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THE IMPACT OF COLOR ON WORKPLACE EFFICIENCY. A STUDY FOR ENGINEERING OFFICES IN THE FIELD OF RESEARCH AND DEVELOPMENT

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Abstract: *This research was carried out in the offices of four multinational companies with an automotive profile in Timisoara (Romania). Through a questionnaire comprising 12 questions on the Google Forms platform, the research addressed employees' attitudes toward the visual environment, the impact of colored walls on work efficiency, desk positioning, the predominant color in the workspace, eye fatigue, and the active perception of wall colors. The conclusions formed the basis for practical recommendations to improve working conditions, emphasizing the importance of color in creating an environment conducive to performance and well-being in the engineering field.*
Key words: *Color, ergonomic programs, employee well-being, visual impact in offices.*

1. INTRODUCTION

In the current era of professional dynamism, where well-being and productivity take center stage, attention to the work environment is increasing. In the same context of [1] "ergonomics is the discipline that studies how the workplace should be adapted to strive for optimal human performance", an appropriate environment can satisfy two interdependent and counterbalanced goals (Fig. 1): company performance, directly determined by staff performance; job satisfaction, stimulated by the well-being, and health of workers.

Part of the well-being of workers in the workplace is the impact of environment color on employee experience.

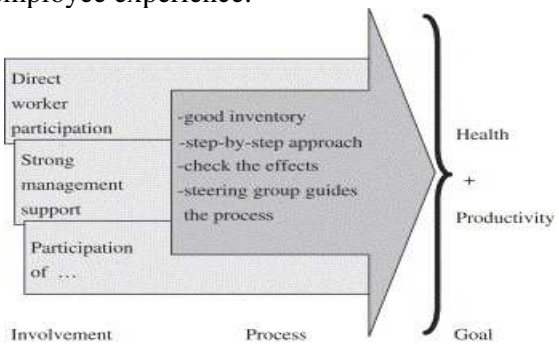

Fig. 1. Model to summarize ergo-factors and goal [1].

This study focuses on worker perceptions in the color design field of engineering offices in research and development, focusing on four prestigious automotive companies operating in Timisoara (Romania). In the first part of the investigation, emphasis is placed on analyzing how organizations have approached the issue of color in the workplace, focusing on those mentioned earlier in the context of scientific literature. This contextualizes the study, providing a comprehensive perspective on existing practices and how they have addressed challenges related to the color environment.

It is fundamental to observe the level of scientific interest in studying colors, the results obtained, and the ways/methods of obtaining them [2][3]. In this first part, we will find out how much has been learned about this subject and what is the general interpretation of the results through some reviews or more extensive state-of-the-art [4][5]. This brief presentation of some scientific conclusions will be useful in analyzing, cataloguing and interpreting the results of our study, but also to propose possible ergonomic measures, in accordance with scientifically proven theory and best practice.

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The paper aims not to demonstrate certain performances in the application of specific interior colors, but to analyze a case study on interior ergonomics, carried out with the help of workers from the research and development offices of three different companies in Timisoara (Romania). This study is a snapshot of the realities in research and development engineering offices and a practical guide for optimizing the work environment. This research is not intended just to bring essential aspects of the relationship between color and performance but to open the door for future explorations and innovations in professional environmental design.

2. RESEARCH STAGES

In the study of the ergonomic efficiency of the use of color effects in interiors, there have been various approaches [6], which have an approach that warm colors reduce energy consumption due to the feeling of warmth emanating indoors, demonstrated both with subjective voting and the physiological index studied. The study [7] on the effects of yellow color on human perceptions has practical implications. The high reflection index and low absorption index of yellow reduce the need for lighting and electrical consumption. Furthermore, the study shows that yellow, when used in combination with a specific lighting mode, enhances the visual comfort of workers.

Another approach to the study of interior colors [8] is from a marketing perspective, focusing on the attractiveness of a store's customers. Interestingly, this approach contradicts Grandjean's principles [9]. For instance, the color violet, which is often perceived as cold, aggressive, and depressing, is found to be stimulating in this context.

Furthermore, [2] provides the characteristic effect of wall color on productivity (in addition to thermal and visual sensation effects). The study notices that, from the color scheme red, white, and blue, white is the most used color in office spaces, the dullest/impersonalized, but with the most significant effect on productivity, followed by blue and red. This potential for color to influence productivity is a fascinating aspect of our research, and it underscores the need for further investigation into the effects of color on productivity.

In addition, [3] presents the study of the color scheme: white, predominantly red, and predominantly blue green. As the results were not very conclusive, she postulated that color is not an individual factor that can influence stimuli. Stimulation occurs differently, depending on the individual's ability to respond to the stimuli as well as on the time during which the color acts in this complex way. Basically, we cannot deduce labor productivity in an ad hoc experiment, but only over a long time can we have relevant results. This conclusion also emerged with [10] supporting the idea that "color schemes alone may not have a noticeable impact on productivity", but also that "the affective state of a given individual may not be relevant for maximizing performance". These conclusions can only be dispelled if "the effects of color schemes on worker productivity are examined with larger work samples over a longer period of time".

