, 2001 and 2003).

Bullying in particular has been considered to be so stressful that it may cause symptoms and reactions in emotional, psychosomatic and behavioural spheres and lead to serious psychiatric diseases (Paoli e Merllié, 2001; Björkqvist et al. 1994; Leymann, 1996; Cassitto, 2003; Punzi et al. 2007; Mikkelsen e Einarsen, 2002; Matthiesen e Einarsen, 2004).

Keashly and Jagatic (2003), in a revision of American literature on the effects of psychological violence at work, report some fundamental considerations. They state that the consequences of negative behaviour which may not at first seem to be serious are, on the contrary, extremely important and affect many areas of the victim's life: personal (psychological, cognitive, physical), interpersonal (aggressive behaviour, family and marital conflicts) and professional (decreasing work satisfaction, increasing absenteeism, changing jobs and retirement). The authors also report that victims of aggressive behaviour can in turn become hostile and aggressive themselves.

Leyman and Gustafsson (1996) found that the most typical psychiatric diagnosis for victims of bullying is post-traumatic stress disorder (PTSD) which was considered to be the best diagnosis in 92% of cases. Matthiesen and Einarsen (2004) confirmed a significant correlation between exposure to bullying behaviour and symptoms of PTSD, with a 72-76% prevalence of the disorder in bullying victims.

In the last few years mental disorders seem to have become more frequent as conditions in the workplace worsen; the effects on health and general well-being are consequently more serious.

Before discussing the results of this study, it is important to clarify some aspects of the methods used. The workers who are the subject of this research had requested medical consultation complaining of a history consistent with bullying at work. The fact that our data were collected in a clinical context increases their reliability: the evaluations made were the result not only of standard questionnaires but also of medical and psychological examinations.

Our study, however, is somewhat limited due to the fact that it was not possible to obtain an objective confirmation of the situation in the workplace. This aspect was evaluated by means documentation regarding the patient and descriptions provided by the patients themselves.

Of the patients in this study, 63% were female and 37% were male. The fourth European Working Conditions survey of the European Foundation for the Improvement of Living and Working Conditions demonstrated in 2005 that harassment in Europe is more frequently perceived by women. It may be, as hypothesised by Balducci et al. (2009), that women pay greater attention to symptoms and ask for medical assistance more often. Balducci et al. (2009) suggested that men probably suffer from disorders with a higher level of intensity because they do not notice symptoms until they become unbearable.

In our study, the women tended to suffer from negative behaviour which involved personal values, their interpersonal relationships and their emotions, while violence towards men involved their job.

There are other studies reporting the prevalence of bullying involving women. Some authors think that women are more likely to experience bullying because they are much more numerous in those sectors in which bullying is rather frequent (for example, the tertiary sector, the health service, hotels and restaurants etc.) (Björkqvist et al. 1994, Mikkelsen and Einarsen, 2002, Quine 2002; Salin, 2001).

According to our results, the mean duration of bullying was 28 months (S.D. 31 months). This seems to be in contrast with Northern Europe where Leymann (1996) and Einarsen S, Skogstad (1996) found, respectively, average periods of 15 and 18 months.

In Southern Europe, the average age for bullying is higher than in Northern Europe and the United States, probably because people with indefinite-term contract (who are generally older) tend to put up with bullying for a long period. On the contrary young people with fixed-term contracts and temporary agency contracts tend to quit their jobs when harassment occurs.

With regard to work sectors, our results (table 2) suggest a wide range of sectors are involved. The European Foundation (2005) also found that bullying was present in many types of businesses, especially in health and social services, hotels and restaurants, education, transport and public administration.

The main characteristic in our data is the wide range of psychopathologies related to the working environment. Depressive disorders, mixed anxiety and depressive disorders, anxiety disorders and adjustment disorders were the most commonly found.

These results are confirmed in studies involving large groups of workers in recent medical literature .

A French study (Niedhammer et al. 2006) confirmed the association between harassment at work and depression in 7694 employees (3132 men and 4562 women). Both male and female victims of psychological violence at work are significantly at risk of depression. The more frequent the episodes of violence, the greater risk there is of mental illness.

In the U.K, a national study has been carried on in order to evaluate incidence of work-related mental diseases (Cherry et al. 2006). 842 occupational physicians and 878 psychiatrists took part in the project. Occupational physicians collected data regarding workers with psychiatric problems and diagnosed mental disorders in 2718 cases between 1996 and 2001; between 1999 and 2001, psychiatrists identified 3624 subjects whose mental illness was related to work. Occupational physicians and psychiatrists made their diagnosis following ICD-10 criteria which were used to identify various different pathologies (depression, anxiety, PTSD and other types of stress and mental illness). Socio-demographic variables, type of employment and events which were thought to be the cause of mental disorders were also investigated.

In patients identified as suffering from psychopathologies, there were diagnoses of anxiety and/or depression in 72 % of cases in diagnoses made by psychiatrists and 60% of cases in diagnoses made by occupational physicians. 3% were diagnosed as suffering from psychosis in cases examined by psychiatrists, while no cases of psychosis was reported in cases examined by occupational physicians. PTSD was indicated in 18% of cases by psychiatrists and in 10% of cases by occupational physicians. In occupational medicine, PTSD is more frequent in men and usually related to work accidents.

Among the precipitating events identified, the most common involved factors intrinsic to the job (above all work overload) followed by problems in interpersonal relationships and changes at work (such as new responsibilities). The incidence of mental disorders was higher in professionals, associated professionals, technical workers and those involved in personal and protective services.

Our results are very much in agreement with Cherry et al. (2006): the total percentages of cases diagnosed as suffering from depression and/or anxiety is approximately 80% , similar to

what was found in the study carried out by occupational physicians and psychiatrists in the U.K.

We found that depression and/or anxiety are not only associated with bullying but also arise in workers who are not particularly harassed at work.

In our data, 15% of patients were affected by anxiety disorders. This result can be compared with the study of Linden and Beate Muschalla (2007), who investigated the correlation between primary anxiety disorders and anxieties which are specifically workplace-related. A sample of 131 subjects (80% women and 20% men) was selected among patients affected by mental disorders in a psychosomatic rehabilitation centre. Participants were interviewed using two questionnaires, one of which aimed at identifying major psychiatric diseases and the other related to workplace-related anxiety. The prevalent diagnoses in women were depression (44%) and generalised anxiety (50%), while in male participants diagnoses generally involved anxiety (31%), social phobia (31%) and dystimia (27%). In this group, 67.4% of subjects suffered from workplace related anxiety but the most significant result was that 14% of the sample suffered from anxiety exclusively related to the workplace without presenting other types of mental disorder. There was a high degree of co-morbidity between work-related anxiety and non work-related mental disorders. 59.3% of participants with panic attacks at the workplace also suffered from generalised anxiety and 60% of patients presented depression in addition to work-related social phobias.

It may be that there are anxiety syndromes which are exclusively associated with the workplace and mental disorders that only develop at work. These may be said to represent a specific clinical entity which needs to be better addressed in terms of prevention, diagnosis and therapy.

It is worth noting the low incidence of PTSD in our sample. In literature on occupational medicine, PTSD has been traditionally documented among specific groups of workers who have experienced traumas and accidents at work or in jobs characterised by danger, violence and life-threatening events. It has been identified in workers with burn injuries, as well as those who have been involved in, for example, various kinds of industrial accidents or bank robberies (Mac Donald et al. 2003); Grunert et al 1999 studied the psychological consequences of traumas to the hand; Robinson et al (1997) reported 13% of PTSD in a sample of 100 suburban police officers and Corneil et al. (1999) found respectively 17.3% and 22.2% of cases of PTSD in two groups of Canadian and American fire fighters.

Other recent studies seem to support the results emerging from our study: in a sample of 22 people who were legally recognised as having been mentally harassed at work (in court decisions passed on harassment and published by the French Ministry of Justice), no symptoms of PTSD were mentioned. The related medical certificates reported only anxiety/depressive syndromes or psychological disorders (Bonafons et al 2009).

In effect this can be explained by the fact that, according to DSM IV criteria, diagnoses of PTSD should be considered as inappropriate in cases of bullying: the A1 criterion deals with exposure to an extreme traumatic event which is a threat to physical or mental integrity. This criterion is never satisfied in bullying and thus psychiatrists do not often diagnose PTSD in these cases. Research and clinical experience have yet to demonstrate that bullying victims present all PTSD symptoms. The B criterion is however well represented by intrusive thoughts about work problems, obsessive and constant revisitations and reports of the traumatic experience which may persist in a chronic form for a number of years. Recurrent nightmares are typical, as is intense discomfort accompanied by physiological reactions to

any internal and external stimuli which recall the trauma. The C criterion involves avoidance of feelings, places, people, or activities related to the traumatic event and this may lead to a person becoming unable to go to work. Marked loss of interest and reduced participation in activities can result in social isolation. There are feelings of exclusion and isolation; limited emotions and affects and feelings of not having any future possibilities. Bullying victims initially and then chronically present increasing arousal. The D criterion concerns people who suffer from feelings of discomfort which may be evident in various different areas of their lives. They may occur, for example, in relations with family or friends and in free-time or domestic activities (Mikkelsen and Einarsen 2002).

Distress is also a significant risk factor for psychopathologies; in our study, among 75 workers displaying symptoms of distress, 41 developed mixed anxiety and depressive disorders, 1 suffered from PTSD, 9 were affected by adjustment disorders, 16 suffered from depression and 8 had anxiety disorders.

These results are confirmed by another study conducted in France in 2008 and published in the journal *Occupational Medicine*: a strong association was found between stress at work and anxiety/depression suggesting that stress could be an etiologic factor in these mental disorders (Brousse et al. 2008). The study provides evidence that jobs characterised by high demand and low control are associated with serious depression (OR 1.74) in men, while women with stressful jobs are at higher risk for depression or anxiety disorders (OR 1.47).

Melchior et al (2007) suggested that workers with highly demanding jobs involving work overload or too little time to carry out tasks, are doubly at risk of developing serious depressive disorders or general anxiety disorders.

Sleep disorders affected most of our patients (85% of the sample). These took the form of difficulty in falling asleep, recurrent waking with nightmares or negative thoughts and waking early. Insomnia is a common disorder in the general population and for 10% of adults is a serious chronic disorder (Ancoli-Israel and Roth, 1999). There is also a high prevalence of sleep disorders in working environments: approximately 10-40% (Broman et al.1996, Linton SJ, Bryngelsson 2000, Simon e Von Korff, 1997).

Several studies in literature have documented the relationship between stress at work and insomnia, but is still unclear what the main psychosocial work factors are leading to sleep alterations (Pilcher and Huffcutt 1996, Jacquinet Salord et al.1993, Stoller 1994). According to Hansen et al. (2006), the victims of bullying were affected by too little sleep, recurrent waking during the night, early waking in the morning and difficulty in falling asleep.

The last point of this discussion regards results obtained in telephone interviews carried out approximately 12 months after the first examination. We consider that monitoring allows us to improve the efficacy and speed of our work in the resolution of individual cases and will also result in a reduction in costs for workers, companies and the community.

The results we have described in this limited group of workers demonstrate that individual support (psychological and psycho-therapeutical care and support) in addition to action aimed at improving work conditions can help patients definitively in terms of mental and physical health. Care given by qualified personnel according to each individual case is useful in terms of psychological support. In contrast, legal action to solve problems at work does not seem to have been as useful.

The role of occupational physicians is important as discomfort at work can be recognised early, health problems can be diagnosed and conflicts solved in cooperation with other professional figures.

CONCLUSION

Documentation regarding work-related mental disorders is rapidly increasing in many industrialised countries. There is a wide and variable range of work-related psychopathologies including adjustment disorder, depression, generalised anxiety disorders and PTSD.

Traditionally bullying is considered to be a source of mental illness, but now we are also aware that there are other work conditions which play an important role in the development of psychiatric diseases even if prolonged moral harassment is not present. Our results confirm this and we suggest that psychological support in association with improved conditions in the work environment may help towards alleviating and curing many work-related psychiatric diseases.

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Chapter 9

BEYOND THE PHYSICAL SERVICESCAPE: HOW SOCIAL, SYMBOLIC, AND RESTORATIVE SERVICESCAPES INFLUENCE CONSUMER BEHAVIOR

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ABSTRACT

This chapter expands on Bitner's (1992) seminal article, in which she introduces the term "servicescapes" to the marketing and environmental psychological disciplines. Bitner originally conceived the term to denote objective, physical stimuli, which are under managerial control and affect both customers and employees within a specific consumption setting. Since then, other marketing researchers have looked beyond a built environment's physical realm to stimuli found in realms that are often uncontrollable by managers. These realms include the social, the symbolic, and the restorative. This chapter reveals how consumers are influenced by a confluence of servicescape stimuli that have social, cultural, and psychological meaning and that affect approach/avoidance behaviors. In addition, the chapter highlights how marketers, environmental and natural psychologists, humanistic geographers, gerontologists, and public health researchers can further explore the influence of servicescape stimuli on human behavior.

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INTRODUCTION

Bitner (1992) coined the term “servicescapes” to denote objective, measurable, or physical factors in a consumption setting, which can be controlled by a firm to enhance or to constrain employee and customer actions (Parish, Berry, & Lam, 2008; Zeithaml, Bitner, & Gremler, 2009). Although countless examples of potential servicescape elements that are under a firm’s or management’s control exist, Bitner consolidates these elements into three composite dimensions: (1) ambient conditions; (2) spatial layout and functionality; and (3) signs, symbols, and artifacts (see also Hightower, Brady, & Baker, 2002; Lin, 2004).

In general, ambient conditions represent background environmental stimuli, or atmospherics (Kotler, 1973; Turley & Milliman, 2000), that affect human senses. These stimuli include visual (e.g., lighting, colors, brightness, shapes; Dijkstra, Pieterse, & Pruyn, 2008), olfactory (e.g., scent, air quality, fragrance; Mattila & Wirtz, 2001), tactile (e.g., temperature, softness, smoothness), and auditory (e.g., music, noises; Morin, Dubé, & Chebat, 2007; Oakes & North, 2008) elements. Spatial layout refers to the manner in which the machinery, equipment, and furnishing are arranged. Along these lines, functionality denotes the ability of all these items to facilitate the service exchange process (Ng, 2003). Finally, sign, symbols, and artifacts refer to the explicit or implicit signals used to communicate about the place to customers. For example, signs may be used as labels for company or department names, for directional purposes, and to communicate rules of behavior (e.g., no smoking). Symbols, such as flags or organizational logos and monikers, and artifacts, such as artwork or decorative items, may be used to enhance a consumption setting and to create an overall aesthetic impression.

