Visual Comfort and Human Wellbeing at Coworking Environs

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ABSTRACT

The lighting design in workplace environments involves/demands multidisciplinary knowledge; however, the principle that supports its conception is repeatedly grounded on aesthetical considerations and technical requirements rather than on comfort and inclusive solutions. Besides legislation it is important to observe how people work and the requirements and expectations felt by individuals according to the tools used, spatial layout, geographical orientation, windows area and the reflectance of the surfaces. Natural light aims to illuminate working plans while it is a crucial factor to manage human circadian cycle and mood. Contemporaneous workplace concept is changing to respond to economic pressure and technical improvements. Coworking spaces require a deep understanding as they shelter people from different professional, cultural and social backgrounds with different gender and age issues. Anthropometric and ergonomic concepts are fundamental for a healthy and comfortable environ in which lighting design emerge and deserve special attention. This piece of research aims to study the "do´s and don'ts" of lighting design in a workplace layout in a way that it becomes useful for future humanised planning of coworking environments. In order to achieve such goals this research will be conducted throughout literature review stemming from elected keywords and the analysis of two case studies: Lx CoWorking and Ávila CoWorking, in Lisbon.

Keywords: Daylight, Workplace, Ergonomics, Artificial Light, Visual Comfort

INTRODUCTION

The purpose of this paper is to contribute to full control and complementarity between natural and artificial light in the workplace. To achieve such goal requires the understanding of the advantages and disadvantages of natural and artificial light since the luminance's good balance arises from the complementarity between both. It is also important to understand the impact of natural and artificial light in comfort, particularly the visual, and also to understand the wellbeing of the individual.

The case studies focus on offices, particularly on CoWorking workspaces environs because of the ongoing search for answers and new solutions resulting from economic pressures and the advances in technology. Portugal has been witnessing the emergence of flexible workspaces, which can be shared between professionals from different professional areas, cultures and social backgrounds; that by consequence requires dissimilar spatial needs and expectations. The example of LX CoWorking space comes from the refurbishment of a building that acquired a new function and the Ávila CoWorking space that was specifically created for this purpose. The first is located at

LxFactory, in Alcântara, a traditional area of the city, related with industrial environs of the beginning of 20th century and the second one is located on Avenida da República where the tertiary related business prevails.

The constant devaluation of natural light and the ineffective use of artificial light have an impact on human life in many ways, including physical, psychological and biological, and this happens because the human being spends much of his/her life indoors which makes the lightening design a crucial focus for promoting the comfort and health.

Lighting Design standard solutions must be challenged by solutions driven by tasks and users. More than the quantity of light, its quality is crucial to maintain human concentration, to increase visual acuity, to create different atmospheres to respond to task demands as users' expectations. Lighting design is not limited to providing sight; it aims to improve our comfort and wellbeing.

INFLUENTIAL PARAMETERS OF COMFORT AND WELLBEING WITHIN WORKPLACE ENVIRONS

Daylight

> "Controlled by the brain, the same programme is re-run day after day in the human body. An internal clock controls not only our sleep and waking phases but also our heart rate, blood pressure and mood. Every cell and every organ has a rhythm of its own that needs to be synchronised regularly with the outside world. Day and night provide the most important cues." (Lich.de, ?)

The lighting design in workspaces requires multidisciplinary knowledge; however, the main concern of employers and companies is the corporate image, namely aesthetic, rather than the importance of comfort and wellbeing impact in individuals (employers, collaborators, users, etc…) as Simeon Keates and John Clarkson argued (2003).

The design of functional spaces such as workplaces demand a special attention to facility construction and maintenance costs; still, there are real people working in these spatial layouts, so comfort issues ought to be considered - both psychological and physiological – to minimize lower performance and/or absenteeism. The use of natural light benefits human productivity, safety and health and it can prevent/cure some diseases while contributing to the reduction of stress levels (Edwards and Torcellini, 2002).

The balance between natural and artificial light is a concern that is constantly relegated to second. Whereas many tasks are carried out with the use of technologies such as computer, the visual comfort is, most often, ignored. The only concern with regard to this matter is the associated energy cost. However the impact of lighting design on human performance is significant and influences his/her body functions, moods, and cognitive abilities, among others.

Individuals and their body functions are categorised by cyclical rhythms: day and weather season. Similar to an accurate mechanism, single cells and organs manage their own time cycle. Functions such as breath and heartbeat, awakening and sleep are influenced by daylight hours. Every morning before the alarm clock sounds, the human body is already awaken: body temperature, blood pressure and pulse rate rise. At lunch time the stomach intensifies acid production to facilitate digestion; the required energy intensifies the body sense of tiredness, and when it gets dark, at the end of the day, the body becomes tired and tranquil anticipating our need for sleep.