This complexity of possible individual effects was supported by [2], concluding that "women indicated more depression, confusion, and anger in lightly saturated office colors (white, gray, beige), while men reported more depression, confusion, and anger in highly saturated office colors (green, blue, purple, red, yellow, and orange)". This appears precisely the opposite in the study [11], which reinforces the individual nature of perceptions, which fall within the sphere of culture and civilization.

The research of [12] points out novel aspects concerning the spectral distribution of incident light power on objects, the spectral reflection functions of surface illumination and the rendering power of color. It does not refer to the effects on humans, but more importantly, to the "strong influence on color perception and in general on the quality and comfort of indoor lighting".

In addition to the study of color and the factors that contribute to its spread, luminosity is the element without which color would not be possible to enhance. For these reasons, we must also pay attention to this catalyzing factor of color, namely the color (warmth) of illumination. In [13] it was underlined that low lighting is preferred due to ease of

accommodation and avoidance of eyestrain. It has also been shown that women are more tolerant to dim lighting and low light warmth (CCT - Correlated Color Temperature) than men.

Starting from this CCT, light color and fatigue through the onset of drowsiness was studied by [14], showing that lighting with CCT below 2000K is not suitable for workplaces because it produces melatonin - the sleep hormone. It is only at 3000K that the effect of melatonin is suppressed and circadian rhythm changes are annihilated, and 4000K should be considered for night work. It should therefore be possible to vary the lighting level.

Discussing the adaptation to change of light, colors, but also the stress caused by it, and the individual complexity of perceiving change, it is worth mentioning the research [15] that support that "our future as individuals and as a species depends on our ability to adapt to strong stressors", including stress at work. According to [16], a stressful situation is when "the demands of the situation threaten to overwhelm the resources of the individual". In this study we learn the mediating correlation between stress and endocrine-immune capacities, of the possibility of finding definite answers only with the involvement of "cognitive-emotional psychology, molecular biology, neuroscience, clinical psychology and medicine".

From the perspective of efficiency, of economics, the most eloquent title is [17]. The definition of ergonomics was adopted by the IEA (https://iea.cc/about/what-is-ergonomics/) in 2000 as: "scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design in order to optimize human well-being and overall system performance". To achieve the goal of ergonomics, the approach is centered on worker comfort, which is also defined by [1]: "The convenience experienced by the end user during or just after working with the product" underling the importance of the study on comfort influencing productivity by creating a comfortable chromatic environment.

Moreover, we will see that the survey, if not based on a thought-stimulating substance, is somewhat sterile. Human perceptions are limited without awareness and the possibility of optimal control for adjusting alternatives. "People who think that they are in control go on to be more successful than others" [1]. Similarly, keeping comfort in mind, [18] argues that moderately increasing the use of good color design can improve overall comfort and worker productivity.

The theme of wall color was the most concise with solutions and conclusions from recent scientific knowledge, was presented in [19], who by answering 10 questions about room color summarized a sum of postulates, including about productivity - what we are interested in. But by addressing all 10 questions we realize the complexity and myriads of influencing factors, hence the conclusion of wide adjustability. The researcher joins those who argue about the relevance of current studies on the impact of color calling it "unimpressive" and "overreliance on color as a way of creating specific behaviors is probably not wise".

With a more recent 2018 published review on the color of the work environment the research presented in [4] considers 40 representative scientific papers on the topic produced between the 1990s and 2016. The situation of tabulated indicators on how to evaluate psychological, physiological, outcome, or preference assessment gathers "robust results that color in the work environment plays a significant role in human perception and behavior, particularly mood, well-being, and performance". Although many researchers consider color research sketchy, [20] identifies 262 articles from which he selects 45 for another review on the impact of color in the work environment.

The same type of conclusion appears in the study by [5], who notes the complexity of approaches and the limitation in volume and contributions to color research in the work environment.

Numerous studies have shown that preferences are more emotional than rational in color design. The study [21] shows that the color design of individual homes overturns the ergonomics of the colors used in office interiors;

favorites were white, blue, red, black, and gray, with purple, green, and yellow in last place.

Concerning the study method, a remarkable one, which analyzes the emotional response to stimuli, received at the level of skin conductivity, respiration but especially at the level of the central autonomic neuronal system, which is studied by neurophysiology is coming from [22]. Thus, the reactions and variations of alpha (relaxation-productivity), beta (conscious-active-concentrated) and theta (drowsiness) wave parameters and parameters of the electroencephalograph (EEG) that occur in response to environmental changes were monitored. The most relevant reactions occur when switching between chromatic and achromatic. "This study provides evidence that the color of the built environment modulates biological systems associated with emotion and helps us understand differences in the processing of different design features".