Although Bitner’s (1992) servicescape framework remains valuable to marketers, it contains a possible shortcoming. Namely, the servicescape framework originates from research conducted in environmental psychology (Barker, 1968) and ecology. Encouraged by Darwin, biologists began developing ecological theory in the early 1900s by investigating how organisms collectively respond to objective stimuli that are present in a spatially bounded area (Stokols, 1977). Barker and others later applied ecological perspectives to stimulus–organism–response theories by exploring how people collectively respond to objective stimuli in spatially bounded areas, such as a consumption setting. Although consumption settings, physical and cyber, indeed comprise objective, measurable, and manageable stimuli that influence all consumers in a collective manner, settings also contain stimuli that are subjective, are difficult to measure, are nearly impossible to control, and may affect consumers and employees in different ways.

A BROADENED SERVICESCAPE FRAMEWORK

Figure 1 represents a broadened servicescape framework that encapsulates objective, physical, and subjective stimuli contained in consumption settings that may enhance or constrain employee and customer actions. These servicescape stimuli are classified into four dimensional realms, each containing classificatory stimuli. Thus, the proposed framework supports Bitner’s (1992) seminal servicescape framework (which addresses the physical realm) and organizes a set of articles that put forth the existence of unmanageable, ethereal,

and even transcendental servicescape realms; we define these as social (Rosenbaum & Montoya, 2007; Tombs & McColl-Kennedy, 2003), symbolic (Rosenbaum, 2005), and restorative (Rosenbaum, 2009; Rosenbaum, Sweeney, & Windhorst, 2009) realms.

Notably, Bitner (1992) put forth that every consumption setting comprises physical, social, and natural stimuli; however, she focused on the conceptualization of a place's physical dimension, leaving future researchers to discover the other stimuli. Thus, this chapter heeds Bitner's request and offers researchers a complete servicescape framework. In addition, although both customers and employees internally respond to perceived servicescapes, this chapter focuses solely on how customers formulate approach/avoidance decisions on the basis of servicescape stimuli.

THE SOCIAL REALM

Rosenbaum and Montoya (2007) conceptualize a social servicescape as customer and employee elements that are encapsulated in a consumption setting. However, they emphasize that this succinct, albeit understandable, conceptualization fails to consider that places not only are socially constituted but also comprise the social, such that questions of "who we are" are often intimately related to questions of "where we are" (Dixon & Durrheim, 2004). In environmental psychology, the place identity paradigm represents a vehicle for discussing the manner in which individuals use physical environments to build or maintain their self-identities (Bonnes & Secchiaroli, 1995). To address all these particular nuances regarding a servicescape's social realm, Rosenbaum and Montoya maintain that a social servicescape comprises the following stimuli: employees, customers, employee–customer ethnic congruency, social density, and displayed emotions of others. These stimuli are now defined.

Employees

More than half a century ago, Stone (1954) concluded that housewives often form friendships with retail employees to help them remedy feelings associated with loneliness; more importantly, he argued that a consumer's need to assuage loneliness may be a driver of consumption. Since then, researchers have discovered that customers often seek out and patronize commercial establishments, such as bars (Cowen, 1982), beauty salons (Price & Arnould, 1999), dating services (Adelman & Ahuvia, 1995), small retail shops (Day, 2000), and neighborhood diners (Rosenbaum, 2006), partly because of life-enhancing, social supportive benefits that customers often receive from employees in these service firms. Indeed, employees in these commercial establishments often serve as *de facto* informal helping mechanisms for people in their time of need (Cowen, 1982), and this social interaction affects consumers' perceptions of store quality (Baker, Levy, & Grewal, 1992).

Indeed, recent research suggests that a socially supportive employee–customer trajectory exists as both parties provide and receive social supportive resources to each other in their time of need (Rosenbaum, 2009). Overall, this discussion suggests that employees need to be considered as social elements in a consumption setting that influence a customer's approach/avoidance decision (Baker, Grewal, & Parasuraman, 1994).

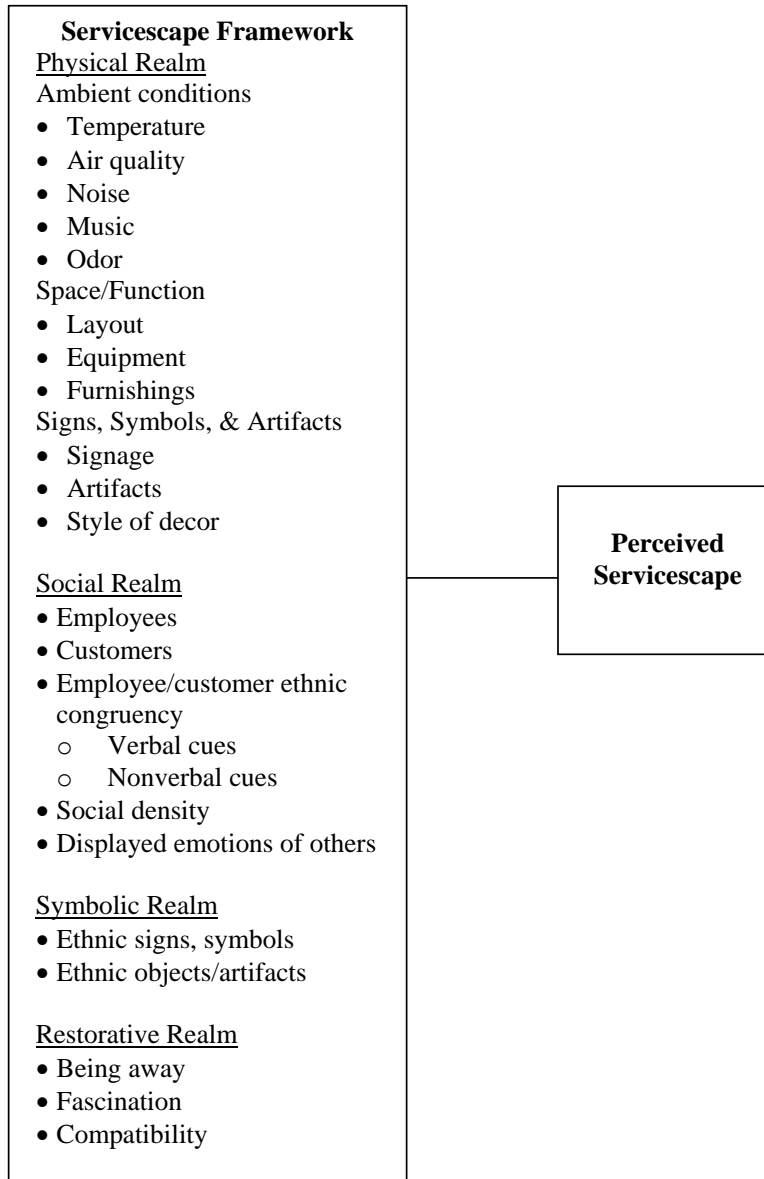


Figure 1. Servicescape Stimuli

Customers

Urban sociologists have a history of exploring the role of relationships between customers in commercial establishments, such as English pubs, laundromats, second-hand clothing stores, and coffee shops, in people's lives (for review, see Lofland, 1998). Indeed, Oldenburg (1999, p. 16) coined the term third places to denote "public places that host the regular, voluntary, informal, and happily anticipated gatherings of individuals beyond the realms of home and work." Third places are usually locally owned, independent, small-scale establishments that are operated by people who seem to know everyone in the neighborhood.

In addition, third places are usually patronized by a group of regular customers who often transform them into their home away from home (Oldenburg, 1990; 2001).

Recent third-place research, in both the commercial (Rosenbaum, 2008) and the not-for-profit (Glover & Parry, 2009) domains, reveals that patrons often seek out and patronize these establishments because they are able to obtain essential, life-enhancing social supportive resources from other customers; these resources include companionship, emotional support, and, to a lesser extent, instrumental support. For example, researchers have shown that consumers who experience the loss of human social support from experiencing negative life events, such as bereavement, divorce/separation, chronic illness, and retirement, may counterbalance lost support by forming supportive relationships with third-place customers (Rosenbaum, Ward, Walker, & Ostrom, 2007).

Other third-place patrons, such as those dying from cancer, may seek temporary solace in Gilda's Club, simply to be among like-others (Glover & Parry, 2009). Notably, research suggests that social support is most effective when it is delivered not from a single source,

such as a sole service provider, but rather from a broad network of people who are in the same boat, so to speak, who have lived the same experiences, or who share the same context of meaning (Gentry & Goodwin, 1995).

The drive to be among like-others may be so strong that it actually encourages a group of retired widowers to volunteer their time on behalf of a commercial third place (i.e., a local diner) simply because they need to instill a sense of routine in their daily lives and experiences (Rosenbaum & Massiah, 2007), while the need for banter encourages a group of senior citizens to regularly gather at McDonald's simply to engage in pure sociability. Indeed, in some instances, a group's requirement for light-hearted banter, in light of actual life realities, may result in the ostracizing of individuals who are painfully and frequently morose (Cheang, 2002).

It is understandable why older-aged and elderly consumers or retirees and empty nesters would frequent commercial establishments that acted as natural forums for their socially supportive relationships or that even offered them the mere possibility of obtaining feelings of togetherness from others. However, research also shows that teenagers, younger men, and middle-aged women may patronize places, such as video arcades, Gold's gym, and Curves, partially because of the social supportive resources they obtain from other customers in these establishments (Rosenbaum, 2008).

Thus, sociologists (e.g., Putnam, 2000) who claim that the marketplace is an anathema of community are somewhat mistaken. Small consumer groups that gather in places that promote customer connectedness and are bonded by social contracts that represent the weakest of personal obligations often provide their members with social support that many believed was only available from traditional relationships, such as families, friends, and coworkers.

In addition, whereas Bitner (1992) put forth that a perceived servicescape influences a consumer's approach/avoidance decision in a servicescape, Hidalgo and Hernández (2001) found that a consumer's ability to obtain social support from other customers in a consumption setting creates a profound bond or "place attachment" between the customer and a focal commercial establishment. This bond results in consumers expressing extreme forms of loyalty to focal firms and dedication to future patronage.

Rosenbaum et al. (2007) empirically demonstrate that place attachment comprises four dimensions. The first dimension, place dependency, suggests that a commercial establishment

fulfills a consumer's utilitarian consumption needs. The second, place identity, states that a consumer's self-identity is congruent with the focal commercial establishment. The third dimension, place lifestyle, suggests that consistent patronage to the place is part of a consumer's daily routine. Last, the fourth dimension, place commitment, suggests that a consumer accepts the establishment's goals and values.

A primary reason consumers are often attached to commercial places that house their supportive networks is that patronage becomes catharsis in nature. For example, leisure companionship, which denotes people engaging in shared leisure activities with others primarily for the sake of enjoyment (Iso-Ahola & Park, 1996), has been shown to reduce depression among Taekwondo participants. In addition, leisure friendships, or supportive friendships among leisure participants, help university students reduce mental illness and enhance well-being (Iwasaki, 2003). Other research shows a positive relationship between intercustomer social support—both in terms of network size and percentage of support obtained in a commercial establishment—and quality-of-life dimensions, including reduced stress, positive well-being, and reduced despondency (Rosenbaum et al., 2007). In summary, this discussion highlights the role of customers in a commercial establishment's social realm and exposes the reality that elements in the social realm may be the "stickiness factor" that bonds customers to places and ensures consistent patronage.

Employee–Customer Ethnic Congruency

The U.S. marketplace has a history of discriminating against ethnic and marginalized consumers, such as African Americans (Crockett, Grier, & Williams, 2003), Jews (Rosenbaum, 2005), Hispanics (Tharp, 2001), and homosexuals (Walters & Curran, 1996; Walters & Moore, 2002). However, although the days when establishments placed placards in their windows touting "whites only" and "no Jews allowed" are gone, establishments still communicate bigoted cues to disfavored consumers through social elements. For example, security may follow African American shoppers for "shopping while black" (Gabbidon, 2003), or employees may deviate from organizational policies and provide inferior service quality to ethnic or marginalized customers (Wakefield & Hudley, 2005).

Rosenbaum and Montoya (2005) argue that given the reality of marketplace discrimination, ethnic and marginalized consumers have learned how to interpret cues in an establishment's social servicescape, which permits them to assess whether the place is congruent with their self-identities. On the basis of qualitative and empirical evidence, they show that Hispanic and gay consumers are aware of their ethnic identity in commercial establishments. Indeed, ethnic consumers approach settings that are congruent with their self-identities and avoid settings that are dissimilar. The data reveal that ethnic consumers evaluate their "place identity," or person–place congruency, by engaging in place likening, a process that Rosenbaum and Montoya conceptualize as ethnic (and marginalized) consumers gauging the extent to which employees and customers in a servicescape are fellow ethnic members. That is, by drawing on the homophily principle, they contend that the similarity among people breeds connections (McPherson, Smith-Lovin, & Cook, 2001) and that the idiom "birds of a feather flock together" is prevalent in contemporary consumption settings.

Rosenbaum and Montoya (2005) further develop the place identity concept, which originates from environmental psychology (Proshansky, Fabian, & Kaminoff, 1983), by

revealing that Hispanic and gay consumers regularly respond both to negative verbal comments and to negative nonverbal cues (e.g., stares, lack of recognition) from customers and employees in retail settings. Thus, they show that approach and avoidance decisions are based not only on physical servicescape that are under management control but also on social stimuli, including feelings of person–place congruency and customer comfort, that may overtake in importance the physical stimuli. Indeed, by being in the wrong place at the wrong time, gay consumers have learned that their personal safety may be jeopardized.

Social Density

Consumer approach/avoidance behaviors are also influenced by the social density of a perceived servicescape. To date, the majority of empirical studies on the topic have shown that extreme densities of customers (crowding) result in negative effects associated with the loss of perceived control in customers reporting poor service evaluations (Tombs & McColl-Kennedy, 2003). However, the converse is also true as there are many situations in which high densities of customers induce positive customer responses (Foxall & Greenley, 1999; Lovelock, 1996; Turley & Milliman, 2000). Tombs and McColl-Kennedy (2003) posit that a customer's approach/avoidance behavior toward a particular servicescape's social density is influenced by whether the customer seeks private or group consumption. For example, diners sharing a romantic meal at a restaurant relish some semblance of privacy. However, customers may feel peculiar being alone in a health club or shopping mall, when being among others is a positive aspect of the consumption experience.

In many instances, customers are attracted to a high social density when the possibility of customers entering into enjoyable, light-hearted associations with others is part of a consumption setting's attraction. For example, consumers often enjoy patronizing weekend farmers markets not only to purchase fresh produce but also because they value the impromptu conversations they have at these markets—"every consumer" (McGrath, Sherry, & Heisley, 1993, p. 308) has the opportunity to "rub elbows" with farmers and other customers.

