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AMBIENTE CONSTRUÍDO E USUÁRIO: PERSPECTIVAS LATINO-AMERICANAS

Além do Relaxamento: Como os Ritmos Circadianos Moldam Espaços de Descompressão Eficazes

Más allá de la relajación: cómo los ritmos circadianos moldean espacios de descompresión eficaces

Beyond relaxation: how circadian rhythms shape effective decompression spaces

Iluminação natural e artificial/ *Iluminación natural y artificial / Natural and artificial Lighting*

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Resumo

Este estudo investiga a eficácia de espaços de descompressão em ambientes de trabalho sob a perspectiva do ritmo circadiano. Foram comparados dois estudos de caso: uma sala de jogos no Googleplex (Califórnia) e uma sala individual na sede dos Correios da Suécia – Think Tank (Estocolmo). As simulações utilizando o *software* Alfa avaliaram o acesso à luz natural, o posicionamento das janelas, a presença de telas e a disponibilidade de vistas para o exterior. Os resultados mostraram que a sala individual, com luz natural abundante e amplas vistas externas, ofereceu condições superiores para o alinhamento circadiano e o descanso mental em comparação à sala de jogos. A pesquisa enfatiza que espaços de descompressão que priorizam a exposição à luz natural, minimizam distrações e facilitam o relaxamento visual promovem mais efetivamente o bem-estar dos funcionários. Integrar princípios de design circadiano no planejamento desses espaços é essencial para futuros projetos.

Palavras-chave: Saúde circadiana. Projeto do ambiente de trabalho. Espaços de descompressão. Luz natural. Bem-estar dos funcionários.

Resumen

Este artículo examina la eficacia de dos espacios de descompresión en entornos laborales desde la perspectiva de la salud del ritmo circadiano. Para ello, se han analizado dos estudios de caso: una sala de juegos colectiva en Googleplex (California) y una sala de relajación individual en el edificio Think Tank (Estocolmo). El método consiste en evaluar qué factores determinan el mejor apoyo a los ritmos circadianos y al bienestar de los empleados, como el acceso a la luz natural, la ubicación de las ventanas, el uso de telas y la disponibilidad de vistas de larga distancia, mediante simulaciones con el programa informático Alfa. Los resultados indican que una sala individual con amplia iluminación natural y vistas de larga distancia es más favorable para la regulación circadiana y la relajación de que las salas equipadas con telas. La incorporación de luz natural, una orientación adecuada y los elementos de relajación visual en el proyecto de espacios de descompresión puede optimizar los beneficios para la salud de los empleados.

Palabras clave: Salud circadiana. Diseño del ambiente laboral. Espacios de descompresión. Luz natural. Bienestar de los empleados.

Abstract

This study investigates the effectiveness of decompression spaces in workplaces from a circadian health perspective. Two case studies were compared: a multi-person game room at Googleplex (California) and a single-person relaxation room at the Swedish Post Headquarters – Think Tank (Stockholm). Environmental simulations using Alfa software evaluated daylight access, window positioning, screen presence, and access to long-distance views. Results showed that the single-person room, characterized by abundant natural light and outdoor views, provided superior conditions for circadian entrainment and mental restoration compared to the screen-centric game room. The findings emphasize that decompression spaces prioritizing natural daylight exposure, minimizing distractions, and facilitating visual relaxation more effectively promote employee well-being. These results suggest that workplace design strategies should integrate circadian design principles to enhance biological resilience, reduce stress, and improve productivity. Incorporating such principles into decompression space planning is critical for advancing healthier and more sustainable work environments.

Keywords: Circadian health. Workplace design. Decompression spaces. Natural light. Employee well-being.

Introduction

The growing recognition of employee well-being as a critical factor for organizational success has prompted a rethinking of workspace design strategies (Rahaman et al., 2020). Sedentary office work, combined with increased screen exposure during the COVID-19 pandemic, has been associated with cognitive decline, mood disturbances, and long-term health risks (Fukumura *et al*., 2021). Amid these challenges, promoting circadian health through architectural solutions has emerged as a promising approach to enhance productivity, mood, and overall well-being.

Decompression spaces—dedicated areas designed for temporary disengagement and mental recovery—have gained traction as workplace interventions to mitigate stress and prevent burnout. While the presence of decompression spaces, such as game rooms and relaxation lounges, has expanded in corporate environments, there remains a gap in the literature regarding their efficacy from a circadian rhythm perspective. Most studies emphasize social interaction or physical relaxation but overlook how environmental parameters, particularly light exposure and visual access, influence biological rhythms essential for mental health and cognitive performance.