This complex and broad framework of scientific fields corresponds to the interdisciplinary approach to ergonomics as the first law of ergonomics [23]. On the other hand, the enormous amount of interdisciplinary research that would bring these fields together is daunting, but may be a target for future research, as most researchers express themselves.

Approaches to the study of color are not only concerned with the reactions of the moment, of reactive pleasure, i.e., attractive design. Rather, the ergonomic, helpful side of using color in interior work environments, especially in the workplace, is considered. Thanks to this ergonomic side, studies are aimed at preserving mental and ocular health, as well as stimulating and preserving human capabilities at high levels of creativity, communication, productivity, and efficiency.

3. METHODOLOGY

The research methodology used a questionnaire survey to collect data and achieved the results for characterizing the phenomena investigated. To gain a detailed understanding of employee perception, comprehensive questionnaires were completed, addressing topics such as attitudes toward the impact of the visual environment, opinions about colored walls and their influence on work activities, hours spent in the office, desk positioning, predominant color in an office, eye fatigue, and active perception of wall color during work.

Through the in-depth analysis of these aspects, it is of interest to identify trends and patterns and propose innovative solutions for optimizing the work environment. It is a call for a reassessment of current conceptions of office interior design, emphasizing the importance of integrating color to create environments that support operational efficiency and employee well-being.

In the data analysis phase, questionnaire results revealed not only individual preferences regarding colors but also significant connections between the color environment and levels of eye fatigue or active color perception during work. These findings provide a detailed framework for understanding the complexity of the interaction between the color environment and team functionality.

Moreover, by examining the impact of human factors like desk positioning and work hours, the study delves deeper into establishing correlations between these aspects and employees' color preferences. This holistic approach provides valuable insights into the intricate relationship between environmental elements and individual choices and suggests practical strategies for tailoring the work environment to optimize the overall employee experience, promoting both comfort and efficiency.

The contribution of paper extends beyond raising issues to formulating concrete suggestions for implementing changes. Proposals include adapting the color scheme of offices based on the type of activity, promoting personalized work areas, and exploring adaptable lighting technologies to create an environment conducive to both performance and eye health.

The study on the impact of color on workplace efficiency utilized a questionnaire with 12 questions on Google Forms to investigate the perception of employees in the engineering offices of research and development. It covered attitudes toward the environment, the influence

of colors on activities, and the overall perception of the color scheme in the work environment.

The questionnaire was distributed electronically to the four targeted companies, ensuring accessibility and ease of participation. By respecting confidentiality and anonymity, the research encouraged sincere responses.

The data collected were centralized and analyzed, revealing significant connections between employee perception and workplace factors. The results were the basis for developing practical recommendations for improving working conditions.

Through this methodology, the study contributes to understanding the impact of colors on the work environment in engineering offices, paving the way for optimizing professional spaces based on employees' perceptions and needs.

3. RESEARCH RESULTS

3.1. The influence of workplace chromatics

Responses regarding workers' attitudes toward the impact of the visual environment reveal an intriguing perspective on its perception in the context of workplace productivity, as reflected in (Fig. 2).

Although 45% consider the visual environment to have a minimal impact, it is evident that this opinion does not always reflect a complete awareness of subconscious influences. This suggests that certain aspects of the visual environment may affect productivity more profoundly than initially perceived.

In contrast, only 23% believe that the visual environment has a considerable impact, indicating the awareness of a smaller segment of respondents regarding the importance of visual influences on workplace performance.

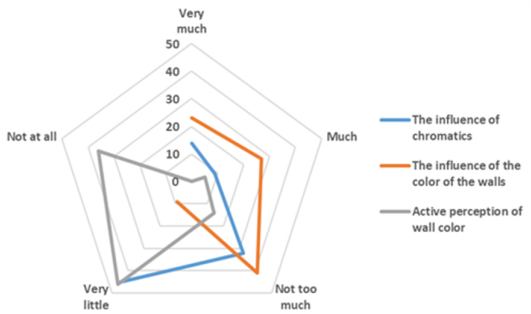

Fig. 2 The influence of chromaticity.

This discrepancy between minimal and considerable perception underscores the complexity of how employees evaluate and understand their own work environment. Additionally, we note the appearance in the diagram of options "very much" at 14% and "much" at 9%, highlighting that a significant portion of respondents attribute significant importance to the visual environment in relation to productivity. This supports the idea that there are significant variations in workers' perceptions of the impact of the visual environment, emphasizing the need for a personalized approach in optimizing working conditions to maximize employee efficiency.

3.2. The impact of wall color

Analyzing in detail the workers' attitude towards colored walls and their impact on productivity, a complex picture of perceptions emerges. Half of the respondents, 50%, believe that colored walls have a minor influence on workplace productivity, while an equal proportion of 50% state that they have a significant impact. This equitable division indicates the diversity of perceptions regarding the impact of colors in the professional environment.