Displayed Emotions of Others

As previously discussed, Hispanic and gay customers respond to negative cues and glances they receive from employees and customers in consumption settings. On a broader note, all consumers may respond to a servicescape's emotional contagion, referring to the displayed emotions of others. Indeed, given the instinctive, contagious power of laughter (Provine, 2004), the ability of consumers to see customers and employees engaged in effortless banter and laughter most likely represents an emotional contagion that, in turn, positively influences their emotions and service quality perceptions. For example, research shows that the displayed emotions of individual baseball spectators tend to become communal emotions and play a major part in the consumption experience (Holt, 1995).

Tombs and McColl-Kennedy (2003) propose that a consumer's consumption experience, private versus group, influences the extent to which the displayed emotions of others will cause him or her to enter into an approach/avoidance decision. Quite simply, when consumers

are engaged in private consumption, such as using an automated teller machine or other self-service technologies, they are unlikely even to interpret the displayed emotions of other people in a servicescape. However, when consumers are engaged in group consumption, such as shopping in mall or grocery store, they might clearly respond to the displayed emotions of others in the servicescape, both positively and negatively.

THE SYMBOLIC REALM

Bitner (1992) put forth that signs, symbols, and artifacts represent an integral servicescape dimension. Yet, when Bitner conceptualized this dimension, she referred to general signs, such as exit and departmental signs, that are typically interpreted in the same manner by all customers and employees within a specific locale. For example, a restaurant, such as the Olive Garden, strategically employs artifacts and symbols to create an ersatz feeling of being in Italy among all its patrons.

However, can certain consumers interpret a particular servicescape's signs, symbols, and artifacts differently, to the extent that approach/avoidance decisions may differ for certain consumers? For example, barbershops and beauty shops in the African American community represent spaces in which the confluence of black hair care, for and by black people, and small talk establish a context for cultural exchanges and career opportunities (Alexander, 2003; Willett, 2000). Homosexuals regularly patronize gay bars (Halkitis & Parsons, 2003) and bathhouses (Bérubé, 2003) despite patronage being associated with risks associated with physical assaults and sexually transmitted diseases. Finally, American Jews are increasingly practicing gastronomic Judaism, which refers to eating Jewish-style foods (e.g., lox and bagel) and equating it to a form of religious practice (Halter, 2000). Yet these findings suggest that African Americans, gays, and Jews have learned how to interpret servicescapes symbols that connote a "sense of place" to them.

Rosenbaum (2005) puts forth the notion that ethnic identification moderates the relationship between a physical servicescape and consumer approach/avoidance behaviors. This contention is based on the idea espoused by sociological theorists that ethnic groups maintain distinct symbolic universes, which evoke common meanings among members. For example, Weber (1978) posits that ethnic groups possess a revered set of symbols of "ethnic honor," and Berger and Luckman (1966) refer to this symbolic set as a symbolic universe. Durkheim ([1912] 1995) also believed that ethnic groups share a symbolic universe. He argued that meanings are transferred to symbols during group gatherings and that images engraved within the symbols permit the group to exist beyond the gatherings. He also maintained that social gatherings are mandatory for group survival and that ethnic members actively try to attend these gatherings. Because each individual's consciousness is closed to other individuals, symbols become tangible intermediaries that permit the individual to realize that he or she is in the presence of fellow ethnic group members. Therefore, symbols may serve to notify ethnic group members that they are in unison with like-others—that is, among members who shout the same cry, say the same words, perform the same actions, and share the same culture.

From data collected from gays and Jews through photo-elicitation methodology, Rosenbaum (2005) defines a symbolic servicescape as signs, symbols, objects, and artifacts

contained within a consumption setting that possess a common interpretation among consumers belonging to a specific ethnic group. These symbols serve to evoke similar sensations of history or utopia, danger or security, and identity or memory among ethnic group members and either encourage or hinder their desire to approach a consumption setting. For example, among gay informants, the rainbow pride flag and pink triangle evoked sensations and emotions, while photos of traditional Jewish delicatessens, with Kosher signs, hanging salamis, and traditional sweets, evoked memories of family and of being comfortable among one's own kind. Indeed, ethnic symbols were found repeatedly to evoke feelings of comfort and inclusiveness among the Jewish and homosexual informants. Finally, it is worth noting that the symbolic servicescape is related to person-place congruency because consumers may read a consumption setting's exterior symbols and then become acute to assessing person-place congruency on entering.

THE RESTORATIVE REALM

Thus far, the discussion has focused on understanding how servicescape stimuli influence a customer's approach/avoidance behaviors to a particular consumption setting. The underlying assumption has been that by providing a customer segment with an attractive servicescape, a commercial establishment will relish positive managerial outcomes, including profitability, satisfaction, loyalty, positive word of mouth, and so forth. Yet, in a thought-provoking article, Frumkin (2003) suggests that some public places, such as commercial third places, represent "good places," which can be therapeutic to human health and well-being. He suggests that researchers should consider how public places can offer people a "sense of place," which Tuan (1974) conceptualizes as the spirit and personality that humans imbue on a locale.

However, a sense of place is more than a mere social servicescape or an ethnically welcoming servicescape. For example, although a vivacious restaurant offers patrons attractive stimuli and a gay bar adorned with pride flags offers patrons a relaxing place, these patrons still might not realize a sense of place. Only when patrons have a sense of place in a third-place locale (e.g., tavern, neighborhood store, diner) will it become meaningful to them as an extension of home; that is, only then will patrons form a small world held together by bonds of sociability and form networks of interpersonal care (Rosenbaum, 2006). Because each patron experiences some type of catharsis through patronage, fields of care can also be deemed as "habit fields," as consistent and daily patronage becomes part of the person's life routine, or place ballet (Seamon & Nordin, 1980), and, more important, becomes essential to his or her well-being.

To understand how a place can influence a person's health, Frumkin (2003) encourages researchers to consider Wilson's (1984) biophilia hypothesis, which suggests that an instinctive bond between human beings and other living systems exists. Thus, the deep affiliation that people often express for nature, such as wanting to vacation in a natural setting or spend time in a natural and outdoor environment, may be inherently engrained in their genetic structure. Along these lines, natural psychologists (Kaplan, 1995) have shown that nature possesses key characteristics necessary for people to undergo individual restorative experiences, which helps them remedy symptoms associated with directed attention fatigue.

Humans do not inherently possess the ability to expend concentrated effort on strenuous tasks for extended periods of time, such as working in front of a computer all day, listening to a lecture, or even caring for a loved one; yet contemporary lives often require that humans perform such tasks. To address this seemingly contradictory reality, Kaplan and Kaplan (1989; see also Berto 2005) put forth Attention Restoration Theory to posit that a person's ability to direct attention in thought and perception to environmental stimuli is a biological mechanism that becomes fatigued with use. Directed attention fatigue transpires when this mechanism becomes impaired; as a result, a person experiences lower mental competence, increased risk for accidents, higher incidences of attention deficit hyperactivity disorder, difficulties with focusing and planning, and irritability. Perhaps all of us can relate to feeling "mentally burned out" and to how irritable we become when we are "mentally exhausted."

However, all is not lachrymose for humankind, as the negative symptoms associated with directed attention fatigue can be remedied when humans restore their ability to focus on unpleasant stimuli for extended periods. This personal restoration typically occurs when people spend time in natural settings, such as parks, beach areas, gardens, or even grassy areas.

For example, children as young as five show decreased attention-deficit hyperactivity disorder symptoms (e.g., trouble paying attention and staying focused on task) after playing in green landscapes, grassy backyards, and parks (Kuo & Taylor, 2004; Wells, 2000). Exposure to nature also enables children to think more clearly and to cope more effectively with stress (Wells & Evans, 2003). University students whose dormitory rooms have natural views perform better on academic and attention measures than students who face manufactured settings (Tennessen & Cimprich, 1995). Finally, research findings show that hospital patients recover more quickly and feel less stressed when they are exposed to visually appealing landscapes during the healing process (Velarde, Fry, & Tveit, 2007).

Recent environmental psychological research purports that natural restorative environments include three environmental properties (Han, 2007). The first property, being away, provides people with a feeling of a break from day-after-day concerns or a feeling, albeit temporarily, of escaping to a different place. The second property, fascination, refers to a setting's ability to hold a person's attention effortlessly. The third property, coherence, suggests that a setting must be rich and coherent enough that it constitutes a whole other world from a person's perspective. Although it makes sense that natural stimuli possess these three properties, a question worth exploring is whether built, commercial servicescapes can also contain these properties.

Similarly, contemporary service research highlights the restorative potential of third places, thus establishing a "place" for commercial third places in public health research (Frumkin, 2003). For example, Rosenbaum (2009) shows that teenage video arcade patrons sense feelings of being away, fascination, and coherence while in the arcade and that college-aged students, who experience the restorative qualities of a third place, have lower incidences of attention-deficit hyperactivity disorder than other students.

In another study, Rosenbaum et al. (2009) analyzed patrons at Mather's-More-Than-a Café, a foundationally supported café located in the United States that offers senior-age customers breakfast, lunch, coffee, snacks, and social activities (e.g., exercise classes, game clubs, computer classes, blood pressure screenings) and that has crafted an environment in which some customers also sense restorative stimuli. In this study, Rosenbaum et al. demonstrate the positive relationship between personal restoration and feelings of personal

well-being. Perhaps Frumkin's (2003) question regarding what constitutes a good place can be answered as one that represents a "restorative servicescape."

CONCLUSION

The environmental psychologist Harold Proshansky (1978, p. 150) stated that "there is no physical setting that is not also a social, cultural, and psychological setting." In reality, this chapter buttresses Proshansky's statement. When coining the term "servicescape," Bitner (1992) focused on a consumption setting's objective and physical elements, which influence customers' and employees' approach/avoidance decisions and are under management control. Yet, in line with Proshansky's perspective, this chapter looks beyond a setting's physical realm and shows that consumption settings may comprise social, symbolic (cultural), and restorative (psychological) realms that contain less manageable or even completely unmanageable stimuli that influence customer behavior.

Perhaps consumer researchers will finally understand how consumers vivify a built environment (Sherry, 2000) when they simultaneously explore the confluence of a place's physical, social, symbolic, and restorative realms on consumer approach/avoidance behavior. Indeed, the authors encourage place researchers not only to study these four realms in tandem on consumer behavior but also to draw on place studies in architecture, natural psychology, humanistic geography, sociology, and public health to explore the existence of other realms that encourage customers and employees to form a "sense of commercial place."

Environmental psychologists are especially encouraged to draw on extant research streams, including place identity, place attachment (Hernández, Hidalgo, Salazar-Laplace, & Hess, 2007), and a sense of place (Hay, 1998), to understand how these concepts apply to consumer behavior within commercial third places and not-for-profit public/private places (e.g., nursing homes, hospitals, retirement villages). To date, these research streams have been applied to understanding person-place relationships to residential homes, communities, religious sites, and even leisure destinations, resulting in a paucity of research regarding the person-commercial place relationship.

We also encourage health, natural psychology, and service marketing researchers to further explore the health potential of commercial third places. According to Frumkin (2001, p. 234), more than half a century ago the World Health Organization defined health as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." Although natural researchers have shown that human contact with the natural environment contributes to human physical and mental health, having access to socially supportive relationships that routinely gather in a consumption settings offers people social well-being, especially among people who realize social support deficits.

Given that third places possess restorative stimuli that are analogous to those found in nature, we might surmise whether access to a third place is more beneficial to a person's health than access to natural stimuli, such as green spaces, beaches, and gardens. We encourage researchers to explore how the qualities constituting quintessential third places (Oldenburg, 2001), such as Mather's-More-Than-a-Café (Rosenbaum et al., 2009), McDonald's (Cheang, 2008; Day, 2000), or local diners (Bounds, 2005; Rosenbaum, 2006),

can be employed in other commercial and not-for-profit settings to enhance personal, public, and societal health and well-being.

For example, inner-city youth who lack easy access to green spaces and who are at high risk for experiencing negative symptoms related to “nature deficit disorder,” including classroom irritability and criminal behavior (Louv, 2005), may be able to remedy some of these negative symptoms by having access to subsidized third places, such as video arcades and even Starbucks (Rosenbaum, 2008). Furthermore, homosexual youth, who are at elevated risk for suicide because of feelings of ostracism from family and classmates, may find solace by coming together in a welcoming third place. Clearly, the cost of subsidizing third places, such as video arcades and cafes, which can serve as fields of care for their patrons, is less than the cost associated with teenage loitering, malfeasance, and mental health problems.

By moving beyond a place’s physical realm, perhaps we can begin to understand Relph’s (1970, p. 141) definition of places as “fusions of human and natural order [that] are the significant centers of our immediate experiences of the world” and why Oldenburg (1999) claims that third places are linked to the rise of great civilizations and great societies. For too long, marketers have considered commercial places mere homogeneous zones of exchange comprised of objective, material stimuli that appeal equally to members of a specific target market. Novel insights are emerging as to the influence of social supportive relationships, which are housed in commercial places, on consumers’ well-being. Consumer researchers are uncovering how ethnic and subcultural consumers possess a symbolic universe that transmits messages to group members, but our knowledge regarding “servicescape symbolic universes” that evoke similar sensations of history or utopia, danger or security, and identity or memory among ethnic and subcultural group members remains incomplete. Last, service researchers are finding that commercial places possess natural characteristics that may help people remedy symptoms associated with mental fatigue and stress. Hence, a “place” for third places exists in public health research.

This chapter summarizes more than a quarter-century work on marketing’s views toward servicescapes. However, much remains to be explored regarding the confluence of physical, social, symbolic, and restorative stimuli on consumer and employee approach/avoidance behavior.

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Chapter 10

PREDICTING CONCRETE AND ABSTRACT FEAR OF CRIME USING INDIVIDUAL AND ENVIRONMENTAL VARIABLES: A MULTILEVEL ANALYSIS

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ABSTRACT

The literature emphasizes two sets of variables fostering fear of crime. One set consists of its individual predictors (victimization, physical and social vulnerability) and the other consists of the characteristics of the environment where people live (urbanization, crime spread, and subjective perception of social and physical disorders in their life space). The main goal of our research was to analyze the influence exerted by these two sets of variables on personal fear of crime (or concrete fear) and concern about crime as a social problem (or abstract fear). We conducted a secondary analysis of the data gathered in January 2008 by the Observatory of North-West on a representative sample of the population over 18 living in Piedmont, a county located in North-Western Italy. We performed a multilevel analysis taking into consideration the following sets of variables: Socio-demographic and victimization variables, as well as the perceived spread of physical and social disorders, were analyzed at the individual level ($N = 750$); official crime rates and the size of the respondents' area of residence were considered as city-level variables ($N = 8$). Just 2% of the variation in concrete fear of crime lied at city level; the variation at the city level of abstract fear of crime was not statistically significant. Since the data were aggregate at the city level, we decided to perform a multilevel analysis to control for the nested structure of the data. Vulnerability indicators (i.e., gender, age, and education) and the perception of disorders were the most powerful predictors of concrete fear, while education was the most effective predictor of abstract fear. In particular, as concerns environmental features, the perception of physical disorders positively influenced both our dependent variables, while the perception of

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social disorders positively influenced concrete fear of crime only. Limits and possible developments of the present research are discussed.