Lighting plays a decisive role in regulating circadian rhythms, affecting mood, energy levels, and productivity. Insufficient daylight exposure can lead to irritability, cognitive impairment, and long-term health risks including cardiovascular disease, obesity, and endocrine disruption (Ticleanu; Littlefair, 2020; Foster, 2020; Kantermann, 2013). Exposure to bright light regulates cortisol levels and improves overall health (Bilu et al., 2020; Petrowski et al., 2020). Despite the well-established importance of light for circadian entrainment, few studies have assessed whether decompression spaces are designed to optimize exposure to beneficial lighting conditions.

The blue wavelength (450–495 nm) is the most effective at synchronizing circadian rhythms and enhancing cognitive performance during the day but negatively impacts sleep if exposed at night (Wahl et al., 2019). The timing, intensity, and spectral composition of light exposure influence the cortisol awakening response (CAR), vital for alertness and motor activation (Clow; Hucklebridge; Thorn, 2010).

Another overlooked factor is the role of visual relaxation elements, such as long-distance views, in facilitating eyeball relaxation and mental detachment from work stressors. The use of screens

within decompression spaces, although intended for entertainment, may counteract relaxation effects by maintaining close-up visual engagement and disrupting natural circadian responses.

Considering these, this study aims to address a critical gap by evaluating two different decompression space designs—one with multi-person game rooms and screens, and another with a single-person relaxation room and daylight access—from a circadian health perspective. Through environmental modeling and Alfa simulations, we seek to identify which spatial strategies better support biological rhythms and promote employee well-being.

By bridging environmental design with circadian science, this study offers new insights into how decompression spaces can be optimized not only for relaxation, but also for biological and cognitive resilience in modern workplaces.

Objective

This study compares two distinct decompression space designs to determine which environmental features more effectively support circadian rhythm alignment, enhance employee well-being, and promote cognitive performance.

Theoretical Framework

The concept of decompression spaces, while widely adopted in contemporary workplace design, does not have a singular academic origin. It draws from principles of environmental psychology and organizational behavior, particularly those concerning restorative environments and stress mitigation. Attention Restoration Theory (ART) demonstrated that exposure to natural elements and distant views helps replenish cognitive resources depleted by mental effort (Kaplan, 1995). These foundations have informed the design of modern decompression spaces aimed at reducing cognitive fatigue and promoting restoration. Although the term "decompression space" gained popularity in the early 2000s, especially in technology companies such as Google and Facebook, its theoretical roots are well-established in the academic literature on occupational health and environmental design. Building upon these principles, lighting has been recognized as a critical factor for promoting circadian health within decompression environments.

Building upon these theoretical foundations, specific environmental parameters, particularly related to lighting, have been recognized as significant elements for promoting circadian health in decompression spaces. Daylight typically provides the optimal intensity and range of wavelengths (spectrum) necessary for proper regulation of the body's circadian rhythms. Therefore, the careful planning of both natural and artificial lighting is fundamental in architectural design.

To evaluate the circadian performance of decompression spaces it is necessary to analyze Melanopic/Photopic ratio (M/P ratio), which indicates circadian stimulus potential. It evaluates the capacity of a light source to stimulate intrinsically photosensitive retinal ganglion cells (ipRGCs) containing melanopsin, while also supporting daytime visual acuity through photopic vision (Aguilar-Carrasco; Acosta, Domínguez-Amarillo, 2023).

By assessing these points, it is possible to indicate whether the room is good enough to provide proper rest for employees and improve mood, energy levels, sleep, and overall well-being (Miller, 2019). High melanopic/photopic (M/P) ratio lighting has several benefits for circadian health and overall well-being (Aguilar-Carrasco; Acosta, Domínguez-Amarillo, 2023):

1. Enhanced circadian entrainment: A high M/P ratio indicates a greater proportion of the blue part of the visible light spectrum, which is particularly effective in stimulating melanopsin photoreceptors in the retina. These photoreceptors play key roles in the regulation of circadian rhythms. By providing stronger signals to the circadian system, high M/P ratio lighting can help maintain the proper alignment of the body's internal clock with the external environment.

2. Improved alertness and cognitive performance: Exposure to light with a high M/P ratio during the day can increase alertness and enhance cognitive functions, such as attention, reaction time, and decision-making. This is particularly beneficial in work environments in which sustained focus and productivity are essential.

3. Better sleep quality: When used appropriately during the daytime hours, a high M/P ratio can help reinforce the natural circadian rhythm, leading to improved sleep quality at night. Promoting a stronger distinction between daytime and nighttime signals can help regulate melatonin production and prepare the body for restful sleep.

4. Mood enhancement: Light with a high M/P ratio has been associated with positive effects on mood and reduced symptoms of seasonal affective disorder (SAD). The increased activation of melanopsin photoreceptors may contribute to these mood-elevating effects.

5. Energy regulation: Proper exposure to high M/P ratio light during the day can help regulate energy levels throughout the day, potentially reducing afternoon fatigue and maintaining a consistent performance.