The 24-hour pattern of light and darkness triggers the cycle of wakefulness and sleep of the human body, called circadian rhythm that is neurologically organized in order to conduct body functions daily. Circadian rhythms are synchronized by the levels of light in the early morning and late afternoon, and the absence of these stimuli can cause lack of sleep at night and concentration struggle during the day and even blind people report those symptoms (Tregenza, 2011; Edwards and Torcellini, 2002).
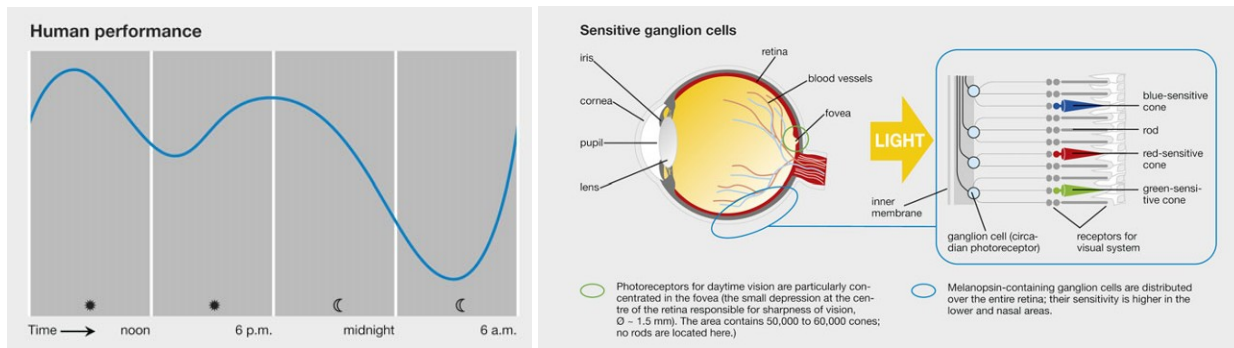
Figures 1 and 2 – Human performance curve over the day and Sensitive Ganglion cells.(Lich.de, ?:9,10)

The light waves entering the eye stimulate the retina and activate two actions (in our bodies): first, nerve impulses travel along the optic nerve to reach the part of the brain that interprets what we see while affects our metabolism, endocrine and hormonal systems promoting our biological and psychological balance (Boubekri, 2008; Steffy, 2008; Hobday, 1999); second, it interacts with our skin through photosynthesis producing vitamin D. The functions of the human eye are optimised when this organ receives the full spectrum of natural light provided by the Sun (Edwards and Torcellini, 2002).

But with the advent of electricity and the artificial light human being managed to have light all day and night long, Mary Ann Steane (2011) alerted that we need to think the quality and quantity of light, in relation to tasks and user needs, not just accepted as a standard given issue. Jacob Liberman (1990) in turn remembered us that human exposition to artificial light, the light that does not present all the characteristics of natural one, can be compared to the malnutrition caused by imbalanced meals. John Ott considered UV light a nutrient, such as a vitamin or a mineral (Jacob Liberman cited John Ott, 1990). According to John Ott (Ott BioLight Systems, Inc. 1997a), the body uses light as a nutrient alike water or food. This author draws our attention to the Sun, once considered as a God, repeatedly associated with a series of crimes leading to the assumption that it is armed and dangerous. Jacob Liberman warned (1990) that with the current propaganda which advises the use of sunglasses with lenses that block UV-400 rays, it is possible that we are contributing to the growth of blindness and eye disease. Richard Hobday (1999) stated that no one ever had a toxic dose of sunlight, but with the intent of limiting our exposure to UV rays, throughout the covering of our skin with clothes, the sunscreen use and the amount of time spent indoors, we are decreasing substantially our reserves of vitamin D for half of the year. Therefore, the artificial light can substitute natural light to help us see, but it deregulates our entire body and its biological and psychological balance.

Human chronobiological rhythms show various reactions in summer and winter. The dark days of winter influence the human body decreasing physical performance as well as concentrating and responding slowly. The winter weather influences our appetite enhancing our tendency to eat, thus increasing our corporal weight and blood sugar levels. The weather and the related seasons reveal a psychological effect, winter months reveal the increase of anxiety level, such as the bad temperament. This happens because there are two distinct properties of natural light: the light emitted by the sun (direct light) and the light from the sky (diffuse light scattered by the Earth's atmosphere) and in the winter the light is more diffuse which results in some kind of apathy and less energy (Tregenza, 2011).

Natural light is more balanced because it reflects sunlight and daylight changes, according to the geographical location, latitude, weather conditions, season of the year and time of the day (morning, afternoon or evening) (Meerwein, Rodeck and Mahnke, 2007; Tregenza, 2011). Human being grow under its influence and variability thus the ambiguity of natural light is more natural than the precision and constancy of artificial light.