The notable difference between extremist opinions is remarkable. Thus, 23% of respondents assert that colored walls have a very significant influence on productivity, emphasizing the importance given to the visual element in workplace efficiency. In contrast, only 9% consider that they have a minimal influence. This discrepancy suggests that a significant segment of the workforce recognizes the strong impact of colors on the atmosphere and efficiency in the workplace. The proportional breakdown of these aspects is visually represented in Fig. 1.

This detailed analysis of workers' attitudes towards colored walls and their impact underscores the diversity of perceptions and highlights the need for a personalized approach in designing workspaces, encouraging an optimal balance between individual preferences and the overall benefits brought by color in the professional environment

3.3. Active perception of wall color

It is observed that, although the color scheme of the surrounding environment plays a significant role in shaping work dynamics and influencing productivity, active awareness of this aspect is limited, as indicated by 81% of the responses collected to this question. Detailing the active perception of wall colors during work, Fig. 1 reveals that the highest proportion, 45%, indicates "very little" attention regarding the influence of colors. This result emphasizes the opportunity to intensify education and awareness efforts among employees regarding the psychological impact of colors on their work environment. Despite this, most respondents seem to pay limited attention to the colors around them in the context of professional activities.

The associated diagram, presented in Fig. 1, provides a clear visual representation of the distribution of these responses, highlighting discrepancies in the active perception of wall colors during work. It offers quantitative data and a visual perspective on how employees consciously perceive their color environment during professional activities. This combination of qualitative and quantitative analysis enriches the understanding of the complexity related to the chromatic impact in the work environment.

3.4. Number of hours spent at the office

The aspects presented regarding the number of hours spent at the office are highlighted in Fig. 3 through the diagram.

The detailed analysis shows that the average effective working hours are 6 hours per day, in an 8-hour schedule. It is significant that there are no responses indicating activity below 2 hours, and 14% of participants state that they work between 2 and 5 hours per day, emphasizing the variety in how employees manage their time in the office. The detailed analysis shows that the average effective working hours are 6 hours per day, in an 8-hour schedule. It is significant that there are no responses indicating activity below 2 hours, and 14% of participants state that they work between 2 and 5 hours per day, emphasizing the variety in how employees manage their time in the office.

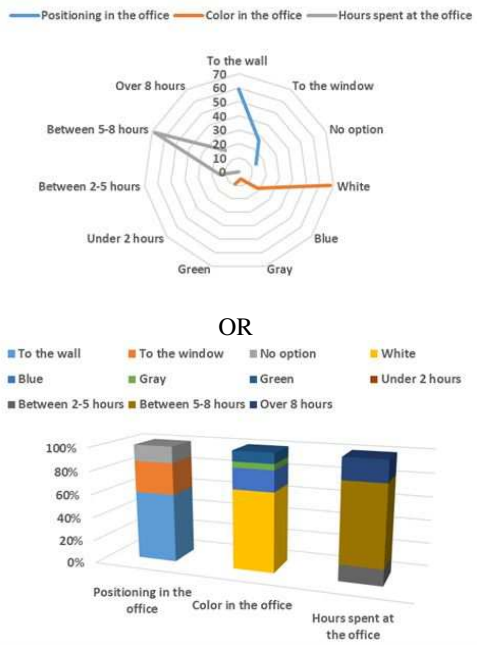

Fig. 3 Positioning, wall color, hours spent.

Furthermore, it is noteworthy that despite the standard 8-hour schedule, 18% of respondents declare that they exceed this duration, working more than 8 hours per day. This finding may indicate increased commitment to work or suggest a professional environment where extending working hours is frequent. The diversity in the hours worked underscores the variability in work culture and individual needs. Thus, the detailed information regarding the number of hours spent at the office reveals a complex picture of time management in the professional environment, emphasizing the importance of adaptability in implementing time management strategies and achieving a proper balance between efficiency and employee well-being.

3.5. Workers' desk orientation

By detailing the aspect of workers' positioning in the office, we observe that the most common choice, at 59%, is orientation toward the wall. This emphasizes the importance of the immediate visual environment for employees, considering that they spend a significant part of their day facing the wall in front of them. Additionally, 27% of respondents mentioned that they are positioned toward the window, indicating another significant preference. This choice may reflect the desire to

benefit from natural light and have a view outside during working hours.

The option "No preference" was selected by 14% of participants, suggesting a possible office configuration where positioning is not at the discretion of the employees or that they did not have a specific preference regarding orientation toward the window or wall. The percentage data is highlighted through the diagram in Fig. 3.

These results underscore the importance of the immediate visual environment in the employees' experience and suggest that chromatic and visual aspects in their peripheral field can have a significant impact on them. It is estimated that approximately 15% of this peripheral visual field can directly influence well-being and productivity.

3.6. The dominant color in teh office

Detailing the predominant color palette in offices, we observe that white occupies a significant proportion, at 68%, as reflected in Fig. 3. Although often associated with simplicity and cleanliness, this prevalence of white raises questions about its impact on productivity. Studies indicate that white walls can be perceived as a “blank canvas”, suggesting a lack of stimulation and inspiration.