Keywords: Fear of crime, Crime spread, Social incivilities, Physical incivilities, Victimization, Multilevel analysis

INTRODUCTION

Fear of crime has been largely studied in social sciences because of its consequences, both at the individual and at the social level (Amerio, 1999). Generally speaking, the literature discriminates between two different kinds of fear of crime: concrete fear (a feeling of dread or anxiety about personal safety or about personal possessions preservation) and abstract fear (a state of dread about crime spread in one's own country more than about personal safety) (Furstenberg, 1971; Nardi, 2003; Roché, 1993). Accordingly, concrete fear concerns the safety and well-being of the individual, while abstract fear concerns the safety and well-being of the community or that of society in its entirety. Thus, given its stronger links with people's quality of life, it is far from surprising that the literature gave much more attention to concrete fear than to abstract fear.

Two main families of studies on the predictors of concrete fear of crime are the most representative ones. The first one analyzed the main individual predictors of concrete fear of crime, giving high relevance to vulnerability, both at the physical—i.e., the perception of increased risk to physical assault due to limited mobility or to the lack of physical strength and competence—and at the social—i.e., the lack of material and social resources necessary to protect one's own home and/or retrieve financial losses in the event of victimization—levels (Killias & Clerici, 2000; Pantazis, 2000). In particular, belonging to the following social categories has been shown to predict high levels of concrete fear of crime: (a) older people (Amerio & Roccato, 2005); (b) women, particularly if fear of sexual assault is not controlled for (Ferraro, 1995); and (c) low socio-economic status groups, e.g., poor people (Kanan & Pruitt, 2002; Pantazis, 2000) and poorly educated ones (Austin, Woolever, & Baba, 1994; Kennedy & Silverman, 1985). In addition to socio-demographic characteristics, victimization experiences turned out to be effective predictors of concrete fear of crime: In spite of the first studies showing a lack of association between them, more recent research performed using multivariate analysis (thus controlling for the vulnerability of the respondents), and/or analyzing its mediators and moderators, pointed out a strong relationship between both direct and indirect (i.e., occurring to people belonging to one's social network) victimization and fear of crime (Hale, 1996; Petrosino, Fellow, & Brensilber, 1997; Roccato, 2007; Santinello, Vieno, Davoli, & Pastore, 2005; Taylor, 1983).

The second family of studies used a bulk of variables assessing people's physical and social environment to forecast concrete fear of crime, focusing on three variables or set of variables. First, the size of the area where people live: Research showed that the larger one's area of residence, the higher his/her concrete fear level (Liska, Lawrence, & Sanchirico, 1982; Yin, 1980). As a matter of fact, concrete fear is primarily an urban problem (Skogan & Maxfield, 1981). Several characteristics of large cities can be sources of fear: among them, poor social integration, population and residential density, ethnic, age, and income heterogeneity, heavy pedestrian traffic (although this applies only to those residents who are

poorly integrated in their neighbourhood), size of buildings, lack of services, of trees and gardens (Kuo, Bacaicoa, & Sullivan, 1998; Lévy-Leboyer, 1981; Newman & Franck, 1982; Perkins, Wandersman, Rich, & Taylor, 1993).

The second variable fostering concrete fear of crime is actual spread of crime. Even though many studies pointed out that crime spread is at most weakly correlated with fear of crime and that the latter is more widespread than the former (Moser, 1999; Taylor, 1995), research showed this association to be consistent, especially for micro-criminal offences (Balkin, 1979; Miceli, Roccato, & Rosato, 2004; Rountree, 1998; Skogan & Maxfield, 1981).

Finally, the literature has analyzed the role of the spread of “incivilities” or “disorders” (Hunter, 1978; Skogan, 1990). Researchers have divided these signs of social disorders into two conceptual categories—social and physical incivilities (Burby & Rohe, 1989; LaGrange, Ferraro, & Supancic, 1992; Skogan, 1986, 1990; Skogan & Maxfield, 1981; Taylor & Hale, 1986; Taylor & Shumaker, 1990). Social incivilities refer to disruptive behaviors such as loiterers, unruly and rowdy teenagers, gangs, beggars, public drunkenness, prostitution, and public drug use or sales. Physical incivilities refer to disorderly surroundings such as abandoned cars, vandalized property, litter, graffiti, vacant houses, and deteriorated homes. In the last three decades, a close-knit family of theories concerning the links between incivilities, psychological reactions to crime, and the actual crime spread, known as “incivilities thesis” (Taylor, 1999), developed. After Wilson’s (1975) and Garofalo’s and Laub’s (1978) seminal works, which aimed at explaining the discrepancy between people’s concrete fear and the crime rates suggesting a link between urban conditions and concrete fear of crime, two main versions of the “incivilities thesis” dominated this research field.

According to the first one (Hunter, 1978), residents are systematically engaged in causal attribution processes, aimed at explaining the spread of physical and social incivilities in their neighborhood. They attribute their community’s actual conditions on the one side to local residents, which are considered unable to manage their neighborhood, and on the other side to the agencies of control which are incapable of preserving order. Moreover, Hunter’s framework also connects incivility and crime, which are considered as nonrecursively linked to each other, through a common underlying cause: neighborhood disorder. Therefore, Hunter moved from the individual-level processes to a contextual model, which explains concrete fear of crime taking into account crime rates and places individual perceptions within varying community environments. Even though both crime rates and signs of incivilities may lead up to experiencing concrete fear of crime, the latter are assumed to exert stronger influence than the former, because they are far more prevalent and visible than crime itself.

The second model, widely known as the “broken windows theory” (Wilson & Kelling, 1982), assumes a temporal perspective to explain the relation between incivilities, crime, and concrete fear of crime. In this view, social and physical disorders make residents fearful as they conclude that social control has broken down. Thus, residents tend to withdraw from the community, relinquishing their roles of mutual support and lowering the level of informal social control. This in turn causes more disorder and may also cause crime to increase, since criminals intensify their offending as they conclude that social control is low and that residents are indifferent of what goes on in their neighborhood. In sum, as minor forms of public disorder lead to concrete fear of crime and to crime spread, a downward spiral of urban decay may occur (Kelling & Coles, 1996). Similarly, Skogan (1990) provided a theoretical framework to explain the link between disorders and crime, even though he focused on

neighborhood level and emphasized neighborhood change as the main and ultimate outcome of interest, shifting to a solely ecological perspective (Taylor, 1999).

The broken window theory has gained weight in criminology and in environmental psychology and has been widely used to shape “zero tolerance” policies, leading the police to crack down on the manifestations of public and social disorders. Even though this theory had a significant influence upon subsequent research and policy developments, it has also received some critics, and solid data showing that incivilities have (or not) a direct and causal relationship with crime spread are still unavailable (see, for example, Gau & Pratt, 2008; Harcourt, 2001; Harcourt & Ludwig, 2006; Sampson & Raudenbush, 1999; Xu, Fiedler, & Flaming, 2005).

However, researchers widely agree on the relevance of environmental conditions for the experience of fear of crime and rely upon different incivilities indicators, mainly dividing them into objective and subjective measures. To capture social psychological variations in incivilities, most researchers have averaged survey-based perceptions across citizens (for example, Perkins & Taylor 1996; Skogan 1990; Taylor, 1999), while a minority of them gathered onsite assessment of data, including site and street block characteristics (Covington & Taylor, 1991; Franzini, Caughy, Nettles, & O’Campo, 2008; Sampson & Raudenbush, 1999, 2004; Taylor & Hale, 1986; Taylor, Shumaker, & Gottfredson, 1985). In this chapter we used the first approach, and thus we considered perceived disorder as lying at the individual, and not at the ecological level. As a matter of fact, perceived disorder turned out to be a stronger predictor of fear of crime than the actual spread of disorders (Taylor, 1999). Even though the development of distinct incivilities assessment techniques gave rise to some methodological and measurement debates, which are still open (for brief reviews, see Piquero, 1999; Taylor, 1999; Worrall, 2006), from a psychological standpoint the supporters of the incivilities thesis agree in considering residents who perceive more “clues” to the underlying level of disorder in their environment as feeling more vulnerable and thus more fearful of crime (Covington & Taylor, 1991). In particular, some researchers showed that social incivilities are more strongly related to concrete fear of crime (Rohe & Burby, 1988) and to risk perception (LaGrange et al., 1992) than physical incivilities.

Since the literature shows that people’s level of concrete fear of crime may depend both on individual and environmental characteristics, hierarchical linear models (HLMs) provide an appropriate approach to predict them. Focusing on concrete fear of crime as the main dependent variable, some researchers applied this technique to investigate simultaneously the role of ecological and individual variables, and thus were able to identify lagged impacts at each level for the predictors they took into consideration (Robinson, Lawton, Taylor, & Perkins, 2003; Wyant, 2008), as well as to recognize some significant cross-level interactions between different predictors (Rountree & Land, 1996a, 1996b; Shafer, Huebner, & Bynum, 2006). For example, Rountree and Land (1996a) found that the relation between victimization and concrete fear is stronger among people living in relatively orderly neighborhoods. Besides studies specifically focused on the comparison between different level variables, given the relevance of environmental features in shaping fear of crime some authors also applied multilevel analysis just to control for potential contextual effects in the relation between individual variables and concrete fear (Franklin, Franklin, & Fearn, 2008; Roman & Chalfin, 2008). This is the approach we used in this chapter.

To conclude, as a whole we have a large number of studies in which the individual and environmental predictors of concrete fear of crime have been analysed. However, just few

studies analysed abstract fear. They showed that its main predictors pertain to the mass media (frequency of TV news watching) and the psychosocial (distrust of others, ethnic prejudice, and political disempowerment) domains (Amerio & Roccato, 2005), while are weakly or even not linked to people's everyday experience. As a whole, they showed that "socially peripheral" people tend to be more concerned than "socially central one". To the best of our knowledge, none of them used multilevel analysis to predict such fear.

GOALS AND HYPOTHESIS

The principal goal of this study was to test the impact of the main families of individual predictors of fear of crime highlighted in literature (i.e., those pertaining to the vulnerability and victimization models and those pertaining to the ecologic models) on both concrete and abstract fear. Since the data we analyzed were clustered, with citizens having been sampled within cities, we controlled for the aggregation bias attributable to the nested nature of the data using the multilevel regression technique of hierarchical linear modeling (HLM) (Raudenbush & Bryk 2002).

Based on previous research findings concerning concrete fear of crime, we hypothesized: (a) women, elderly, and poorly educated people to exhibit more fear of crime than their counterparts (Amerio & Roccato, 2005; Austin, Woolever & Baba, 1994; Kennedy & Silverman, 1985); (b) direct and indirect victimization experiences to be positively associated with fear of crime (Hale, 1996; Roccato, 2007); (c) people who perceive many social and physical incivilities in their immediate environments to be more fearful than those who do not (Taylor, 1999) and, in particular, perception of social incivilities to exert a greater influence on concrete fear than physical incivilities perception (LaGrange et al., 1992; Rohe & Burby, 1988). As concerns abstract fear, considering the few studies that focused on it, we hypothesized that "socially peripheral" people, e.g. poorly educated people, would exhibit higher levels of abstract fear than "socially central" ones (Barbagli & Maccelli, 1985; Roccato, 2007; Russo & Roccato, 2009).

METHOD

Data Set

We performed a secondary analysis on data gathered by the Observatory of North-West.¹ The sample ($N = 750$), interviewed by phone in January-February 2008, was representative of the population over 18 living in Piedmont, a county located in North-Western Italy.

Dependent variables

We assessed fear of crime using two four-category items: "Think of micro-criminality. How would you define the situation regarding this problem in your area of residence?" and "Think of micro-criminality. How would you define the situation regarding this problem in

¹ The Observatory of North-West (www.nordovest.org) is a research institute of the University of Turin that conducts surveys on the attitudes and behaviours of the Italian population three times a year.

Italy?”. As often done in Italian research on fear of crime (see Amerio & Roccato, 2005, 2007; Nardi, 2003; Roccato, 2007), we considered these items as operationalizations of concrete fear of crime and of abstract fear respectively.

Individual-level independent variables

We used three sets of individual-level variables to predict concrete and abstract fear. The first one included socio-demographic characteristics, we considered as proxy of vulnerability: gender (0 = woman, 1 = man), age, education (years of school attended), and number of family members.

The second one included victimization experiences: Six kinds of criminal offences (car theft, burglary in one's own home, pick-pocketing, robbery, violent assault, and sexual assault) were taken into consideration, asking respondents to report if they had been directly victimized, indirectly victimized (i.e. if a person belonging to their social network had been victimized), or if they had not been victimized at all over the 12 months preceding the survey. We then computed six synthetic indexes for direct and indirect victimization experiences, aggregating offences against the property (car theft, burglary in one's own home, and pick-pocketing), against the person (sexual assault and violent assault), and against both of them (robbery).

The third set of variables included the perception of social and physical incivilities. Six items assessed respondents' perception of social disorder asking them with which frequency (always, often, seldom, never) they used to see in their area of residence drugged people, prostitutes, homeless and drunk people, loiterers, beggars, and people working illegally in the streets. The perception of physical disorder was estimated through six items assessing the presence (or the absence) in the respondents' area of residence of abandoned houses or green spaces, unlighted streets, office buildings, unguarded building yards, crowded shops streets, and signs of vandalism such as burned garbage bins, abandoned cars, and broken telephone boxes. We computed two synthetic indexes, assessing social incivilities ($\alpha = .750$) and physical incivilities ($\alpha = .573$) respectively.²

Main city-level independent variables

When designing this research, we aimed at including two city-level variables in the analysis to control for contextual effects on citizens' fear of crime. The first one was official crime rate (we gathered the data from Istat³), calculated as the entire amount of crimes denounced from the police force during 2007. Crime rates were available at main city-level, thus our units of analysis were 8⁴. The second one was the degree of urbanization of the city where our participants lived, assessed through the size of the respondents' area of residence (whether it was a town with less than 10,000 people, between 10,000 and 100,000 people, or larger than 100,000 people). As we will show below, given the low quota of the overall variance of our dependent variables lying at the contextual level, we did not enter these

² We considered the latter α as reasonable, given the low number of items which composed the physical incivilities battery.