It is important to note that, while high M/P ratio lighting offers these benefits, its use should be carefully timed and balanced. Exposure to light with a high M/P ratio in the evening or at night can disrupt the natural circadian rhythm and negatively affect sleep. Therefore, implementing dynamic lighting systems that adjust the M/P ratio throughout the day to mimic natural light patterns can maximize benefits while minimizing potential drawbacks.

The concept of decompression rooms as spaces with video games, foosball, and pool tables initially emerged among large technology companies in Silicon Valley, such as Google, Facebook, and LinkedIn. These strategies can also be found in some smaller companies. However, not all decompression rooms exhibit these characteristics. Some of these are simple rooms with large windows and comfortable sofas. This study compared rooms with and without games (screens).

While environmental configurations are essential, behavioral and organizational factors also significantly influence the effectiveness of decompression spaces. Cognitive performance is not determined solely by environmental variables such as lighting or spatial arrangement. Work patterns, and the frequency and quality of breaks, also play critical roles. Even short breaks may not fully prevent mental fatigue from prolonged office work (Brazaitis; Satas, 2023). Therefore, the design of decompression spaces must not only facilitate exposure to beneficial environmental stimuli but also encourage effective disengagement from cognitive demands to optimize recovery.

Method

This study employed a comparative environmental simulation approach to evaluate how different decompression space designs influence circadian alignment and employee well-being.

1. Selection of Case Studies

These two decompression spaces represent typical decompression space design philosophies—social and screen-based versus individual and nature-focused. They were selected based on contrasting spatial characteristics: a) Googleplex (Mountain View, USA): A multi-person game room equipped with video games and foosball tables; b) Think Tank (Swedish Post Headquarters) (Solna, Sweden): A single-person relaxation room featuring natural daylight access and long-distance views.

2. 3D Modeling

Both spaces were digitally modeled using Rhinoceros software to replicate their architectural and environmental conditions, including room dimensions, material properties, and window orientations.

3. Circadian Simulation

Simulations were conducted using Adaptive Lighting for Alertness (Alfa), a specialized tool for circadian lighting analysis. Key simulation parameters included: a) Day and time: March 21st, at 9:00 a.m. (equinox conditions for comparable daylighting), in San Francisco and Stockholm; b) Material properties: White walls and ceilings; gray (Googleplex) or wooden (Think Tank) flooring; Double Insulated Glass Unit (IGU) with 45% visible transmittance; c) Lighting conditions: Only natural daylight was considered; no artificial lighting was simulated.

4. Evaluation Criteria

Environmental performance was evaluated based on the following factors: a) Daylight access: Amount of natural light reaching eye level (1.20m seated, 1.65m standing); b) M/P Ratio; c) Screen presence: Identification of potential disruptions due to screen-based activities; d) Long-distance views: Availability of distant visual relaxation points beyond immediate room boundaries.

Thresholds were established based on Alfa software parameters: a) M/P > 0.9: Strong circadian stimulation (alertness enhancement); b) M/P < 0.35: Relaxation-inducing environment.

5. Simulation Scenarios

The Googleplex concept is based on an educational environment. It was designed by Clive Wilkinson Architects and built in 2005. “The reasoning for this was the idea that within the loosely structured university system, there are resources available to allow the individual to conceive, investigate, and execute the impossible—and that is how Google was originally conceived” (Meachem, [2006?], p. 4).

The design incorporated 13 distinct zones (Figure 1), mirroring typical college campus environments, which were methodically integrated into each building's overall layout using a hot-cold scheme. Hot zones represented more public and lively areas (hence decompression spaces), whereas cold zones represented more isolated and private spaces. These areas were determined based on their positions along the main and secondary circulation pathways, respectively. The Clubhouse, zone 1, is a decompression space where we can find a pool table, as it is possible to see in Googleplex hot and cold zones (Figure 1). Googleplex has many types of decompression areas, both outdoors and indoors. However, this study only analyzed a room with video games (arcade) and a foosball table (Figure 2). It can be observed that the arcades are in front of the windows, reducing the amount of daylight inside the space. The arcade room is 4.80m x 6.00m x 2.80m.

The eye views were considered to be facing forward in the model according to the equipment used, as shown in Alfa simulation (Figure 3). Some eye views face the window, while others face the opposite wall. The tool has a limitation, and it is not possible to set the heads looking down. Users were considered standing up.

Figure 1: Googleplex hot and cold zones



Source: Meachem ([2006?], p. 4).

The second case study has an outstanding architecture in many aspects: façade design, interior design finishes, and daylight design. The Head Office for the Swedish Post (Figure 4–6) is known by Think Tank and/or Arken, or Ark in English, referring to the fact that the building resembles a

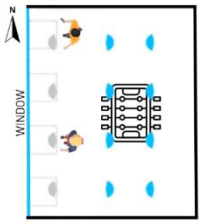
boat (Noah's Ark) stranded on a mountain. The building is a result of a contest, and its construction ended in 2003.