This perception may disrupt creative flow and, consequently, reduce employee efficiency. The option of blue, registering at 18%, represents a popular alternative in color choices for offices. Associated with calmness and focus, blue is gaining popularity in the workplace, providing an atmosphere conducive to tasks that require attention and concentration.

Green and gray, with smaller percentages of 9% and 5%, respectively, bring up the variety of employees' color preferences. This suggests a diversity of tastes regarding the visual atmosphere of workspaces.

This detailed analysis of the predominant color in offices underscores that, despite the popularity of white, it may not be ideal for stimulating productivity. Thus, it highlights the importance of a careful approach to chromatic elements in workspace design, considering their psychological impact to create environments that optimize both efficiency and employee well-being.

3.7. Employees’ eye fatigue

This detailed insight into employee eye fatigue highlights the importance of adapting the visual environment to employees' needs and implementing ergonomic strategies to improve workplace quality and comfort. The presented percentage breakdown is outlined in Fig. 4 (line visual exhaustion of employees).

Most employees firmly acknowledge that eye fatigue is a real issue, especially for engineers who dedicate entire days to computer work without taking regular breaks to alleviate the strain on their eyes. One of the significant contributing factors to this fatigue is the workplace color scheme, particularly colors considered tiring in the long run, such as white or red. For instance, the color white, often predominant in corporate offices, can create a “blank paper” sensation, contributing to visual exhaustion.

Statistically speaking, 57% of participants confirmed experiencing eye fatigue, highlighting the significant impact of the visual environment on eye health and employee comfort. This finding underscores the urgent need to pay increased attention to visual conditions in the workplace and implement strategies to reduce eye fatigue and enhance overall staff well-being.

In contrast, 33% of respondents have not mentioned encountering issues related to eye fatigue, suggesting that, in certain situations, the work environment can be effectively managed to minimize this problem. Additionally, 10% indicated that eye fatigue occurs occasionally, emphasizing the complexity of individual experiences in the context of working conditions.

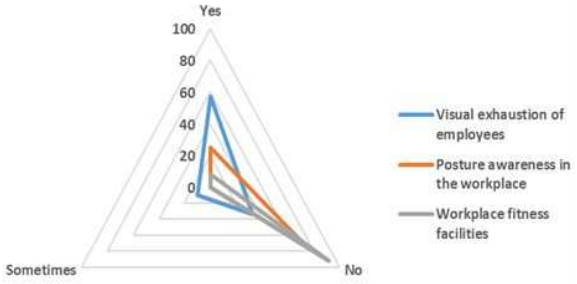

Fig. 4. Ocular fatigue, posture, fitness.

3.8. Ergonomic actions for well-being

The statistical analysis uncovers a noteworthy trend: a limited awareness of maintaining proper posture during work hours, as indicated by responses to the question, "Are you aware of bad posture during work hours?" The breakdown reveals that only 25% of participants are conscious of their posture, while a substantial majority, 75%, lack awareness. This discovery raises concerns about potential long-term implications for employee well-being. Prolonged poor posture can contribute to musculoskeletal issues, discomfort, and an overall decline in health. The prevalent lack of awareness emphasizes the immediate need for ergonomic interventions to mitigate the risk of sustained harm to employees.

In summary, the data highlights a concerning lack of awareness regarding bad posture during work hours, underscoring the immediate need for ergonomic actions to safeguard the long-term health and well-being of employees, as depicted in Fig. 4 – line - posture awareness in the workplace

3.9. Workplace physical activity

The absence of designated spaces for physical activity within office environments raises significant concerns regarding employee well-being. This lack of facilities not only hinders individuals from engaging in recreational exercise but also contributes to the development of a sedentary work culture, which can have far-reaching consequences.

The data gleaned from the question "Do you have a designated place within the office to practice physical activity?" is particularly alarming, with a striking 92% of respondents indicating the lack of such spaces. This statistic underscores a critical aspect of workplace infrastructure that can impact employees on multiple levels.

The inability to practice physical activity within the office has broader implications. Regular exercise is not only crucial for maintaining physical health but also plays a vital role in supporting mental well-being and overall job satisfaction. Without designated spaces for exercise, employees may experience increased stress, reduced energy levels, and a higher likelihood of posture-related issues due to prolonged periods of sedentary work.

Employers and workplace planners should recognize the importance of creating environments that foster a healthy work-life balance. Implementing designated spaces for physical activity can encourage employees to incorporate movement into their daily routines, contributing to improved overall health, increased productivity, and enhanced job satisfaction. Addressing this deficiency is not only a matter of promoting physical well-being but also an investment in creating a positive and supportive work environment (refer to Fig. 4 at line - workplace physical activity).

3.10. Perspectives on office furnishings

Office furniture holds a dual role, being both functionally essential and influential in shaping the comfort and efficiency of employees, especially critical elements like chairs and tables designed to meet ergonomic standards, significantly impacting individuals' daily activities. The survey results highlight an opportunity for improvement, with 19% of respondents expressing the need for enhancements in their interactions with office furniture. To provide a more nuanced understanding of these responses, let's explore the insights the accompanying Fig 5 offers.