Despite what has been explained above, the main difference between natural and artificial light is the correspondent spectrum: the continuous spectrum of the natural light is more natural than the discontinuous spectrum of artificial light. There are several advantages in natural light from which we chose its unpaid availability, its mutability giving the notion of weather conditions and time of day (morning, afternoon or night) and the established relationship with the outside world. In a sustainable perspective, natural light shows great relevance on energy consumption, and is more beneficial to human being too. (Cuttle, 2007).

Christopher Cuttle (2007) argued that the compromise of natural and artificial lights is required, although obeying their own principles, since natural light offers no warranties, especially in periods when the day appears cloudy or in

the transition between day and night. But he also reminds us that the natural light is the one that help us to maintain the balance that we need in the biological and psychological aspects of our body which affects positively our humour and mood.

Daylight influences human mood, particularly in open space solutions, daylight is harness just for those beside windows creating twilight areas for those areas away from them. These areas become dependent on artificial illumination with a spectrum that does not always correspond to human demands while developing a precise task: quantity, quality and direction of the luminous flux. Coworking environs depend essentially on activities with digital documents despite the device used (PC, tablets, smartphones). Human interaction with these devices requires luminous contrast to minimise visual effort while avoiding glare occurrences. Nevertheless, the requirement of luminous contrast does not exclude the human need of daylight and the contact with exterior perspectives that an opening can offer.

Artificial Light

The discussion is raised. There are advantages in using artificial light: artificial light denotes the ability to control its intensity and distribution, allowing the creation of visual effects, like contrasts; disadvantages relate with the ability of artificial light to cause distress, block our learning skills and cause pain in the eyes, since the electrical light provides a brighter light than the natural one (Edwards and Torcellini, 2002).

A qualified light aims to contribute to a better human performance while accomplishing dissimilar functions. Effective lighting delivers the best working area illumination while avoiding vision impairment; it shapes illuminance to the visual field required by the function and distributes luminance uniformly in the area. A qualified light fitting restricts direct and reflected glare and reveal good colour rendering index providing a light which does not flicker and considers the daylight provided by wall and/or ceiling openings.
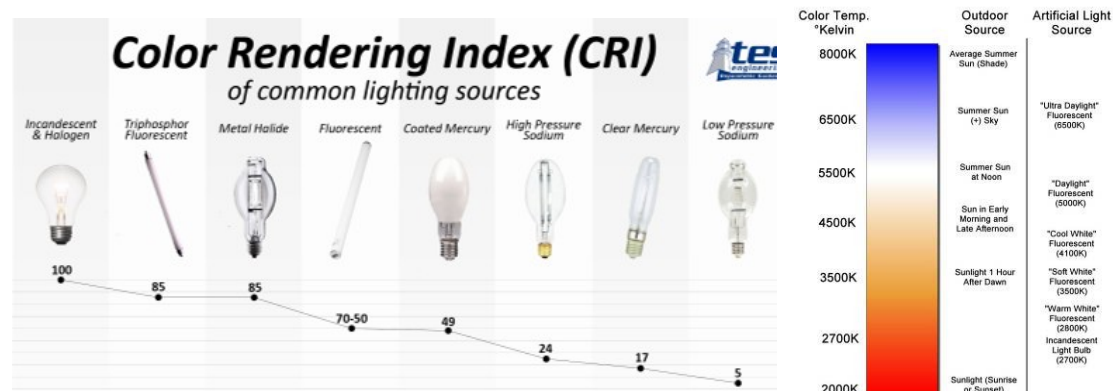
Figures 3 and 4 – Colour rendering index of lighting sources (LiquidLeds Lighting, 2013) and Colour Temperature (Inspired Concepts, 2014)

Colour rendering index conveyed in a 0-100 scale and designates how a light source reveals the colour of an object to the human eye. The higher value corresponds to a more qualified colour rendering capacity. When approaching the CRI issue it is common to consider the colour temperature of the light, too. This parameter concerns the colour appearance of the light source and consequently the light emitted.

Each light source has a CRI (Colour Rendering Index) which is the ability to reproduce colour, changing in a scale value from 0 to 100. The CRI (Colour Rendering Index) has a direct relationship with the reproduction of colours obtained with natural light, with a CRI of 100, as well as the incandescent light sources. Soon, artificial light will be closer to natural light characteristics, once natural light is the one that human eye is naturally adapted (Cuttle, 2007).

The colour temperature is a parameter that affects the perception of space. Comparing natural light with artificial light (see figures 3 and 4), reveals that when the sky is overcast the colour temperature of the light is 6500 K (6226.85°C), the halogen lamp has a temperature of 3000 K (2726.85°C), the incandescent light bulb has a colour temperature of 2700 K while the candle has 2500 K (2226.85°C), i.e. the higher the value of colour temperature (Kelvin) the colder the hue.

The visual perception depends on the reflected light and not on the incident flux on the surface. The features offered by the lamp light emission are important depending on the position of the observer and the visual activity level, so that the illuminance and luminance (reflected light) does not interfere with the visual process. These points emphasize the importance of choosing the type of lamp and the characteristics of the control devices. The reflected light depends on materials and colours features applied to the spatial finishing.