³ Istat is the Italian National statistic institute (www.istat.it).

⁴ In Piedmont there are 8 main cities (Alessandria, Asti, Biella, Cuneo, Novara, Torino, Verbania, and Vercelli). The measures of crime rate pertain to each city and its surrounding area.

variables in our final analyses, and we used hierarchical linear models just to control for the contextually nested nature of our data.

Data analysis

As we stated before, to examine individual factors associated with citizens' fear of crime, since the data we analyzed were clustered, with citizens having been sampled within eight main cities, we used the multilevel regression technique of hierarchical linear modeling (HLM, Raudenbush & Bryk 2002).

RESULTS

Preliminary analyses

Descriptive statistics for the individual variables are shown in Table 1.

Table 1. Individual Level Variables: Descriptive Statistics

Variables	Mean	Std. Dev.	Min	Max
<i>Individual level (N = 750)</i>				
Fear of crime (concrete)	2.35	0.76	1	4
Fear of crime (abstract)	3.44	0.59	1	4
Socio-demographic characteristics:				
Age	50.49	16.14	18	87
Gender (1=male)	0.39	0.49	0	1
Education (years)	11.81	3.98	5	21
Family components (N)	2.76	1.13	1	7
Victimization experiences:				
Direct against property	0.11	0.32	0	1
Indirect against property	0.38	0.49	0	1
Direct against property/person	0.01	0.12	0	1
Indirect against property/person	0.05	0.22	0	1
Direct against person	0.01	0.09	0	1
Indirect against person	0.04	0.20	0	1
Perception of social disorder	4.77	3.47	0	18
Perception of physical disorder	1.30	1.28	0	5

A preliminary step in HLM involves fitting an unconditional model and examining the variance of the dependent variable, partitioning it into individual- and ecological-level components. In our sample, just 2% of the variation in concrete fear of crime lied at city level, $\chi^2(7) = 25.84$, $p < .001$. Although the estimated city-level variances of concrete fear of crime gained statistically significance, it was clear that there was much more variability between individuals within cities than between cities. On the other hand, the variation at the city level of abstract fear of crime was not statistically significant, $\chi^2(7) = 8.27$, $p = .309$. Thus, since

the ecological-level components of our dependent variables' variances were significant but really small for concrete fear of crime, and not significant at all for abstract fear of crime, we decided not to analyze the influence exerted by our ecological predictors on fear of crime at the city levels. However, since the data we analyzed were aggregated at the city level, in order to avoid this "design effect" (Murray, Varnell, & Blitstein, 2004) we statistically controlled for the nested structure of the data using multilevel analysis (for the formula we used to predict our dependent variables, see the Appendix of this chapter).

Table 2. Correlates of Concrete Fear of Crime

Variables	Coefficient	SE	<i>t</i> ratio	<i>p</i>
Intercept	1.91	0.19	9.96	.001
<i>Level 1 – Individual</i>				
Age	0.01	0.01	2.06	.039
Gender (1=male)	-0.16	0.05	-2.91	.001
Education (years)	-0.01	0.01	-1.99	.047
Family components (<i>N</i>)	0.01	0.03	0.12	.905
Property direct victimization	0.12	0.08	1.40	.163
Property indirect victimization	-0.03	0.05	-0.60	.546
Property/person direct victimization	0.21	0.22	0.98	.326
Property/person indirect victimization	0.32	0.12	2.60	.010
Person direct victimization	-0.46	0.30	-1.55	.122
Person indirect victimization	-0.07	0.14	-0.51	.607
Perception of social disorder	0.07	.01	8.24	.001
Perception of physical disorder	0.04	.02	1.96	.050

Table 3. Correlates of Abstract Fear of Crime

Variables	Coefficient	SE	<i>t</i> ratio	<i>p</i>
Intercept	3.92	0.15	25.51	.001
<i>Level 1 – Individual</i>				
Age	-0.01	0.01	-1.12	.265
Gender (1=male)	-0.06	0.04	-1.38	.168
Education (years)	-0.04	0.01	-6.34	.001
Family components (<i>N</i>)	-0.01	0.02	-0.66	.509
Property direct victimization	0.02	0.07	0.31	.754
Property indirect victimization	-0.04	0.04	-0.91	.365
Property/person direct victimization	0.16	0.18	0.87	.384
Property/person indirect victimization	0.18	0.10	1.76	.079
Person direct victimization	-0.24	0.24	-0.97	.334
Person indirect victimization	-0.05	0.11	-0.47	.636
Perception of social disorder	0.01	.01	1.64	.100
Perception of physical disorder	0.04	.02	2.09	.037

Within-City Analysis

The within-class HLM model for individuals' abstract fear of crime is shown in Table 3. The variables we included explained 5.8% of the variation of the dependent variable. As hypothesized, participants' level of education exerted a negative influence on abstract fear, while no victimization experience significantly influenced it. The perception of physical incivilities exerted a positive influence on abstract fear, while the perception of social incivilities did not.

CONCLUSION

Fear of crime has been largely studied in environmental and social psychology, in criminology, and in sociology. In this chapter we predicted concrete and abstract fear of crime using three sets of individual variables that the literature shows to foster concrete and/or abstract fear of crime: social and physical vulnerability (Killias & Clerici, 2000; Pantazis, 2000), victimization experiences (Hale, 1996; Petrosino, Fellow, & Brensilber, 1997; Roccato, 2007; Taylor, 1983), and perception of the spread of social and physical incivilities (Burby & Rohe, 1989; Hale, 1996; LaGrange et al., 1992; Skogan, 1986, 1990; Skogan & Maxfield, 1981; Taylor & Hale, 1986; Taylor & Shumaker, 1990). The aim of our research was to analyze the impact exerted by these individual-level variables on concrete and abstract fear statistically keeping under control the contextually nested nature of our data.

Generally speaking, our multilevel results were just partially satisfactory. On the one hand, they showed there was no significant variation of abstract fear of crime at the city level. Thus, they provided new evidence confirming that abstract fear depends on people's "social peripherality" (Amerio, Gattino, & Roccato, 2004; Nardi, 2003). This was the first time a multilevel prediction of abstract fear has been performed. On the other hand, even if small, our results indicated a significant variation at the city level of concrete fear of crime indicator. These results seem to confirm that concrete fear of crime is at least in part actually connected to the characteristics of the context where individuals live (Hale, 1996). However, they should be considered with caution because of the small number of cities we could include in our analyses. Future research is needed, involving more cities and more detailed information regarding a city's characteristics. Such research, based on a larger ecological variation between cities than we could manage in this chapter, should be used to more deeply analyze the lack of significant correlations between the characteristics of the cities and abstract fear.

Concerning the individual predictors of concrete fear of crime, our results, confirming our hypotheses, supported the idea that—even partialling out the city-level variables—physically, psychologically, and socially vulnerable people tend to be more fearful than those who are not. Indeed, consistent with previous research (Amerio & Roccato, 2005; Ferraro, 1995; Roman & Chalfin, 2008), the highest levels of concrete fear have been shown by women and by older people, and by poorly educated people (Austin, Woolever, & Baba, 1994; Franklin et al., 2008; Kennedy & Silverman, 1985). Our results confirmed the literature as concerns perception of environmental characteristics also, as the perception of physical and (above all) social incivilities exerted a positive influence on concrete fear of crime (Rohe & Burby, 1988; LaGrange et al., 1992).

As concerns victimization experiences, we confirmed the literature only partially: The only significant effect exerted on concrete fear of crime by victimization was that of indirect robbery, while direct victimization showed no significant influence on concrete fear. It is not easy to interpret such a result, for two reasons. On the one hand, the reason why this victimization experience, and not another, fostered concrete fear of crime was not clear. Generally speaking, one could argue that this strong effect may have depended on the fact that robbery is a crime that involves both the person and his/her property, and thus its consequences may be perceived as very severe because they may produce both financial losses and physical damage simultaneously. However, in previous Italian research the indirect victimization experiences which most strongly influenced fear of crime was shown to be pocket-picking and bag-snatching (Miceli, Roccato, & Rosato, 2004). On the other hand, in the literature direct victimization usually more strongly influences concrete fear than indirect victimization. As a matter of fact, a few studies in which the latter influenced concrete fear more strongly than the former do exist (for a review, see Hale, 1996). Their results are interpreted as based both on the fact that indirect victimization is much more widespread than direct victimization, and because it “allows one’s imagination full scope without perhaps the same urgency to find some coping strategy” (Hale, 1996, p. 105). Nonetheless, to the best of our knowledge this was the first time that such a result has been found in the Italian literature. One may hypothesize that our results have been inconsistent with previous Italian results in that in this research the effect of contextual variables have been partialled out for the first time: In this light, a moderator influence exerted by city-level variable may be postulated. This is just a conjecture, as recent studies in which multilevel modeling have been used to predict concrete fear of crime did not use victimization among their predictors (cf., for example, Franklin et al., 2008; Roman & Chalfin, 2008). As a matter of fact, parallel analyses performed using the individual variables only brought results analogous to those we chose to publish.⁵ Thus, as a whole, new research explicitly aimed at deeply analyzing such inconsistencies is needed.

As concerns abstract fear, our results were substantially analogous to those available in the literature. Participants’ education was the only socio-demographic variable that negatively influenced it: This evidence, as well as the lack of association between the other socio-demographic variables and the victimization experiences with abstract fear, was congruent with previous results showing the importance of “social peripherality” in fostering our dependent variable (Roccato, 2007). As concerns environmental characteristics, our data provided new evidence that a positive relation between physical incivilities and abstract fear exists. Thus, the perception of signs of physical decay in their area of residence, besides shaping our participants’ level of personal fear, affected also their concern for the entire society. This evidence suggests a new interpretation of the consequences of the perception of signs of decay in one’s own immediate environment. Indeed, considering that abstract fear was shown to be mainly predicted by the ways people perceive, represent, and evaluate their social context (Amerio, Gattino, & Roccato, 2004; Nardi, 2003), it may be hypothesized that people interpret physical incivilities as a sign of disorder of their life-space as well as of their whole country. Why just physical signs exert this influence remains an interesting open question that would need *ad hoc* research to find an answer.

⁵ We do not present them for saving space. Readers interested in examining them may contact the corresponding author.

Even though our research showed some new results and suggested new directions of research, it had some limits, mainly because it was based on secondary analysis. Advantages and drawbacks of this method are well known (e.g., Kiekolt & Nathan, 1985). In our case, the use of secondary analysis made it possible to obtain low-cost, high-quality data gathered on a representative sample of the adult population living in Piedmont. This was particularly appreciable, as representative samples are still seldom used in environmental psychology. Clearly, our data may not be generalized to individuals living in other parts of the world; replications of our research performed on samples representative of other populations will be welcome.

On the negative side, we are aware that the variables we could use to assess concrete and abstract fear were not completely satisfactory, mainly because they consisted of single items and not scales. This prevented us from testing the reliability of the measurement of the two constructs. Moreover, recent research pointed out that crime-related fear involves an emotional and a cognitive dimension (Ferraro, 1995; Kanan & Pruitt, 2002; Rountree & Land, 1996a). As a matter of fact, however, such items have been used many times in Italian research on fear of crime displaying a nice construct validity (see Amerio & Roccato, 2005, 2007; Nardi, 2003; Roccato, 2007), leading to consistent results, and showing strong, significant correlations with concrete and abstract fear of crime scales (Parisi & Roccato, submitted). Nonetheless, future research performed using more satisfactory measures of fear of crime will be welcome.

Moreover, we could not contribute to the debate on the relation between disorder and crime spread. As a matter of fact, this is a very important and still open issue, directly linked to policing strategies for crime rate reduction (for recent research on the effects of police crackdown on disorders and minor crimes see Hinkle & Weisburd, 2008). In spite of the limitations above, however, we believe that our results can be considered as a useful preliminary multilevel exploration of the predictors of concrete and, above all, abstract fear of crime, to be more deeply analysed in further research, performed in more heterogeneous contexts.

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APPENDIX

Fear of crime = γ_{00} + γ_{10} (age) + γ_{20} (gender) + γ_{30} (education) + γ_{40} (number of family components) + γ_{50} (direct offence against participant's property) + γ_{60} (indirect offence against participant's property) + γ_{70} (direct offence against the participant) + γ_{80} (indirect offence against the participant) + γ_{90} (direct offence against participant's property and the participant him/herself) + γ_{10} (indirect offence against participant's property and the participant him/herself) + γ_{11} (perceived social disorder) + γ_{12} (perceived physical disorder) + u_0 + r

Chapter 11

ON THE FUTURE DEVELOPMENT OF THEORIES IN ENVIRONMENTAL PSYCHOLOGY: THE ROLE OF THE ENVIRONMENTAL PSYCHOLOGIST AS A RESEARCHER AND AS A PRACTITIONER

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ABSTRACT

The choice and use of theory is of primary concern to the development of environmental psychology. Since there are so many potential theories that may be applied in the environmental domain, the choice of theory is greatly influencing the cumulative empirical knowledge that constitutes the field and the development of the discipline. Two issues of future theoretical developments for environmental psychology that are equally important are proposed and discussed; 1) modifying psychological theories to the environmental domain and developing new theories unique to the area of environmental psychology and 2) externally validating the theories in societal projects.

Considering the vast challenges that faces human kind in terms of environmental problems and the obvious anthropogenic nature of these problems, it might seem strange that environmental psychology is such a small subfield of psychology. Nonetheless, this peripheral section of psychology has grown in the last decades and there is no doubt that we will see an even larger expansion of empirical research within the area in the near future. The field of study is peripheral in an academic sense, but it is at the very core when it comes to finding solutions to some the most serious threats facing the earth¹.

So how do we cope with this expansion and how will the field develop? A clear risk for any expanding field is that the studies conducted become isolated islands which make it

¹ This chapter will address theories that concern human influence on the environment. Environmental factors that influence humans will not be covered.

difficult to replicate findings and build a cumulative knowledge base. I believe that environmental psychology is especially vulnerable to this process for several reasons. Firstly, much of the research is carried out (at least in Sweden) in collaboration with other disciplines such as economy, political science or technology. While this is very good and necessary in order to find solutions to and managing environmental problems, it also generates problems in keeping a clear environmental psychology perspective. Secondly, the issues that we study are diverse; areas such as transportation, consumer behaviour, energy conservation or attitude change all entails different contextual challenges. Thirdly, much of this research is carried out with funding from organizations or councils with specific aims and objectives, making it a difficult task to integrate the results into existing environmental psychological knowledge. Finally, the fact that environmental psychology is a subfield to a very large academic discipline makes the range of potential theories in which we may build empirical studies very large. Since the amount of empirical studies is relatively few, the choice of the theoretical model that we use to study a certain problem is greatly influencing the cumulative empirical knowledge that constitutes the field.