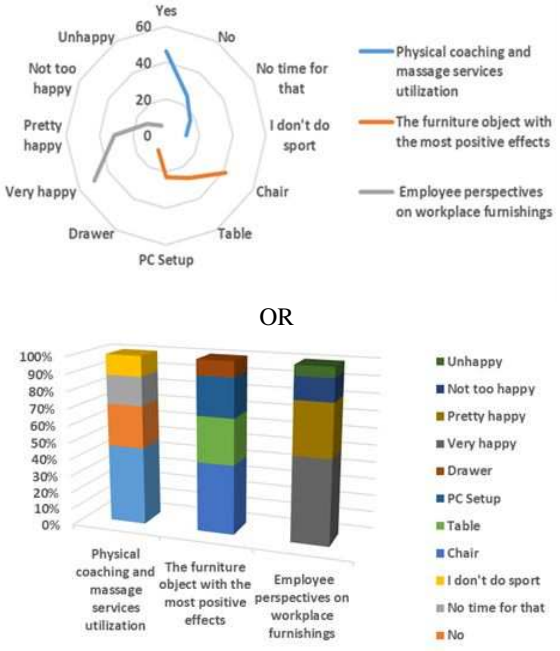

Fig. 5 Opinions about the furniture.

An impressive 50% express being “very happy”, indicating substantial contentment with the existing office furniture, which suggests a harmonious alignment between employees' needs and preferences and the characteristics of the current furniture. Additionally, 31% fall into the “pretty happy” category, indicating overall satisfaction but suggesting room for improvement. In contrast, 13% express dissatisfaction, categorizing themselves as “not too happy”. This group emphasizes the need for more significant adjustments to better meet employees' needs and create a more conducive working environment.

The “unhappy” category, comprising 6% of respondents, is particularly alarming, indicating a pressing need for immediate intervention to address unsatisfactory aspects of the furniture. These findings underscore the significance of office furniture in the workplace and emphasize the ongoing need for adaptation and improvement to meet the evolving needs of employees, as highlighted in Fig. 4.

3.11. Furniture objects and their impact on workplace well-being

A significant 41% of individuals, when asked about the object furniture with the most positive effects, specifically mentioned their chair. The recognition of the chair's impact suggests an awareness among respondents regarding its crucial role in overall well-being and comfort during work hours. Recognizing the chair as a pivotal element in the work environment underscores the understanding that investing in ergonomic and supportive seating can positively affect physical health and cognitive performance.

The distribution of responses, as depicted in the diagram from Fig. 4 provides further insights into the perceived impact of different furniture objects: Chair 41%, Table 27%, PC Setup 23%, and Drawer 9%. These proportions offer a nuanced view of employees' priorities on various aspects of their workstations, reinforcing the notion that the chair holds a central position in their considerations for a conducive and beneficial work environment.

3.12. Workplace well-being preferences

The survey results uncover a prevailing sentiment among employees, with a significant 46% expressing openness to the idea of utilizing the services of a dedicated coach or masseur during work hours. This inclination suggests a growing awareness of the importance of well-being in the workplace, particularly considering the extended hours spent in an office environment. The breakdown of responses sheds light on the diversity of perspectives. While a notable percentage (25%) indicates a reluctance to embrace such services, 17% cite a lack of time as a hindrance. Additionally, 12% express disinterest in sports, providing a range of reasons behind the varying attitudes toward incorporating physical coaching and massage services into the workday.

The data, encapsulated in Fig. 4 physical coaching and massage services utilization, underscores the need for workplace wellness initiatives that cater to employees' diverse preferences and priorities. Offering access to dedicated coaches or massage services during work hours can emerge as a valuable resource for physical well-being and foster better focus, relaxation, and overall job satisfaction.

As companies prioritize employee health and well-being, understanding and accommodating, these preferences can create a more supportive and fulfilling work environment. The insights gleaned from this survey can inform the development of targeted wellness programs that resonate with the needs and desires of the workforce.

4. OPTIMIZING WORKPLACE WELL-BEING

4.1. Interior chromatic

In the scientific works presented [3, 7, 11, 20, 23] but also in the general ergonomic Romanian theory [22-26] we know that white has the best reflectance index, giving the lighting additional valences, but the color has an emotional but also utilitarian imprint on health and efficiency at work. However, since scientific results are not yet able to provide definite solutions, we will have to allow for individual variation when choosing colors [1, 18]. These choices [4]

depend on the following factors: type of work, type of light (CCT and intensity), gender, even cultural heritage [11]. Individual projector lamps can achieve this with multiple settings.