Repeatedly, the distribution of luminaires is based on a symmetric aesthetical organisation. The given argument is the lack of spatial layout, function(s) to develop there and the users profile of that place. The final result may be the inadequate location of the luminaires causing shades on working plans and the sun glare on computers monitors.

The spectrum of the artificial light and by consequence its colour index rendering are not always the required ones by the tasks and human profile. Frequently this parameter of the light fitting is based on fitting apparatus, energy costs and the design trends. The visual acuity of the user as well as the professional performance is not part of the procedure concern.

The monotony of direct light implies now and then less luminous contrast while indirect light provides more confortable environments. This type of light fitting can improve the sense of comfort during coffee breaks and informal areas, inviting to permanence of individuals.

Task lights are frequently ignored by lighting design schemes and by users. This type of light is more than ever an important issue to consider while it is a way to orient the direction of the light flux to the required surface (frequently the computer keyboard, or the draft written on a piece of paper that requires a digital version).

These considerations about artificial light are very useful for workplace planning, mainly when considering open spaces particularly when driven to flexible working methods, where the users and tasks are changing in a regular basis. The features of the lighting design encourage more qualified professional performances, concentrative and motivated mood and the interaction among individuals.

Light enables us to be more proactive. Light supports us while performing different functions, build up ambiences, and acts positively on our health. The previous statement supports human requirements and expectations related to lighting design. Sustainable lighting design responds to human need and expectations while creating a liable use of energy resources. To create ambience and illuminate the space the lighting design concept must consider the quantity of light demanded by the function and user features; preferentially the light source should be controlled by dimmers, timers and presence sources to a responsive management of requirements and consumptions.

Visual Acuity and Comfort

Physically, light is electromagnetic radiation ranging between a wavelength of 360 and 780 nanometers (nm), which is perceived by the photoreceptors (rods and cones) of the human visual system. This range presented by the wavelengths is another human need, as the monotonous environments at extreme levels, cause lethargic behaviours and lead to cognitive fatigue. The concept of visual comfort emerges as a fundamental parameter which is psychologically associated, with the visual quality, manifesting itself in the ability to see details, avoiding brightness and in perceiving a pleasant visual environment (Baker and Steemers, 2002).

At a technical level, the visual performance depends on the apparent size of the object, the state of fatigue of the observer and the luminance level available to perform a certain task. The contrast between the object and the background, the directionality of the light and the presence of sources of light within the field of view are quite influent (Cuttle, 2007).

Lighting reveals what we need to see and creates ambiences throughout light and shadows arrangements. The type of light source influences the quality of the colour we perceive, as the finishing environs colours reflect coloured light caused by their colour materialization. Light quality may be inadequate for what the visual system needs due to insufficient or excessive light, excessive uniformity, veiling reflections, shadows, flickering (shimmering light), accommodation and disability glare (Boyce, 2003).

The natural light that comes from openings can create an environment in which individuals see details and colours more accurately. But, this light can also produce uncomfortable sun glare and reflections of high luminance in computer screens causing visual impairments. Usually, users avoid natural light whenever it challenges the visual and thermal comfort.

The ability of the human eye to see details is called visual acuity, which normally increases when light levels increase, the reverse happens when the threshold decreases until reaching the mesopic adaptation. To Christopher Cuttle (2007) there are five factors that influence the visual acuity:

- The increased intensity of light;
- The required level of light, according to the task specifications;
- The illumination angle, which influences the relationship between light intensity and acuity. When lighting is directed to the eye it can cause glare. Therefore, the light source shall be directed to the object or the plan we need to see. "To avoid indirect glare the light source positioning must be equal to its angle of incidence." (Muga, 2005: p 36);
- The distance of the object position. As the distance increases visual acuity decreases;
- Fixing time, since the observation period of a given object augments the probability of object identification augments also.

Furthermore, the contrast is important since the perception of what surrounds us is based upon the amount of luminous contrast and not on the quantity of light; however since this parameter is very sensitive for senior individuals is always preferable to avoid abrupt changes in luminance level. The contrast has emotional impact and the lack of it tends to cause apathy. The ageing of the eye is critical to the perception of what surrounds us.

Cuttle (2007) concluded that the preference of natural light can be attributed to the belief that working with natural light involves less stress and discomfort than working with artificial light. And he adds that this belief is not due to natural light being beneficial but because the light's power is harmful to health in the long term.

Human beings are the crucial concern in the design of the architectural environment; therefore, they should be seen holistically and intimately connected with the material and immaterial components of the human condition that contains the biological, physical, physiological, psychological, social and aesthetic concepts (Meerwein, Rodeck and Mahnke, 2007).