All of the factors above have a potential centrifugal effect on the discipline. In order to prevent this effect and promote cumulative knowledge within the discipline a key factor is the choice and utilization of theories. Since theories are the analytical tool that we use for understanding and explaining a certain subject matter, the choice of theory is a crucial part in the development of the research area, and also for the identity of environmental psychology. The choice of theory determines not only the scientific area of study but also the way that this knowledge may influence attempts to manage and solve environmental problems.

The choice and use of theories is an important determinant for scientific development for most disciplines, but for the reasons stated above I argue that it is of more concern for environmental psychology than for most other fields. I will illustrate this point with a few examples, and then turn to future theoretical developments.

Applying Psychological Theories

The first theory used to explain pro environmental behaviour was the norm activation theory (Schwartz, 1977; Schwartz & Howard, 1981). The norm activation theory is proposed to explain the relationships between moral norms and overt behaviour. More specifically, the theory is concerned with explaining why individuals often fail to act in accordance with their moral norms. Two conditions are identified as necessary for individual norms to be activated and subsequently influence behaviour. The first is awareness of the consequences that may be the result of the behaviour. The second is that some degree of responsibility for these consequences must be accepted. Both personal characteristics and situational factors can influence the degree of awareness of consequences (AC) and ascription of responsibility (AR). The norm activation theory thus suggests that the relationship between norms and behaviour is dependent upon how the individual defines the situation. Without some degree of AC and AR, the individual will not realize that the decision is moral and will thus not behave according to his or her moral norms.

The second theory is the Schwartz value theory (Schwartz, 1992; Schwartz & Bilsky, 1987). This theory builds upon a universally set of structured values which refers to the organization of values based on their similarities and differences. Two different domains are

conceptually distant if it is empirically or logically contradictory to give high priority to values in both domains simultaneously. Two domains are conceptually close if placing high priority on values in both domains is compatible. People differ only in the relative importance they place on a universally important set of value types.

Research in environmental psychology has found relationships between self-transcendent values and environmental concern (behaviour and attitudes). Generally, valuing the dimensions of Self-transcendence and in particular universalism are positively related to pro-environmental behaviour (Bardi & Schwartz, 2003; Karp, 1996; Nordlund & Garvill, 2002), and pro-environmental attitudes (Nilsson, von Borgstede & Biel, 2004) while the Self-enhancement dimension are negatively related. These relationships have also been found in different cultures (Schultz and Zelezny, 1999).

The third example of a widely used psychological theory is the theory of planned behavior (TPB) (Ajzen, 1988; 1991). In contrast to the norm activation theory and value theory, that concerns activation of moral norms and abstract motives; TPB is designed to predict all kinds of behaviour and focuses on explaining specific intentions to behaviours that are under personal control. The theory has been applied on a wide range of environmental issues, for instance to predict purchase of genetically modified (Cock, Kerr & More, 2002) and organic food (Sparks & Shepherd, 1992), recycling behaviour (Cheung, Chan, & Wong, 1999), and composting of household waste (Taylor & Todd, 1995).

The three examples of widely used theories in environmental psychology have (at least) two things in common. Firstly, they were developed outside the environmental domain. The risk of using such theories without modifying them is that there might be things unique to the environmental domain that is missed out. Pro-environmental attitudes and behaviours are treated as having the same motives as altruistic behaviours, or in case of TPB, the same type of antecedents as most other behaviours. The idea that intrinsic rights or priority to the environment is a specific value or motive is thereby excluded. Even if the terms vary, these different classifications have in common that nature has a value in itself and not only as a value for human purposes. Merchant (1992) labelled this an ecocentric ethic, and Stern and colleagues as a biospheric value (Stern, Dietz & Guagnano, 1995).

Secondly, they are not primarily concerned with changing behaviour or attitudes but rather to explain or predict them. Although necessary and important, we know quite little about how these theories really work when implemented in societal attempts (governmental, NGOs) to change or promote environmental attitudes and behaviour.

Modifying Existent Theories and Developing New

As a complement to applying existent psychological theories an important part for the future of the discipline is to develop new theories and modifying existent theories unique to the environmental domain. One of the exceptions to the rule of using psychological theories in empirical environmental psychological research is the Value-belief- norm theory (VBN) that was originally developed to predict environmental activism (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). The theory links value theory, norm activation theory, and the new environmental paradigm (NEP) scale through a causal chain leading to pro-environmental behaviour. Each variable is postulated to affect the next variable in the chain and may also directly affect variables further down the chain. This causal chain consists of

personal values, NEP, AC and AR beliefs and personal norms for pro-environmental action. The theory furthermore postulates that the consequences that matter in activating personal norms are adverse consequences for the things the individual values. The theory has addressed different aspects of support for environmental movements. Individuals, who accept the basic values of a movement, believe that valued objects are threatened, and believe that their actions can restore those values, should also experience an obligation (personal norm) for pro-movement action. VBN has been used to predict three different types of environmentalism: environmental citizenship, private-sphere behaviour, and policy support (Stern et al., 1999). It has also been used to successfully predict acceptability of energy prices (Steg, Dreijerink, & Abrahamse, 2005), conservation behaviour (Kaiser, Hübner, & Bogner, 2005), environmental attitudes in organizations (Nilsson, von Borgstede & Biel, 2004; Nilsson & Biel, 2008) and general pro-environmental behaviour (Oreg & Katz-Gerro, 2006).

Thus, the difference with VBN theory compared to the unmodified psychological theories is that it takes into account specific environmental motives through NEP and (environmental) values, making it possible to disentangle different motives of environmentalism.

Another related example of modifying an existent theory are attempts find a specific environmental value cluster in Schwartz value theory (Stern & Dietz, 1994; Stern et al.; 1995; De Groot & Steg, 2007 ; 2008). In these studies, items have been selected from the Schwartz Self-transcendence dimension together with additional environmental items, in order to investigate if a specific environmental value cluster distinct from other self-transcendent values can be discerned. Values representing the self-enhancement value orientation to reflect egoism were also included. These value clusters were hypothesized to relate to beliefs about environmental consequences (to the biosphere, to others, and to the self) and to behavioural environmental intentions. Although earlier attempts did not find this distinction (Stern & Dietz, 1994; Stern, et al., 1995). Later research have supported this distinction using the same values (Steg, Dreijerink, & Abrahamse, 2005 De Groot & Steg, 2007; 2008).

By modifying the Schwartz value theory to fit the environmental domain, a new building block has been formed to be used in future studies. Without this modification, future value research would base their studies on Schwartz' original theory, thereby missing out the specific environmental motivation to behave pro-environmental.

Finally, the quest for finding a general and broad environmental psychology theory that can be applied in different environmental domains should be given a top priority. The social dilemma paradigm might be suitable for such a theory since it provides a common framework of concepts and definitions. The main difficulty with such a grand theory would probably be to broaden the scope from experimental research to real life environmental problems. Such a theory would however greatly benefit the discipline in terms of increased cumulative knowledge and the identity of the discipline.

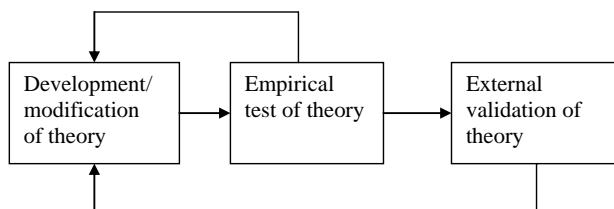


Figure 1. Schematic view of the relationships between modifying, testing and applying a theory

The Environmental Psychologist as a Practitioner

Here we come to the second endeavour for the environmental psychologist; to be a part of the policy making process and projects and applying the theories. Psychology has the potential to give policy makers, non-governmental organisations and community planners an improved knowledge base in order to change environmentally destructive behaviour. Psychological research provides a very important perspective on environmental problems and their possible solutions, since it concerns theories of how to change behaviour and attitudes, a core issue in solving environmental problems caused by humans. In these areas the individual psychological perspective should be able to serve as a direct input into political and environmental decision making.

This entails the environmental psychologists actually being part of developing information campaigns, preparing new policies, evaluate policies and campaigns and so forth.

When doing this, I believe it's important to base the contribution on a thorough theoretical base suitable for the field of environmental psychology. This might seem as self-evident, but in the process compromising with other practitioners, and more importantly the demands from funding organisations, there is a clear risk that theory and theory development will be traded off.

In order to work closely to the policy making process we need a strong theoretical base. The empirical knowledge that is gained by actually being part of implementing theory would greatly benefit future theoretical development. Most importantly, the discipline can benefit by actually measuring real *change* in attitudes and behaviours in different real life contexts, compare different theories, and use the results to modify these theories.

To illustrate this figure with an example, suppose a governmental organisation is planning a new information campaign to promote or change environmental attitudes. The role of the environmental psychologist is to choose and possibly modify a psychological theory. In this case, Elaboration likelihood model (Ajzen, 1991) may be suitable. According to the theory there are two routes to persuasion, the central route and the peripheral route. The central route uses message elaboration, and can produce a significant and long lasting positive attitude change, while the peripheral route uses different message irrelevant heuristic cues to illicit a quick response with a minor and not so resistant shift in attitude. Which way that is chosen depends on if the individual has the motivation and the ability to elaborate on the message. The motivation in turn depends primarily on if the message is interpreted as being personally relevant or not.

To my knowledge, this theory hasn't been tested in an environmental domain, and therefore it has to be modified to suit the need for environmental attitude change². We might assume that most of the environmental attitudes are relatively strong (i.e. a lot of knowledge and beliefs are associated with the attitude) considering the vast amount of information on environmental issues that people have been targeted with in developed countries (Eagly & Kulesa, 1997). However, how can it be determined what kind of information people consider as personally relevant and how do we test this? One hypothesis is that people with strong environmental values will consider general environmental information personally relevant. Certain types of more specific information however, let's say information about road pricing,

² Bator & Cialdini (2000) has written an excellent overview of applying persuasion theory to the environmental domain, but these guidelines are general and do not incorporate any specific environmental motivation

will be personally relevant for other people as well - for those using cars in cities. Here comes the second stage, empirically testing the theory in an environmental domain using questionnaires or experiments. This might lead to modifications of the theory. We might for instance corroborate the hypothesis that motivation is dependent on environmental values. In the third stage the modified theory is tested in the campaign and the results are evaluated, leading to further developments or modifications of the theory applied to the environmental domain. By using a follow up study we might discover that messages concerning issues that are not well known combined with strong environmental values among the targets for the information produce long lasting attitude change. This knowledge can finally be used in further modifications of the applied theory.

To conclude, by using narrow theories specifically developed for a special context, or worse, using no theory at all, it will be difficult to build on others research, in turn leading to a disintegrating discipline.

I propose two areas of future developments for environmental psychology that are equally important to expand and enhance the subject area; 1) applying more psychological theories to the environmental domain and modify them to fit the cause. This includes attempts to find a grand theory for environmental psychology. And 2) externally validating the theories in societal projects and learn from this to enhance the theoretical tools.

In order for the discipline to mature and develop, a lot is gained by using broad theories modified to the environmental domain, and testing these theories in as many contexts as possible to find a broad base of cumulative knowledge to build upon. The extensive collaboration with other disciplines, being a subfield to a very large scientific discipline, the demands from funding organizations, and the diverse areas of study makes this especially important for environmental psychology.

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Chapter 12

THE LINK BETWEEN LANDSCAPE PREFERENCES AND PERCEIVED RESTORATIVENESS - CURRENT RESEARCH TRENDS AND SUGGESTIONS FOR FUTURE STUDIES

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ABSTRACT

There have been major advances in the last 30 years in terms of our understanding of the relationship between natural landscapes and human health. Studies within environmental psychology have shown that the visual qualities of landscapes affect human beings in many ways, including reducing stress, improving attention capacity, facilitating recovery from illness, ameliorating physical well-being in elderly people, and assisting behavioural changes that improve mood and general well-being. These effects have been addressed by means of viewing natural landscapes either from a window, in a picture or a video or having vegetation around the residential or work environments.

Several recent reviews have assessed the evidence of health effects of different landscape types, assessing the range of landscape types currently used in environmental psychology studies. In environmental psychology the studies of restorative effects of landscapes have traditionally used a narrow range of landscape types, focussing on purely natural versus very urban settings. Little information has been available regarding particular landscape elements and structures within the urban versus natural categories. For the results to be more applicable in landscape planning and urban design, it is necessary to go beyond such coarse categories and explore the facets of the “nature”

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versus “urban” dichotomy. One of the key questions for future research is: what are the particular qualities of a restorative landscape? Identifying these qualities in order to apply them to landscape design has been identified as one of the major research challenges of the future.

Extensive research on landscape preferences has explored aesthetic appreciation related to specific landscape elements and landscape types. Several researchers have started to explore the link between preferences and perceived restorativeness, and in some studies a strong relationship has been confirmed. Key theories within landscape preference research, such as the preference matrix of Kaplan and Kaplan (1989), have made the assumption that preferences are linked to positive psychological reactions. Bridging the gap between preference research and research on restorativeness can provide knowledge about the particular qualities of a landscape that enhances its positive effects on human health. Looking at current research trends within environmental psychology, several projects are underway exploring these links, identifying landscape elements and qualities of landscapes enhancing restoration and preference. These efforts provide valuable steps towards a future restorative landscape design.

INTRODUCTION

Links between landscape and health have been observed for a long time and in many different cultures and societies, but the connection between nature and healing was gradually superseded by increasingly technical approaches and the idea that access to nature could assist in healing lost much of its significance (Cooper-Marcus & Barnes, 1999; Ulrich, 2002). However, in the last 30 years these traditional ways of linking nature and health effects have re-emerged as a topic of interest in the field of human health. Research has generated a relatively rich literature to explain the ways in which natural and other environments have an effect on human health.

Society is facing increasing challenges with stress related diseases, and knowledge about the way the visual landscape affects health and well being can help mitigate stress and increase restoration. The importance of landscapes for people’s health and well being is also well established on the political agenda, and the European Landscape Convention (Council of Europe, 2000, p.2) aims to promote landscape protection, management and planning, considering landscape as “a key element of individual and social well-being”.

There have been major advances in the last decades in terms of our understanding of the relationship between natural landscapes and human health. Studies within environmental psychology have shown that the visual qualities of landscapes affect human beings in many ways, including reducing stress, improving attention capacity, facilitating recovery from illness, ameliorating physical well-being in elderly people, and assisting behavioural changes that improve mood and general well-being. Natural landscapes were found to have a more positive effect on health than urban landscapes. These results support Ulrich’s “Stress recovery theory” (1979, 1984) and the “Attention Restoration Theory” of Kaplan and Kaplan (1989) - the latter claim that natural landscapes more often provide the key factors necessary for restoration. Still, these theories remain open to modification and development in the light of the accumulating evidence (Hartig, 2004).

