Can the Physical Environment Play a role on Workers' Safety Outcomes? A Brief Commentary on Restorative Design at the Workplace

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Abstract

Physical characteristics of the environment directly affect psycho-physiological well being. Stress occurs when there is an imbalance between physical setting demands and human resources, because individuals cannot cope with in the proper way. One of the causes of unsafe behaviours and performance are physical and mental resources jeopardized by stress due to the workplace physical characteristics. Moreover, physical settings may impact on individual's capacity to direct attention not only consuming it, but offering respite from mental fatigue (due to the overuse of directed attention) thorough the so-called "restorative design". Inside a quite unanimously accepted general theoretical framework, which consider contextual factors - such as safety policies and practices, safety culture and safety climate, influence of leaders and coworkers, as distal antecedents of safety performance, this brief communication suggests an innovative perspective, adding the restorative qualities of the physical environment among these contextual factors which can enhance safety at work.

Keywords: Work Accidents; Restorative Design; Physical Environment; Mental Fatigue; Health and Safety

Practitioner Summary

This brief commentary wants to draw greater attention to the role of "restorative qualities" of the workplace in enhancing safety at work giving a view on the state of art and showing some preliminary evidences.

A Theoretical Framework for Safety at Work

Workplace safety is an important issue, which is connected with heavy human and economic costs. A better understanding of the mechanisms that could

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predict work accidents is surely a good way to help individuals and organizations in the hard task of accident prevention, and in the implementation of effective strategies for a safe work environment. Several studies provided empirical evidence on different factors affecting safety at work. A large amount of empirical evidence allowed Beus and co-workers to purpose a nomological net to explain accidents in the workplace [1]. In their research synthesis on workplace safety these authors review and analyse a series of causal links, mainly according with three different theoretical frameworks: job performance theory, the job demands-resources model and organizational climate theory [2-6]. This nomological net links distal and proximal antecedents with safety-related behaviours and workplace accidents, in a multilevel perspective, which considers organizational/group level variables as well as individual level ones. In their model Beus, et al. [1] suggest, at group level, the influence of "contextual factors", which are considered distal antecedents. These contextual factors affect some proximal antecedents at individual level, specifically some psychological processes, which in turn affect safety behaviours - considered as leading indicators - and lagged indicators as accidents, micro-accidents and near misses. Among proximal antecedents at individual level, this nomological net considers personal resources, both cognitive and physical. Considering contextual factors affecting psychological processes, the authors speak about policies, practices, safety culture and safety climate, leaders and co-workers [7]. In the literature, few researches -if any- consider an important contextual factor, i.e., the physical environment. This brief communication wants to draw greater attention to the role of "restorative qualities" of the workplace in enhancing safety at work.

Restorative "Work" Environments

Physical environment may impact on individual's capacity to direct attention not only wearing it out, but offering respite from mental fatigue (due to the overuse of directed attention). The potential for physical settings to affect a cognitive process like attention could play an important role also in enhancing safety at work. It is difficult to act in a reasonable way when you don't have a clear head, when you are feeling hurried, disorganized and prone to mistake [8]. Confusion and fatigue are mental states people try to avoid, specifically at work where they can cost a failure or an accident; by contrast the pleasure of "clarity" is also a compelling motivation. Clarity of the mind is not that easy to be reached but it can be supported by environments specifically planned to

sustain the capacity of "direct attention[1]", which is almost necessary for everything but is unfortunately in short supply [9]. Workplace design focused on restorative qualities can integrate in workplace elements that are effortlessly engaging and draw on what is called "fascination", in order to have people attend to visual patterns without a lot of effort [9,10]. Humans are more likely to function effectively in those environments that possess attributes similar to the settings where they evolved, i.e. natural environments, and there is also evidence for genetically determined biases that affect environmental preference and perceived restorativeness [11]. As a matter of fact most natural environments meet all the requirements to be "restorative environments": they are distinct settings, either physically or conceptually from everyday work environments (being-away); they contain patterns that hold one's attention effortlessly (fascination); they have scope and coherence that engage the mind and promote exploration in time and space (extent); and they fit with and support one's inclinations or purposes (compatibility) [9,12,13]. In this regard, Nature[2]'s restorative value should be considered, after safety basics, the most important factor to take into account in workplace design [14]. Restorative design refers exactly to the "therapeutic" potential the physical layout resembling Nature's patterns and contents (e.g. perfect balance between coherence and complexity, high legibility, sense of refuge, immediate comprehension, etc.) and restorative qualities have in reducing mental fatigue and avoiding other sources of stress in workers. In fact, because of the sensory mechanisms developed solely in response to natural environments, humans have also an innate preference for the particular patterns that natural settings carry. From our standpoint, a workplace should provide a restorative experience for those working in it [15]; to this end, each space within the workplace has to be specifically planned to foster "cognitive sustainability" and a sense of "here-ness", and consequently to increase safety at work.