Spatial layout causes a spontaneous emotional reaction. Psychosomatic studies have shown that the mind and body affect each other, meaning that physical disease may have a psychological origin and vice versa. Emotions affect the body, and stress can cause headaches, the fear can increase the heart rate, anger can affect the digestive process and increase blood pressure. Mahnke et al. (2007) also indicated that, psychoneuroimmunology assumes that emotions can even influence our immune system. Biochemists and immunologists discovered networks of nerve fibres and molecular "bridges" that maintain a permanent connection amongst the mind and body. Evidence shows that emotions exert an influence which often extend to the last cell of our body and therefore strengthens or weakens our body defences. From a psychotherapeutic point of view, the architectural space may have expected it since the architectural space and furniture are considered important factors that support the reconstruction of self-acceptance and self-esteem as well as to promote social relationships.

Philomena Bluyssen (2009) stated that stress can be caused by indoor environment and by consequence enhance or generate the arrival of human pathologies in the short and long term, both mental and physical. Kiel Moe (2010) added that we are treating the symptom and not the problem. The exterior views, particularly those natural, tend to produce positive responses, and they are more effective to reducing stress and anxiety on the concentration and improvement of human mood.

Workplace

We are outdoor animals, and we are synchronized with changes in the light levels that occur between the rising and setting of the sun (Hobday, 2006).

An important effect of natural light is to contribute to a more positive state of mind for employees, increase job satisfaction, involvement, motivation, and the reduction of absenteeism (Heerwagen, et al., 1992). In 1988, Clark and Watson found that the negative mood is associated with the discomfort and distraction. In addition, inappropriate use of daylight can reduce productivity and increase absenteeism due to the possibility of extremely high levels of lighting, glare and high temperatures (Edwards and Torcellini,2002).

Studies demonstrate that proper use of daylight contributes to reduce the occurrence of headaches, Seasonal Affective Disorder (SAD) and eyestrain. Still, the eyestrain is the most important complaint according with health clinics indication (Ott BioLight Systems, Inc. 1997a), which is related with the spectrum of light in space and the

ability of the eye to constantly change the focus. Markus (1967) used a questionnaire to determine the satisfaction of office workers with their workspaces. Ten environmental factors, including the sun and the exterior views were presented to the staff for a satisfaction analysis. It was found that 96 % of respondents preferred to work under natural light as opposed to electric light. Approximately 86 % preferred to have the Sun in the office throughout the year. It was also noted that employees sitting near windows were happier, while those who were seated away from the window openings are more critical. Wotton and Barkow (1983) also founded that 57 % would like to have a window next to their work place, rather than in front or behind. Karlen and Benya (2006) stated that visual tasks should be performed easily and comfortably; fortunately, this concern has grown in order to increase the satisfaction of employees in most work spaces, because light should contribute to a visually and psychologically satisfying environment.

In spite of the research developed about workplace environments and its impact within human professional and individual performance, the solutions that illustrate this type of environment are conceptualised by corporative images, personal choices of construction cluster, administrative choices and the tendencies of an era. Rarely conceptual options are aware of ergonomic and proxemics considerations, ignoring the importance of spatial layout within human behaviour. The work developed nowadays is based upon information and collaborative networks. Some tasks require concentrative (and sometimes private) environments while others require collaboration and interaction between individuals performing different activities. This dynamic implies different ambiences in the workplace, provided by different units of furniture and equipment, different finishing and different light types. Individuals' differences of sex, age, race and culture strengthen the importance of the responsiveness to the workplace conception. Thus, in the project's concept phase there is a clear need to provide natural light in buildings in order to facilitate the stimulation of the circadian rhythms of comfort (wellbeing), mainly through the input of light in interior spaces, high ceilings, geographic location, orientation, proper sizing of window openings and reflective ability of materials.

Ergonomics

> "Space is so powerful. It's one of the most powerful experiences that people take for granted. That's why I think it's fantastic that, more and more, we're focusing on wellbeing as a problem of space. Good spaces create good experiences. Spaces are fundamental for wellbeing." (Leiserowitz, 2014)

Over the past 20 years, the nature of the work done in offices has changed significantly, as the means to do the job have changed. In offices in which people work with paper, the main work surface is horizontal, while using computers, the surface becomes vertical. The introduction of computers in offices has been a fundamental change in the luminance in office requirements. The VDT (Visual Display Terminal), are usually set vertically or near vertically and the screen is self-luminescent, i.e., it can be seen in place without lighting, so the increase in light that reaches the screen decreases its visibility (Boyce, 2003).

A 1992 study on energy efficient buildings studied the strategies that office workers used to reduce discomfort. To enhance comfort, some employees change clothes, go for a walk, take a break, complain, look for something to drink, add a heater or fan near their workplace (Heerwagen, Loveland, and Diamond, 1992). With these inefficient methods, the results are dissatisfaction, the loss of work efficiency, reduced motivation and fatigue. Whenever employees try to ignore the problem, the mental energy is absorbed instead of being focused on their work. (Edwards and Torcellini, 2002)

The light falling on the screen can have three undesirable effects: reducing the contrast of the display, the increased competition for users' attention between the screen and after images, and the constant need of accommodation due to the fact that the screen and after images meet up at different distances from the observer. The way to avoid these problems is to reduce the luminance of the reflected images.