4.2. Positioning of the worker against color

As shown in the line graph in Fig. 2 regarding desk positioning, most are positioned towards the wall. If the wall were colored according to the abovementioned factors using a lamp with various settings, the ergonomic measure would be partially fulfilled. Moreover, the relaxation of the eye muscle, which changes the concavity of the crystalline, occurs when we look far away. Chronic eyestrain can lead to [24] “painful irritation, diplopia, headaches, reduced accommodation and convergent vision, and reduced visual acuity”. Moreover, addressing the critical aspect of ocular health is paramount in ensuring the overall well-being of employees.

Implementing awareness and prevention programs for eye fatigue is essential to a holistic approach. Educating employees on proper screen ergonomics, the 20-20-20 rule (taking a 20-second break every 20 minutes, looking at something 20 feet away), and encouraging regular eye exercises can significantly reduce eye strain and fatigue.

4.3. Furniture and physical activity

Implementing individual choice solutions that provide furniture and work equipment customized to the individual needs of employees. Implementing such programs can significantly reduce the likelihood of posture-related issues and contribute to the establishment of a healthier environment and much more motivated work. Within the domain of office spaces, elevating the work environment can be achieved by introducing dedicated areas for physical exercise, allowing employees to integrate physical activity into their workday.

Promoting movement and decreasing sedentary behavior can also be explained from a medical point of view, but it can also be associated with active rest in which the employee has some socialization and different activities other than the daily routine. Moreover, conducting periodic awareness sessions on maintaining proper posture during working hours proves beneficial, aiming to educate employees about the significance of sustaining a correct position. These ergonomic postural principles can be presented, adapted and continuously improved during regular OSH (Occupational Safety and Health) training.

In the domain of visual aesthetics within office spaces, strategically allocating areas with colored walls emerges as a valuable strategy to amplify visual impact and foster a more conducive working atmosphere. Emotional and psychological reactions to color significantly influence mood, creativity, and overall well-being, workers' energy and productivity.

5. CONCLUSION

The conclusions drawn from the processed information provide a detailed perspective on the intricate relationship between the chromatic aspects of the work environment and employee productivity. The analysis of the collected data in the research reveals that, despite the significance of chromatics, a substantial proportion of respondents are not actively aware of the impact of colors on their productivity.

Concerning the visual environment, most respondents believe it has a significant impact on productivity. However, disparities in the perception of this impact may suggest the existence of subjective and individual factors influencing how employees perceive the chromatic aspects of their work environment. Results regarding the attitude towards colored walls highlight a division of opinions, with half of the respondents considering them to significantly impact productivity, while the other half perceived their impact as minor. This divergence may indicate the need to adapt to individual preferences regarding the visual aesthetics of the office.

Regarding the number of hours spent in the office, it is observed that most employees work approximately 6 hours per day effectively on an 8-hour schedule. However, a significant percentage exceeds this interval, raising questions about the balance between professional and personal life.

Positioning within the office is crucial, and the results indicate that most employees are positioned facing the wall. This finding underscores the importance of considering

spatial orientation for the comfort and efficiency of employees. The predominant color in offices, with 68% being white, may suggest the need to reconsider the chromatic palettes used, considering studies indicating that mixed with lightning, CCT may negatively affect mood and creativity. Employee eye fatigue is a significant issue, and the study highlights that a considerable portion of respondents experience this fatigue. This may indicate the necessity of implementing policies or environmental changes to reduce the negative impact on eye health.

The research underlined the complexity of the relationship between the work environment and employee productivity, emphasizing the importance of adapting working conditions to employees' individual needs and preferences to create an environment conducive to professional success and well-being.

Future research will focused on a detailed investigation into the emotional and creative impact of colors in the workplace could better unveil employees' chromatic preferences based on the context of their activities. Also, analyzing how specific colors influence performance during tasks could lead to personalized recommendations for workspace design.

6.ACKNOWLEDGEMENT

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7. REFERENCES

[1] P. Vink, E. A. P. Koningsveld, and J. F. Molenbroek, *Positive outcomes of participatory ergonomics in terms of greater comfort and higher productivity*, Appl Ergon, vol. 37, no. 4 SPEC. ISS., pp. 537–546, 2006,

[2] N. Kwallek, H. Woodson, C. M. Lewis, and C. Sales, *Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity*, Color Res Appl, vol. 22, no. 2, pp. 121–132, 1997,

[3] N. Kwallek, K. Soon, and C. M. Lewis, *Work week productivity, visual complexity, and individual environmental sensitivity in three offices of different color interiors*, Color Res Appl, vol. 32, no. 2, pp. 130–143, 2007,

[4] N. Savavibool, *The Effects of Colour in Work Environment: A systematic review*, Environment-Behaviour Proceedings Journal, vol. 1, no. 4, p. 262, 2016,

[5] A. Lechner, L. Harrington, and E. F. Magusson, *A Meta-Analysis of Color Effectiveness in Designed Environments*, Óbuda University e-Bulletin, vol. 3, no. 1, p. 301, 2012.