HEALTH EFFECTS OF DIFFERENT LANDSCAPE TYPES

Several recent reviews have assessed the evidence of health effects of different landscape types, analysing the range of landscape types currently used in environmental psychology studies. A literature review of publications linking landscapes and health effects was conducted by the authors reporting evidence of health and well-being effects related to exposure to visual landscapes (Velarde et al., 2007). More than 100 articles were reviewed in detail, of which 31 were found to present specific evidence of health effects of landscape views. The results from the review revealed that the great majority of studies used a narrow range of landscape types, and the categories used in comparison between environments were generally very coarse, mostly focussing on purely natural versus very urban settings. Little information was available regarding particular landscape elements and structures within the urban versus natural categories.

The majority of studies reviewed by Velarde et al (2007) used only two categories (e.g. exposure to natural landscape versus urban or comparing landscape view versus no view). Less than 25% of the studies applied subcategories of natural and urban. These coarse categories clearly fail to reflect the vast variety of landscapes and landscape elements that are important in defining the character of “natural” or “urban” landscapes. Even though there was a wide range of landscape elements used in the reviewed studies, they still provide us with little information about which landscape elements have contributed most to the reported health effects. In two studies sub-categories related to the presence or absence of water in natural and urban scenes. A further two studies assessed the effect of openness in natural and urban settings. Other detailed studies were not related directly to specific elements (e.g. comparing golf landscapes to forests) and only one study analysed responses to specific landscape elements by comparing the effects of different tree canopy shapes.

Extensive evidence was found that natural environments have more positive health effects on people than urban environments. However, because of the coarseness of the categories compared it is difficult to distinguish which of the urban landscapes were worse or better or which of natural ones gave the strongest positive health effect. The results indicated that the presence of water gives a positive health effect, but they were rather weak. No clear relationship was identified between openness and health effects. In 29% of the studies the effects of varying amounts of greenery in residential or working environments were assessed. All of these environments are urban with varying amounts of natural elements present. These studies investigating the health effects of greenery around work or living places indicated that the greener the environment the better. However, they did not provide any information about what kind of greenery produces the greatest benefit, or whether all kinds of natural elements give similar effects.

One of the key questions that remains open is: what are the particular qualities of a restorative landscape? Identifying these qualities in order to apply them to landscape design is one of the major research challenges of the future.

On the other hand, extensive research on landscape preferences has explored aesthetic appreciation related to specific landscape elements and landscape types. Several researchers have started to explore the link between landscape preferences and restorativeness, and in some studies a strong relationship between perceived restorativeness and preference has been confirmed (Tenngart Ivarsson & Hagerhall, 2008; Nordh et al., 2009; Purcell et al., 2001).

Key theories within landscape preference research, such as the preference matrix of Kaplan and Kaplan (1989), have made the assumption that preferences are linked to positive psychological reactions. Looking at current research trends within environmental psychology, several projects are underway exploring the links between restorativeness and landscape preferences, identifying landscape elements and qualities of landscapes enhancing restoration and preference. These efforts provide valuable steps towards a future restorative landscape design. The trends within research on landscapes and health shifting from coarse categories to comparisons within scene types are shown in Figure 1.

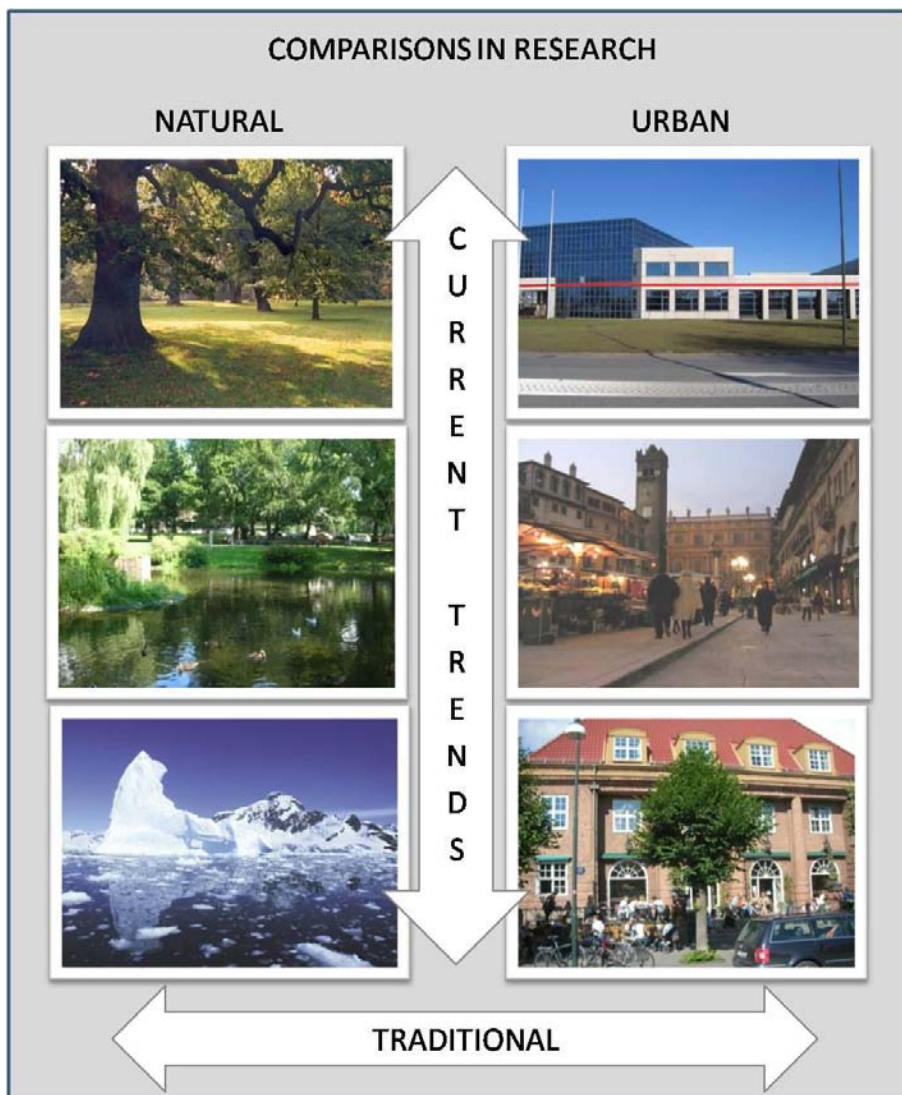


Figure 1 Photomontage showing examples of coarse categories of natural and urban traditionally used in research on health effects of landscapes, and current trends of comparisons within scene types.

TRENDS IN RESEARCH ON HEALTH EFFECTS OF LANDSCAPES

It is evident that the research community interested in restorative environments is growing fast. One of the major forums in environmental psychology, The International Association of People Environment Studies, IAPS, has recently launched a new network group on Restorative Environments. Furthermore the IAPS biannual conference in 2008, displayed several sessions focusing on restorative environments. Interestingly these included sessions dedicated particularly at new directions for restorative environments research, dissertations in progress, restorative mixed, built, virtual/simulated and conceptual settings. Studies including comparisons of similar settings, such as “wild” versus “tended” woods (Dörte & Nicole, 2008), where “tended” woods were found to give a stronger improvement of well-being than “wild” woods. Furthermore papers were presented exploring the impact of sound on the restorative values of parks (Payne, 2008). Evidence was presented for that some built environments, like historic panoramic places can be valued as equal to parks and nature in restorativeness (Troffa & Fornara, 2008).

The restorative urban environment is also now being discussed in relation to how we can design socially sustainable neighbourhoods. New conceptual models aiming to integrate natural, ecological and social dimensions of the open space in the city are emerging (Thwaites & Simkins, 2008). Links to sustainability also goes through the interest in how perceptual and emotional response to different biological criteria like biodiversity can be linked to the acceptance and support for conservation and management measures of biotopes (Johansson et al., 2008)

Progress is also now being made on the important question if particular components in environments are more important for the restorativeness. In a recently published study Nordh et al (Nordh et al., 2009) show that, within a sample of small urban parks, some park components are more important for the likelihood of restoration than other components. Most predictive of restoration was grass, amount of trees and bushes along with the perceived size of the park.

Nature and health relationships are also currently in focus by international organizations outside the social sciences. Examples are the European Cost Action E39 "Forests, Trees, and Human health and Wellbeing" and the launch of a Task Force on Forests and Human Health by the International Union of Forest Research Organizations, IUFRO¹.

TRENDS IN METHODOLOGICAL APPROACHES AND MEASUREMENTS OF RESTORATION AND PREFERENCE

The review by Velarde et al (2007), included studies of the health effects of visual exposure to landscapes or natural elements, and the visual stimuli used in the studies ranged from viewing natural landscapes either from a window, in a picture or a video or having vegetation around the residential or work environments. A wide range of research designs were used in the reviewed studies, reflecting the range of health effects that have been investigated. Both quantitative and qualitative methods were used. The quantitative methods

¹ <http://www.iufro.org/science/task-forces/forests-trees-humans/>.

included observations such as frequency of sick-calls, number of days in hospital, doses of analgesics needed, motor function tests, attention-tests or quantitative emotional tests as well as physical measures including blood pressure, skin conductance, brain activity, heart rate, muscle tension. Among the qualitative methods were observations of behaviour as well as surveys, including self-reports. Behavioural changes were mainly assessed through observations, self reports, questionnaires, structured interviews or by parent ratings and direct observation in the case of children. The identified health effects fall into three main types: Firstly, short term recovery from stress or mental fatigue (psychological); secondly, the physical recovery from an illness or reduced incidence of physical illness; and, thirdly, a long term behavioural change and an overall improvement in well-being (increased social interaction, reduction of aggressive behaviour).

Current trends in research on health effects of landscapes include not only new research questions and approaches, but also novel methodology and research designs. Virtual reality is emerging as a means of assessing how landscapes are perceived and the effects of different landscape elements on humans (Ziesenitz & Krömker, 2008). Electroencephalography (EEG) measurements are being used to assess emotional responses to fractal patterns (Hagerhall et al., 2008) and forest biodiversity (Johansson et al., 2008).

Several researchers have used the Perceived Restorativeness Scale (PRS scale) in assessments of different scene types and restoration. Some authors (Fischl et al., 2008; Payne, 2008) use new PRS scales for sound and architectural details while Tenngart Ivarsson & Hagerhall (2008) used a PRS scale to compare two examples from the same mixed environment (therapeutic gardens) rather than to test a contrast between built and natural. The results from Tenngart Ivarsson & Hagerhall's (2008) study show that the gardens are perceived restorative and that the PRS scale succeeded to discriminate between the two gardens. This points to the PRS being a useful tool and emphasizes the shortcomings of broad scene type definitions. The results show that one scene type can include environments that are significantly different in perceived restorativeness.

Most of the studies reported short term health effects of either psychological or physical nature, e.g. short term recovery from stress or mental fatigue (psychological) (Velarde et al 2007). Health and psychological well-being are, nevertheless, not only about not being ill. It is important to consider resources that regularly become diminished, "as when we tire mentally over the course of a work week" (Hartig, 2004, p.2). Even though some of the measured behavioural changes are apparently short-term effects, the accumulation of such short-term outcomes may have implications for longer-term health outcomes (Hartig, 2004). Such cases thus support the likelihood of long-term health benefits related to behavioural changes associated with social ties (Kuo et al., 1998), improving self discipline (Taylor et al., 2002), decreasing aggressive behaviour (Kuo & Sullivan, 2001a, 2001b) and generally improved comfort and well being (Grahn et al., 1997; Kuo, 2001; Milligan et al., 2004; Stigsdotter, 2004).

CONCLUSION

Through the last three decades extensive scientific evidence of nature's restorative abilities have been compiled. Studies have shown that exposure to natural environments give

more positive health effects than urban settings. However, until recently the categories used in comparisons within environmental psychology have been very coarse, typically focussing on the natural versus urban dichotomy. Current trends within the field of research are addressing the need to understand which landscape elements and qualities within a landscape type make a difference on the health effects that the landscape can provide. This also requires development of new methods and approaches suitable to address the issues on a more elaborate and detailed level.

We believe that by bridging the gap between preference research and research on restorativeness, it is possible to gain knowledge about the particular qualities of an environment that enhances its positive effects on human health. Research on landscape preferences have provided rather detailed knowledge about which landscape elements and characteristics enhance people's appreciation. There is already evidence of links between landscape preferences and restorativeness, and exploring these links can be a valuable first step towards a future design of restorative environments.

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Chapter 13

DIFFERENT LEVELS OF PLACE IDENTITY: FROM THE CONCRETE TERRITORY TO THE SOCIAL CATEGORIES

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ABSTRACT

Many scholars suggested that in the age of globalization place is no more a relevant reference for identity building (Bauman, 2004; Royal & Rossi, 1996) but others still underline that this does not concern all the citizens (Tartaglia, 2009). Individuals with a high rootedness in the local territory (i.e. less educated or elder) could develop high identification with the local community they live because of their intense and significant use of the territory and of the lack of other possible identifications (Lewicka, 2005). This could be true for small territorial units (i.e. the neighborhood), that could be directly experienced by people, but it is not convincing for larger territorial units (i.e. the whole city or the region) that rather could be social categories carrying ideal meanings not based on a direct contact with the territory and its inhabitants. Present work was conducted on a sample of 349 adults residing in a north Italian big city. The aim was to compare the impact of different predictors on place identification. Three progressively larger spatial ranges were considered: the neighborhood, the city, and the region. Results showed that identification to the three spatial ranges is affected by different predictors, implications are discussed.

Keywords: Place Identity, Territorial Community, Social Categorization.

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INTRODUCTION

Place Identity in the age of Globalization

Places always affected human activities providing resources and setting limits, but also had psychological impact provoking relevant feelings and furnishing a base for cognitive elaboration. Psychology studied the emotional impact of places using the concept of Place Attachment (Altman & Low, 1992) and its cognitive implications by means of Place Identity (Proshansky, Fabian, & Kaminoff, 1983).

Place Identity Theory posits that places could be the base to define relevant categories that individuals use to describe themselves: place can be considered a social category and it is subject to the same rules as a social identification (Twigger-Ross & Uzzell, 1996). As it is well known, the Social Identity Theory and the Self Categorization Theory (Tajfel, 1981; Tajfel & Turner, 1979; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987) aim at showing which processes are responsible for individuals conceptualizing themselves as members of specific social categories. Thus, Place Identity and identification would express membership of a group of people who are defined by their location (Twigger-Ross & Uzzell, 1996). A study carried out following such an approach (Twigger-Ross & Uzzell, 1996) showed the salience of place identifications to a group of residents and concluded that these identifications are a legitimate addition to the existing range of identifications. To sum up, place identification applies specifically to the aspects of identity and those of the self-categorization on the basis of the membership to a locally defined group.