Some Preliminary Empirical Evidences

At the present we know very little about the potential role of restorative quality of physical environment at workplace on workers' performance, wellbeing and

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[1]Unfortunately the room is not enough here for a broader and proper description of the Attention Restoration Theory, the theory "direct attention" and "fascination" refer to. We put off the readers to the numerous essays written by the author Stephen Kaplan.

[2]In this paper we will use "Nature" with the capital "N" to indicate the biosphere and the abiotic matrices (soil, air,water) where it flourishes, to avoid confusion with the "nature" understood as the intrinsic quality of a certain creature or certain phenomenon [11].

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safety. A first contribution of environmental psychology focused on restorative quality of workplaces dates back to the earlier '90 [15]. It is focused on the role of natural environment in fostering workers' health. It showed that the view of nature from the window can have a positive impact with respect to physical health and job satisfaction, highlighting the restorative role of Nature in restoring direct attention. After that very few studies explored how physical characteristics of work environment can help in restoring attention and improving workers wellbeing. A study conducted with office workers in agriculture, trade, public administration, education, human resources, service, and health and personal care by Bellini, Ramaci and Bonaiuto showed that perceived restorativeness of work environment positively affects workers' engagement, pointing at the role of restorative qualities of physical context as an employees' aid to recover from work stress and to increase work motivation [16]. At the same time, another study on office workers highlighted that restorativeness had an indirect effect on job satisfaction through the mediation role of work engagement [17].

No study in our knowledge explored whether restorative qualities and design of work environments affect workers' safety performance. Aiming to fill this gap, we are conducting some studies to test the hypothesis that a restorative "physical" work environment positively impact on safety outcomes, through a mechanism that restore direct attention. We involved a large sample of metal-mechanic workers from some north-east Italy companies in a study on safety at work. A short version of the Perceived Restorativeness Scale (PRS-11) tailored on metal-workers' physical setting was used to measure perceived restorativeness of workplace, and self-report accidents were recorded [18,19]. This short version considered four of the five dimensions, that is Fascination (3 items), Coherence (2 items), Being-Away (2 items) and Compatibility (1 item). Examples of the items are: "At my workplace I have to pay attention to things I am not interested in" (Fascination, reverse item), "At my workplace everything is clearly located and I cannot be wrong" (Coherence), "At my workplace I can never be distracted and think about pleasant things" (Being-Away, reverse item). Safety outcomes were assessed with self-report data. Workers were asked about the number of injuries and near misses that happened to them in the last two years. A significant negative relationship was found between perceived restorativeness and safety outcomes: Workers who perceived their workplace as less "restorative" also referred they had more accidents or near misses. A deeper analysis is still going on, but some first results show that the sub-dimensions of the Perceived Restorativeness Scale have a different impact on safety, with a larger effect of Coherence and an ambiguous effect of Being-Away. Nevertheless, these first results seems to be a first step starting a promising research line which can contribute to safety research, both from a theoretical and a practical point of view.

Concluding Remarks

The physical environment has the potential to cause mental fatigue, also negatively affecting workers' safety performance. However through a proper design, physical work environment can help workers maintaining the optimal level of stimulation and even recovering from mental fatigue.

For a workplace to be labeled as restorative, the following characteristics have to be present at the correct level: environment's *enclosure*, *separation from distractions*, *environmental stimulation*, *coherence*, *complexity*, *affordances*, opportunities for *visual contact with Nature* and the presence of *biomorphic patterns;* these characteristics have to be carefully assessed in a setting in order to be restorative. In this regard, the Biophilic Quality Index an assessment tool recently devised within the Biophilia Hypothesis and the Attention Restoration Theory can help translating theory into practice [20-22]. The BQI establishes more robust *quantitative* rather than *qualitative* parameters in restorative design and measures, and tracks the above-mentioned variable efficacy in the environment in order to capture the restorative benefits offered by a design that keeps in mind human psychophysiological wellbeing, and affects positively individuals' cognitive processes.

In conclusion, inside a quite unanimously accepted general theoretical framework, which consider contextual factors - such as safety policies and practices, safety culture and safety climate, influence of leaders and co-workers-as distal antecedents of safety performance, our propose is to suggest an innovative perspective, adding the restorative qualities of the physical environment among these contextual factors [23,24]. In addition, the perceived characteristics of physical settings can be studied in a multilevel perspective, considering not only the individual perceptions, but also the shared perceptions concerning perceived restorativeness, at the group level. Workplace environment is frequently shared by workers in the same work unit, and this allows to consider workers' shared perceived restorativeness as a group level contextual antecedent of individual attention, and consequently of safety at works.

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