The constant changing line of eyesight between paper and screen forces the eye to adjust to different distances (accommodation) leading to fatigue. This problem is aggravated when the eye has to adjust to different densities of light at the same time (adaptation). The distance between the user and the screen must therefore be the same as the distance to the piece of paper whenever used. The piece of paper should have the same angle and the light density similar to the computer screen as well as closer as possible from the user (Meerwein, Rodeck and Mahnke, 2007).

Working on computer screens is a daily base routine for many users and they must be informed about the advantages and the stress that this function can produce. The continuous visual perception leads to increase stress on the eyes

and an unnatural posture. Unconsciously, workers who work on computer screens tend to adopt a posture to avoid reflections in the centre of their field of vision. Office furniture and equipment are likely to be cause and consequence of the changes motivated by the new methods of work as the innovations on workplace layouts to improve the functionality, comfort level and efficiency of the facility.

The awareness with workplace environments went beyond physical ergonomics considerations. New methods of work which implies flexibility and interaction influence workplace layout to a supportive and social environment: professional performance demands more thinking than physical presence and this reality demands dimensions never considered before. The inflexible cubicle popularised in the last decades of the twentieth century, based upon static postures is giving place for mobility, interaction between individuals in spite of their physical or virtual presence and furniture to support new and more informal postures, for instance the chairs ergonomic configuration (simulating the spinal movement) to support human interaction with different technologic devices such as computer, laptop, tablet, smartphone, etc… Steelcase Research centre (2014) develops studies to understand the impact of sedentary behaviours on working environs and they concluded that a sedentary life style have a strong impact in weight gain, metabolic syndrome and diabetes. The contemporaneous workplace concept ought to be grounded on a diverse pallet of ambiences (answering to functional and users' requirements), movements (to avoid sedentary styles as to encourage interaction between individuals) and postures (to support human interaction with the different technical devices available).

As people's work changes, their needs change. And as needs change, work environments also need to change to remain supportive. The evolution of offices as places primarily for process work to places for creative work has profound implications for wellbeing. Creative work is all about making connections, being open to new ideas, taking risks and experimenting. These behaviours are impossible in a stressed state of mind. For creative work to thrive, the workplace needs to be a supportive and positive environment. For creative work, the workplace matters more than ever, and it needs to do more than ever. (Steelcase Inc., 2014)

CoWorking is a type of collaborative working which does not aim the loss of individual independence and individuality; coworking aims the share of technical resources and space amenities– and in the process of human relations, supports collaborative behaviours and improves expertise between coworkers. CoWorking is the phenomenon of workers coming together in a shared or collaborative workspace for one or more of these reasons: to reduce costs by having shared facilities and equipment, to access a community of fellow entrepreneurs, and to seek out collaboration within and across fields (DeGuzman and Tang, 2011).

Case Studies

> "Traditionally workplaces have been designed for efficiency, and sometimes take a 'one-size-fits-all' approach. But that doesn't offer employees the ability to choose the right kind of setting for the work they need to do. When they have choices, employees have a sense of control that helps them feel more empowered, engaged and less stressed." (Benoist, 2014)

Workplace layout expose a poor design ignoring the growing collaborative work style of contemporaneous knowledge workers, causing less productivity, poor levels of work stimulus and high costs due to the ineffective use of the space.

Policies driven to flexible workplace layouts are required and expected to settle the rising mobile workforce: users demand flexible work environs with high-tech descriptions. Collaborative working environments emerge as a reaction to team and project-oriented work styles. The technological development tried in the last years encourages the promotion of nomadic professionals searching for new models of work where flexibility is the slogan. Coworking is the expected development from dissimilar ways of remote work.

Coworking is about working with others in a shared physical layout. In spite of individual professional status or the project to be dedicated to, people work with technical apparatus and share the same amenities. Interaction between individuals emerges in spite of its physical, analogical or digital nature.

Figures 1 and 2 – Cowork Lisboa, the first coworking place in Lisbon - Contributor of Photographic material: Caramelo Gomes

To illustrate collaborative work environs, the authors pinpointed two examples: Lx Coworking and Ávila Coworking; similar on the concept to provide a workplace to collaborative and flexible forms of work they diverge on the type of individuals and corporate entities to attract. Lx Coworking was the first working place conceived with the spirit of creating a community of persons that by chance work in the same physical space. This work environment was conceived and is managed by Fernando Mendes, a professional designer with strong commitment with humanitarian/communitarian activities such as Banco Alimentar[1] e Cais[2]. The working facility is located within Lisbon city in an old industrial building block in an ancient industrial neighbourhood (see figure 1). Lx Cowork or Cowork Lisboa started in 2010 and a considerable percentage of the coworkers are there from launch. The spatial layout, based on open space, is structured in informal areas, designated or hot desks, meeting rooms and cubicles oriented to small enterprises (see figure 2). Being part of this community does not oblige to a minimum contract period. Workplace although its designated or hot character, allows its use from 9AM to 9PM; the cubicles allow the 24/7 access and/or use. Since the beginning workplace occupancy ranges from 60 to 70%, with individuals from 18 to 66 years old.