[6] H. Wang, G. Liu, S. Hu, and C. Liu, *Experimental investigation about thermal effect of colour on thermal sensation and comfort*, Energy Build, vol. 173, pp. 710–718, 2018,

[7] J. López-Besora, A. Isalgué, H. Coch, I. Crespo, and C. Alonso, *Yellow is green: An opportunity for energy savings through colour in architectural spaces*, Energy Build, vol. 78, pp. 105–112, 2014,

[8] K. Yildirim, A. Akalin-Baskaya, and M. L. Hidayetoglu, *Effects of indoor color on mood and cognitive performance*, Build Environ, vol. 42, no. 9, pp. 3233–3240, 2007,

[9] E. Grandjean, *Ergonomics of the Home*. London: Taylor & Francis, 1973.

[10] N. Kwallek, H. Woodson, C. M. Lewis, and C. Sales, *Impact of three interior color schemes on worker mood and performance relative to individual environmental sensitivity*, Color Res Appl, vol. 22, no. 2, pp. 121–132, 1997,

[11] P. Leekitvatana, *Effects of Nine Workplace Interior Colors on Thai Worker Mood and Color Preferences*, Mahidol University, 2017.

[12] L. Fontana, *Effect of indoor surfaces' spectral reflectance on the environmental light spectrum modification and on objects perceived color*, Results in Engineering, vol. 17, no. November 2022, p. 100805, 2023,

[13] A. Mostafavi, T. B. Xu, and S. Kalantari, *Effects of illuminance and correlated color*

temperature on emotional responses and lighting adjustment behaviors, Journal of Building Engineering, vol. 86, no. February, 2024,

[14] A. Kraneburg, S. Franke, R. Methling, and B. Griefahn, *Effect of color temperature on melatonin production for illumination of working environments*, Appl Ergon, vol. 58, pp. 446–453, 2017,

[15] N. Schneiderman, G. Ironson, and S. D. Siegel, *Stress and health: Psychological, behavioral, and biological determinants*, Annu Rev Clin Psychol, vol. 1, no. Lacey 1967, pp. 607–628, 2005,

[16] R. S. Lazarus and S. T. A.-T. T.- Folkman, *Stress, appraisal, and coping*, 1984, *Springer Pub. Co., New York*. doi: LK - https://worldcat.org/title/609341596.

[17] H. W. Hendrick, *Good Ergonomics Is Good Economics*, 1996.

[18] Ozturk Elif, *the Effects of Color Scheme on the Appraisal of*, Bilkent Universty, 2010.

[19] S. L. Schatz and C. A. Bowers, *10 questions on room color: Answers for workplace designers*, Ergonomics in Design, vol. 13, no. 4, pp. 21–27, 2005,

[20] H. Amani, S. H. Shojaei, and H. Zarei, *Color and Its Impact on People in the Workplace: A Systematic Review Article*, Journal of Ergonomics, vol. 8, no. 1, pp. 8–11, 2020,

[21] L. R. Prado-León, *Color Preferences in Household Appliances: Data for Emotional Design*, Procedia Manuf, vol. 3, no. Ahfe, pp. 5707–5714, 2015,

[22] I. S. Bower *et al.*, *Built environment color modulates autonomic and EEG indices of emotional response*, Psychophysiology, vol. 59, no. 12, pp. 1–17, 2022,

[23] A. Draghici, *Ergonomics - New theoretical and applied approaches*. Timisoara: Editura Politehnica, 2006.

[24] Choong, S. W. J., Ng, P. K., Yeo, B. C., Draghici, A., Gaureanu, A., Ng, Y. J., ... Selvan, H. K. T. A *Preliminary Study on Ergonomic Contribution to the Engineering Design Approach of a Wheel Loader Control Lever System*, Sustainability, 14(1), 122, 2021.

[25] Draghici, A., Dursun, S., Bașol, O., Boatca, M. E., Gaureanu, A., *The mediating role of safety climate in the relationship between transformational safety leadership and safe behavior—The case of two companies in Turkey and Romania*, Sustainability, 14(14), 8464, 2022.

[26] Constantin, D., Mazilescu, C. A., Nagi, M., Draghici, A., Mihartescu, A. A., *Perception of cabin air quality among drivers and passengers,* Sustainability, 8(9), 852, 2016

Impactul cromaticii asupra eficienței la locul de muncă. Un studiu detaliat în birourile de inginerie din domeniul cercetării și dezvoltării

Această cercetare a fost realizată în birourile a patru companii multinaționale cu profil auto din Timișoara (România). Prin intermediul unui chestionar cuprinzând 12 întrebări pe platforma Google Forms, cercetarea a abordat atitudinile angajaților față de mediul vizual, impactul pereților colorați asupra eficienței muncii, poziționarea birourilor, culoarea predominantă în spațiul de lucru, oboseala ochilor și percepția activă a culorilor pereților. Concluziile au stat la baza unor recomandări practice pentru îmbunătățirea condițiilor de muncă, subliniind importanța culorii în crearea unui mediu propice performanței și bunăstării în domeniul ingineresc.

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