Figure 2: Foosball and video games (arcade) room



Source: Tech Vision (2020).

Figure 3: Alfa simulation



Source: the authors

The building includes multiple decompression rooms designed for eating and social interaction. However, one small room attracts attention: the single-person decompression room. The room accommodates a single chair and there is no external shading in this portion of the building. The room is 1.20m x 1.50m x 2.30m. Only one person was considered in the calculation, sitting down, with the head looking at the window.

Figure 4: Think Tank – building view



Source: BSK Architects (2025).

Figure 5: Think Tank – lateral façade view



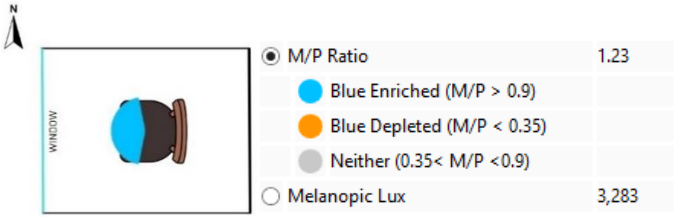
Source: BSK Architects (2025).

Figure 6: Think Tank – single-person room view



Source: BSK Architects (2025).

Figure 7: Single-person room Alfa simulation



Source: the authors

6. Comparative Analysis

Performance results from both decompression spaces were compared to determine which spatial features most effectively support circadian health and employee well-being.

Although the Googleplex simulation (Figure 3) indicates a good result on the foosball table (M/P ratio), the head looks down to the table, which may affect the amount of light that reaches the retina (due to table material luminance and light reflection). Users positioned in front of arcade games receive minimal daylight exposure, reducing circadian stimulation. The use of a screen in the arcade or pool table does not contribute to eyeball relaxation, because it does not have long-distance view possibilities.

The advantages of Think Tank decompression room are that long-distance views promote eyeball relaxation, circadian rhythm entrainment due to daylight access at the retina height, no screens, relaxation and disconnection from work, and a high M/P ratio (Figure 7).

Results and Discussion

The comparative simulations of decompression spaces at Googleplex and the Swedish Post Headquarters revealed significant differences in their potential to support circadian health and employee well-being.

At Googleplex, the multi-person game room showed limited daylight penetration due to the positioning of arcade machines in front of the windows. The simulated Melanopic/Photopic (M/P) ratios indicated minimal circadian stimulation for occupants, particularly those engaged with screen-based activities. Furthermore, the absence of long-distance views reduced opportunities for visual relaxation, potentially exacerbating cognitive fatigue.

In contrast, the single-person decompression room at the Swedish Post Headquarters demonstrated superior circadian performance. The room's design allowed unobstructed daylight access at eye level, leading to consistently high M/P ratios conducive to circadian entrainment. The inclusion of expansive long-distance outdoor views, free from visual obstructions or digital screens, further promoted relaxation and mental restoration.

These findings corroborate existing literature emphasizing the role of daylight exposure and spatial openness in maintaining circadian alignment and supporting cognitive performance (Wahl *et al*., 2019; Ticleanu; Littlefair, 2020). Spaces designed to maximize natural stimuli—rather than technological engagement—appear more effective in fostering mental resilience and physiological health.

However, it is important to recognize some limitations of this study. The simulations assumed static occupant positions and fixed lighting conditions, without accounting for seasonal variability, occupant behavior, or personal device usage (e.g., smartphones). Furthermore, potential influences from material reflectance and minor artificial light sources were not modeled. Future research could incorporate real-world post-occupancy evaluations, physiological monitoring, and expanded typologies of decompression spaces to validate and deepen these findings.

Overall, the study highlights that decompression spaces prioritizing natural light access, eliminating screen distractions, and facilitating long-distance views are more effective in promoting circadian health and employee well-being. These design strategies represent essential considerations for future workplace environments committed to enhancing holistic health and productivity.

Conclusion

This study demonstrated that decompression spaces designed to maximize natural light exposure, eliminate screen distractions, and promote long-distance visual relaxation more effectively support circadian health and employee well-being than screen-centric, obstructed environments. The single-person decompression room at the Swedish Post Headquarters outperformed the multi-person Googleplex game room across all circadian performance criteria, highlighting critical design considerations for future workplace environments.

By prioritizing daylight access, window positioning, and screen minimization, employers and designers can create decompression spaces that not only enhance relaxation but also strengthen biological resilience and productivity. As organizational priorities continue to shift toward holistic well-being, the strategic design of decompression spaces will be increasingly essential in fostering sustainable, high-performing work cultures.

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