The working spatial areas are wide; the circulation space encourages individuals' movement and interaction while decreasing the possible difficulties associated with kinaesthetic human requests (see figure 3). The circulation space is large enough to support particular human and functional requirements like the use walking crutch or wheelchair.

Figures 3 and 4 – Cowork Lisbon interior space, fixed and hot desks. Hallways inviting to relax and chat instants - Contributor of Photographic material: Caramelo Gomes and Fernando Mendes

Informal areas are available to chat and/or work, and they function as relaxed atmospheres inviting to concentration. The professionalism of the individuals minimise the questions raised by proxemics issues (see figure 4). Dissimilar types of seats encourage different postures. Working areas are more or less adapted and personalised by users according with their status of hot or owner working places. Different devices are used however computer laptops are the most representatives. The chairs are supportive for human postures and whenever required technical gadgets are used to position laptops, monitors and keyboards. The spatial atmosphere is peaceful; generous windows permit a

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[1] Banco Alimentar – Food Banks are Private Institutions of Social Solidarity.

[2] Cais – Homeless magazine.

delightful and stimulating standpoint to the river Tagus and to the city, granting natural light and interaction with the exterior.

Light, despite its natural or artificial nature, it is crucial to define the ambience of a place. Natural light is the main source of illumination along the day, which is controlled by blinders to decrease the impact of the south/west orientation of the working area. Whenever natural light is inadequate, task lights complements it through tasks lights oriented to the keyboards. Hallways and social areas are illuminated by smooth and warm light welcoming relaxing and chatting moments.

The corporate image is intended to be an avant-garde and minimalist one as is the image and spirit experienced at this neighbourhood. The ambience is grounded on an achromatic composition performed by floor, chairs and desks; this contrast is accentuated when the natural light is profuse and can be disruptive for the coworkers that are just beside the openings. The workplaces beside the openings are the owners' workplaces and are the ones which show a major demand from the promising coworkers. Certainly natural light, natural ventilation and particularly the gorgeous outlook over the river Tagus are causes that influence significantly the individual decision.

The second example to illustrate a cowork environment is Avila Coworking, located on a central area of the tertiary tissue of Lisbon, oriented to professionals and companies that search for a high standard workplace in Lisbon city centre offering workplaces and secretariat, meeting and work rooms. The furniture is Steelcase (chairs and tables), a brand that ensures the ergonomic requirements of function and users (see figures 8, 9 and 10); working areas are complemented by a cokitchen for the provision of quick meals, a locker and a lounge area to socialise, informal meetings and coffee breaks (see figures 11 and 12). The accessibility by public and private transportation is enabled by the several types of public transportation that stops nearby and public car parking including a private one inside the building. Avila Coworking also offers a complete virtual office service.
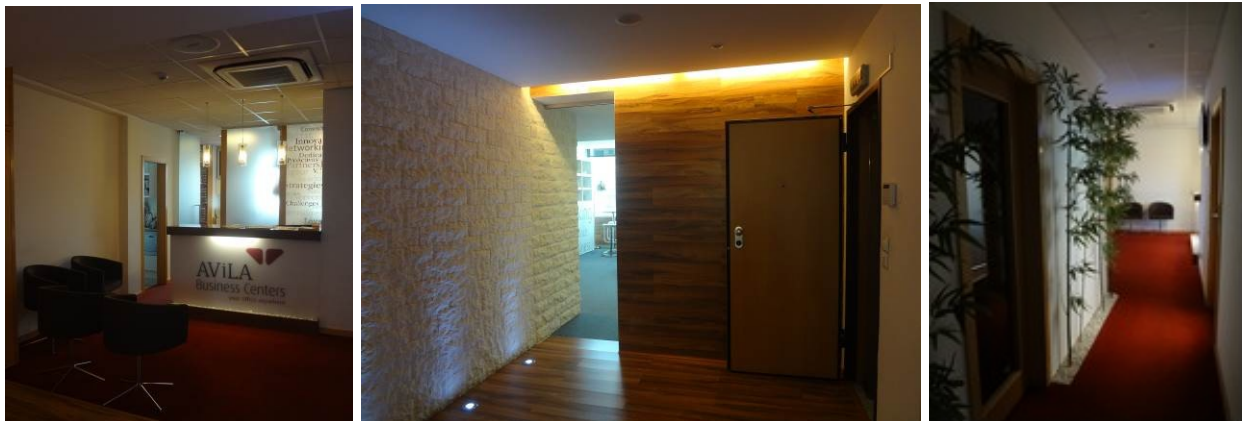
Figures 5, 6 and 7 – Ávila Cowork main entrance and corridor - Contributor of Photographic material: Caramelo Gomes and Preto