The importance of territorial categories in defining identity was proved by several studies but yet Riger and Lavrakas (1981) underlined the fact that places are not equally important for all the people. In particular they asserted that attachment and social interaction in urban communities are lower for people with higher self-sufficiency and autonomy. On the contrary, individuals with a high rootedness in the local territory (i.e. less educated or elder) could develop high identification with the local community they live because of their intense and significant use of the territory and of the lack of other possible identifications (Lewicka, 2005). Place Identity, in fact, can differ according to some demographical variables. If gender is considered, the research reports divergent data. Whilst in some studies men and women show the same levels of place attachment (Brown, Perkins, & Brown, 2003; Lewicka, 2005), in others women express stronger place connections (Hidalgo & Hernández, 2001; Mesch & Manor, 1998). Prezza, Amici, Roberti and Tedeschi (2001) found that gender positively influences local relations, which in turn have a significant effect on Place Identity. Tartaglia (2006) commented similar findings suggesting that attachment to relational community is higher among women probably because of their social role: the majority of responsibility for childcare and home management are usually assigned to women, binding them more to local interaction.

Age has also a key role, especially because its connection to residence time, which is one of the main predictor of place identification (Hernández, Hidalgo, Salazar-Laplace, & Hess, 2007; Lewicka, 2005; Knez, 2005; Stedman, 2002).

Another remarkable variable is the cultural level, although its role has rarely been investigated. For Mesch and Manor (1998) the more educated people take more pride in the neighborhood and are likely to feel sorry to move out. However, as the authors pointed out,

the pride can be due to the fact that more educated individuals tend to live in high socioeconomic areas that enjoy high prestige. When the cultural level is studied in reference to place identification and not to pride, in fact, dissimilar evidences are provided: Lewicka (2005) showed that the level of education was a negative predictor, arguing that persons better educated are more geographically mobile and thus less dependent on a specific place.

However, most of these studies have been focused on small territorial units (i.e. neighborhood), that could be directly experienced by people. The findings are not so convincing for larger territorial units (i.e. the whole city or the region) that rather could be social categories carrying ideal meanings not based on a direct contact with the territory and its inhabitants.

In the last decades, socioeconomic transformations usually defined by the concept of globalization contributed to release people from dependence on places. Sociologists pointed out the loss of importance of territory at macro social level (Badie, 1995; Bauman, 1998) and psychologists noticed a similar trend at individual level (Royal & Rossi, 1996). But also in the context of a general reduction of the territorial importance, Tartaglia (2009) observed that place is still more relevant for subjects with lower education, that remain more dependent on the territory where they live.

Objectives

The aim of the study was to compare the impact of different predictors on place identification with three different territorial ranges: the neighborhood, the city, and the region. We expected that place identification should be affected by different variables according to the considered spatial range, since small territorial units, i.e. the neighborhood, are directly experienced by the residents, whereas larger areas, i.e. the region, are too big to be completely experienced by the subjects and rather are more similar to social categories.

We used as predictors a set of socio-demographical variables (gender, age, educational level, length of residence and place of birth) that yet resulted related to a strong bond between individuals and places (Hernández, Hidalgo, Salazar-Laplace, & Hess, 2007; Hidalgo & Hernández, 2001; Knez, 2005; Lewicka, 2005; Mesch & Manor, 1998; Stedman, 2002; Tartaglia, 2006).

In particular we hypothesized that:

1. At neighborhood level the dependence on the place provokes a higher place identification. This means that people usually more rooted in the local community (i.e. women, less educated, and long-time residents) are more identified with the neighborhood.
2. In respect to larger spatial ranges (i.e. the city and the region) place dependence does not affect identification because the relation between individuals and these territorial units is based not on a direct contact but on a cognitive process of categorization. Since the place of birth contributes to the definition of the self based on territorial membership, at this level we expect an influence of the place of birth on place identification.

Method

The study was carried out on a sample of 349 adults living in Turin, a city of about one million inhabitants located in the region of Piedmont, in the north-west of Italy. Participants were recruited from three apartment buildings randomly chosen in each of the ten city's districts (globally thirty apartment buildings were involved). They were contacted directly at home. The rejection rate was 5.7%.

A total of 48.7% of the subjects were male and 51.3% female, the average age was 42.2 years ($SD = 16.5$). They attended school on average for 13.4 years ($SD = 4.0$, range: 5-18 years). About half (52.6%) of the subjects were born in Turin, 23.8% in other cities or villages of Piedmont, and 23.6% in other Italian regions, mainly in the south of Italy. Overall, the participants had lived in Turin for an average of 31 years ($SD = 16.91$).

Data were gathered by means of a questionnaire including two sections:

1. In the first, participants were requested to answer three items on neighborhood, city and region identification (i.e.: being an inhabitant of my neighborhood reflects an important part of me). Items were scored on a 7-point likert-type scale from (1) completely untrue for me, to (7) completely true for me.
2. In the second, socio-demographical variables (gender, age, educational level, place of birth) and the length of residence in Turin were investigated.

Besides descriptive analyses, data were analyzed by means of multiple regression analyses.

Results

The average scores of neighborhood, city, and region identification were respectively 4.26 ($SD = 1.97$), 4.84 ($SD = 1.94$), and 4.61 ($SD = 2.15$). All the variables were positively correlated: the link between the identification with the larger areas, i.e. the city and the region, was the strongest (Person's $r = .58$). The smaller ranges, i.e. the neighborhood and the city, were also related (Person's $r = .35$), as well as the neighborhood and the region identification (Person's $r = .36$).

To investigate the predictors of place identification three multiple regression analyses were performed, in which every spatial range identification was regressed onto socio-demographical variables (gender, age, educational level, length of residence, and place of birth). To perform regression analyses, the place of birth was transformed in two different dummy variables: to be born in Turin (0=no, 1=yes) and to be born outside the Piedmont (0=no, 1=yes).

As presented in table 1, the length of residence and the educational level accounted for a large proportion of variance in neighborhood identification (adjusted $R^2 = .16$): long time residents ($\beta = .35$) and less educated individuals ($\beta = -.23$) were more likely to identify with their neighborhood. Being a woman was also a significant predictor ($\beta = .11$). Concerning city identification (table 2), the overall variance explained was lower (adjusted $R^2 = .12$) than in the case of the neighborhood. Two variables had a significant effect: the length of residence ($\beta = .26$) and the place of birth outside the region ($\beta = -.26$). This last predictor had a key role

also in the case of the identification with region ($\beta = -.40$). Such place identification was indeed affected by the place of birth in Turin ($\beta = -.16$) and the age ($\beta = .19$) (table 3). The overall variance explained in this analysis was the highest (adjusted $R^2 = .20$).

Table 1. Multiple regression analysis predicting neighborhood identification.

Predictor	β	t	p
Gender (0 = male)	.11	2.14	.033
Age	-.10	-1.16	n.s.
Educational level	-.23	-4.05	<.001
Length of residence	.35	4.49	<.001
Place of birth: Turin	-.04	-.61	n.s.
Place of birth: outside Piedmont	-.06	-1.10	n.s.

R^2 adj. = .16

F (6, 343) = 12.06 $p < .001$

Table 2. Multiple regression analysis predicting city identification.

Predictor	β	t	p
Gender (0 = male)	.07	1.33	n.s.
Age	-.04	-.48	n.s.
Educational level	-.10	-1.68	n.s.
Length of residence	.26	3.19	.002
Place of birth: Turin	-.06	-.80	n.s.
Place of birth: outside Piedmont	-.26	-4.17	<.001

R^2 adj. = .12

F (6, 341) = 8.40 $p < .001$

Table 3. Multiple regression analysis predicting region identification.

Predictor	β	t	p
Gender (0 = male)	-.06	-1.19	n.s.
Age	.19	2.28	.023
Educational level	-.09	-1.76	n.s.
Length of residence	.11	1.49	n.s.
Place of birth: Turin	-.16	-2.26	.024
Place of birth: outside Piedmont	-.40	-6.68	<.001

R^2 adj. = .20

F (6, 345) = 15.24 $p < .001$

Discussion

As expected, the identification with the neighborhood is influenced by the place dependence. In line with literature, to be a woman and the length of residence increase the identification whereas the length of education decreases it. People that for different reasons

are more rooted in the local community are the ones that express stronger identification with it. This is the case of women, probably because of the requests of their social roles, as proposed by Tartaglia (2006). In any case, to verify this specific interpretation, it should be necessary to compare groups of women similar for cultural level and age, but with different social roles (mothers vs. not mothers, or married vs. not married). Concerning educational level our results confirm precedent findings (Lewicka, 2005; Riger & Lavrakas, 1981; Tartaglia, 2009). We can maintain that people with higher educational level have more possible identifications than less educated and thus they give less importance to the neighborhood. In addition, the more educated have more personal resources, are more self-sufficient and autonomous and probably do not need to identify with the local community. On the contrary, less educated share this need, since the local community represents an important source of social resources. Finally, length of residence once more results a strong predictor (the strongest of the ones included in our study) of place identification.

Gender and educational level do not affect identification with the whole city. This spatial range is directly experienced equally by men and women and by less and more educated. Instead length of residence is still a factor that increases identification. We can hypothesize that this spatial range is not small enough to be the base of an identification founded on place dependence but is not big enough to be insensible to the daily experience of living inside it. The more people live in the city the higher their identification. Moreover, to be born outside the region decreases the identification with the city.

Finally the identification with the region seems to be not linked to a direct contact with the territory: neither place dependence (gender and educational level) nor the time passed inside territory (length of residence) influence identification with this kind of place. Such identification results affected by the place of birth: both people born outside the region and individuals born in the capital (Turin) identify less with the region than people born inside the region but outside the city of Turin.

Also the age influences the identification with Piedmont. This datum probably depends on socio-cultural circumstances. In the past century, from the Fifties to the Seventies, Piedmont received a large migratory inflow from southern Italy that caused some problem of integration between migrants and residents. As suggested by Tartaglia (2009), for people that lived through this period the categorization Piedmontese vs. non Piedmontese could be more relevant than for younger people, who that did not experience the social problems connected with the immigration.

Also the influence of the place of birth (both on city and region identification) could be interpreted in terms of social categorization: the place of birth contributes to the self-categorization as members or not members of the city and the region.

Globally, the present results contribute to a more in depth understanding of the characteristics that affect place identification. Still in the age of globalization places are an important base for identity building for several reasons that change in accordance to the dimension of place. The small places are important for people that concretely use the resources they offer and develop inside the territory their social network. This importance could foster a positive identification with the place. As place dimension grows, the importance of real characteristics and of a direct contact decreases but places could become the base for relevant social categorization processes for less concrete reasons. These considerations suggest exercising some caution when choosing which spatial range take into

account in research and intervention, since the psychological processes that are connected to place identification can highly differ according to the considered territorial area.

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Chapter 14

ENVIRONMENTAL CHANGE AND PSYCHOLOGICAL IMPACT

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ABSTRACT

The environment surrounds everyone. Due to the holistic concept, bio-psycho-social concern for any disorders owing to external insults should be used. For sure, environmental change has an impact on both physical and psychological aspects. In this article, the author briefly discusses environmental change and psychological aspects.

INTRODUCTION

The environment is everything around us. It includes both living and nonliving things. Since it is external, environment can be an insult to human beings. Based on the present holistic approach, while one focuses on a medical problem, the bio-psycho-social approach must be considered. Looking at environmental change, which can be classified as an external insult, the consideration of bio-, psycho- and social- aspects must be used. Environmental change can cause both physical and psychological impacts and this will be further discussed.

How Can the Environment Produce a Psychological Impact? [1–10]

“How can the environment produce a psychological impact?” is an interesting question. In view of environmental psychology, the environment can act as a stressor [11]. This is easily explained if the quoted environment is a living thing. For example, cattle in the field near a village might produce annoying sounds during the night and this can lead to sleep disturbances for the villagers. This might result in a cause of stress for the villagers. Another example can be the scenario of a mob in the city. This thing, for sure, can create anxiety in the

people who live in that city. However, the scenario might be more complex in the case of non living things. In one dimension, the organic disturbance due to an environmental hazard, such as lead intoxication, might result in a finalized organic psychological problem. In another dimension, an indirect impact on the psychological appearance of the people due to environmental change can be seen. Hot weather due to a recent heat wave attack made the people in many cities of Europe became crazy and anxious. This is a good recent example.

How Do the People Psychologically Respond to the Environmental Change? [1–10]

The perception of the environmental change to human beings can be via five main sensory pathways (touch, taste, sight, smell and hearing) as well as “mind”. Although the process of perception is the same for all, the interpretation and response is different. Some might have an action to a specific environmental change but others might express it in a totally different way. For example, when it becomes cold in a tropical country, such as Thailand, the local people feel glad and go to the hill resorts for a vacation while when the weather becomes hot in Europe, many people become anxious; some may take off their shirt and jump into the fountains. The complex responses to environmental change is hereby clarified. It can be said that the response is individually independent. This is also the known basic concept in psychology.

Based on the view of chronology, the response can be acute or chronic events. The acute response is well defined in case of sudden environmental change. This is usually referred to as the case of a natural disaster. For example, after a big storm, the emergence of post traumatic stress disorder cases can be seen [12–15]. This is the problem of psychological adjustment to environmental change. If one has weak psychological strength, he/she is at risk to develop a psychological disorder if he/she gets changed or lost due to the environmental change. In a chronic scenario, the response is usually due to the underlying psychological stage. The repeated or chronic stress due to environmental change to a person can exhibit itself in many ways. People in that situation might become anxious. Some might develop finalized tolerance to that stress while the others, who cannot develop tolerance, will become psychologically ill [16].

Variety of Psychological Disturbance Due to Environmental Change [17– 19]

The wide spectrum of psychological disturbance due to environmental change can be demonstrated. This can be at any level and will be further discussed.

1. Anxiety

Anxiety is a common problem owing to environmental change. Annoyance of daily life is the basic thing that might result in an anxious state.

2. Depression

Depressive disorder due to environmental change can be seen. This might relate to the loss of something due to the environmental crisis. In some cases, the depression,

which might have some genetic underlying, is due to the natural cycle such as season change [20].

3. Psychosis [21]

This is the most serious case. This is also the worst result. This usually happens in cases where no adjustment is made to the big sudden crisis in one's life due to environmental change.

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