Working areas are peaceful and comfortable. Interior layout is divided into functional areas (does not show an open plan configuration); the configuration allows easy circulation among the different areas even for the individual with some mobility impairments. The geographical orientation of the building is West (main façade) and East (posterior façade) defining the entering points of natural light. Walls, ceiling and furniture are white to improve the reflected light. The generous windows encourage the contact with exterior; both geographic orientations (of the façades where the windows are located) reveal busy arteries of the city. The natural light is controlled by blinders that minimise the light from west direction, and this natural light is complemented whenever required by artificial one (see figures 8 and 11). Artificial light is composed by direct, indirect and task lights particularly to meeting rooms and working areas distant from windows. Hallways and social areas are illuminated by smooth and warm natural light from the generous west windows and at the end of the day by direct lights (see figures 8, 9, 10). The tranquillity perceived in this working environment illustrates the theoretical concepts stated by the literature review. Indirect light gives a sense of comfort and complements natural light during the day. This kind of light exists in working areas and in meeting rooms. The meeting rooms gain a more peaceful ambience and provide the advisable type of light to illuminate the environment and yet create contrast with computers monitors and projector screen.

Figures 8, 9 and 10 – Ávila Cowork coworking areas - Contributor of Photographic material: Caramelo Gomes and Preto

The walls show different types of materials, from smooth wood to textured stone appealing to our senses (see figures 6 and 7). The floor surface is coated carpet which muffles the sound of individual movements. Some walls have touches of bold colours to coloured the ambience (see figure 10), to identify places and to give some dynamism to interior layout. The desks are white with matt finishing minimising the possibilities of glare created by the luminance of the spatial area. These furniture elements have electrical outlets so there are no cables in sight. Informal areas have different types of chairs and tables encouraging different postures and behaviours. These informal areas have also accent lighting to show or illuminate particular areas. The coffee area receives also natural light through a glass wall that separates it from the coworking area (see figures 11 and 12).

Figures 11 and 12 – Ávila Cowork informal areas - Contributor of Photographic material: Caramelo Gomes and Preto

Even though these two spaces of coworking are oriented towards different targets, both of them show the success of this type of facilities for flexible forms of work and both convey a corporate image to the choice of their clients. In spite of an avant-garde and minimalist or a luxury ambience these are working environs chosen by users. In a contemporaneous society where sustainability is the motto, the employment tissue changes, the professional performance of professionals is challenged and technology improves too quickly, coworking environments emerge as a solution to adapt and improve towards comfortable and pleasant working ambiences.

Conclusions

The aesthetics interpretations from architects are very different from those of the general public (workers and companies). Companies are mostly concerned with the costs associated with the facility: energy costs, maintenance, management and so on. Workers are concerned with their basic instincts, which can be expressed in terms of comfort and wellbeing. Architects must bear this duality in mind when creating a workplace. Repeatedly conceptual process of working environments is grounded upon corporate image, trends, individual preferences (from the creative professionals or the owner) and financial resources. The level of comfort and wellbeing of the user are

barely considered by employers and by creative professional which (by artistic behaviour or voluntary ignorance) overlook its impact within worker productivity. New methods of work emerge as result of technological advancement and the growth of information society to the detriment of industrial society. Workplace environments ought to be part of these changes. Contemporaneous qualified workplaces support physical health and mental state. This conception encourage office facilities composed by different areas oriented to nomadic, concentrative, collaborative and relaxed forms of work. Flexible forms of work demand physical and virtual presence and use technical devices (computers, laptops, tablets and smartphones) to accomplish professional and individual functions. These technical devices emits light unlike paper that reflects light; this feature requires new models of lighting design to avoid computer vision syndrome which symptoms are mainly headaches, blurred vision, neck pain, fatigue and eye strain which have direct impact within individual productivity.

Coworking environments emerge to respond to new methods of work as well as new models of developing a professional career. Despite engaging a corporate image to their users they do not represent a corporation rather experts from different professional areas which aim a qualified place to perform their working functions. In common they have the use of advanced technology and the search for humanised and supportive working environments. These spatial layouts are featured by different areas with different ambiences to support different methods of work and users requirements. Ergonomics are considered for chairs and desk models, finishing materials and lighting design. Despite the centrality of lighting design to the physical health and state of mind of the individual in coworking environs this subject faces a challenging trial once users and functions are more dynamic than in a traditional work environment. Direct, indirect and tasks lights are important as well as remote controls and presence sensors. The emergence of coworking environments and their plain acceptance by users encourage the required research on the multidisciplinary issues that improve a more humanised workplace.

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