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DESIGN CONSIDERATIONS FOR WORK SPACE EFFICIENCY: THE EFFECTS OF COLOUR

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Abstract: In order to achieve optimum level of physical and mental comfort, which is the primary aim of Architecture, there is need to harmonise all the interior elements of work spaces which consist of different colours. Colour have been used carelessly in most work spaces, many designers tend to concentrate on other design considerations for workspaces and little or no attention is given to colour as an element of design. Other designers only care about the aesthetic aspect of colour without given attention to the aspect in which the space is designed for as colour affect the mood of people using workspaces. The use of colours in architectural design is very fundamental as lack of colour is impossible because it is like a preponderance of white and grey wall, which is emotionally sterile and usually dangerous. A systematic study of colour, their effects and characteristics in work spaces would be investigated but equal to this, the basic consideration in the application and choice of colours gives clear combination of the use of certain colours in interior design of work space. The proper use of colours in Interior work spaces no doubt has not achieve its proper context. Human comfort has not been really and totally achieved. Various studies have shown that the use of colours in interior work spaces can also be achieved when the basic combination of colours is developed in relation to the character and emotion. Therefore, it has become necessary to study the effects of colours on our emotion in order to make colour choices that best suit people for better productivity, since every colour, image and symbols are best influenced by culture, history and circumstances. This research presents colour as a universal language which is understood and appreciated by everybody, it enlightens on how colour is used to create spaces that fulfill the fantasies as well as the practical needs of workspaces, colour creates atmosphere that also create focal points, change the mood of workspaces, increases and decreases the feeling of spaciousness and also turn dull spaces to dramatic spaces. This research examines the studio and office workspaces of the department of architecture, university

of Jos. Both quantitative and qualitative research design is drawn using questionares and field survey, it is aimed at providing theories and findings from studies on colour for providing a good, sterile, and warmth workspace which can help improve performance of workers on workspaces for better productivity. It is known that colour has a psychological effect on peoples' mood and behaviour, the choice of colour in a work space goes a long way in determining the productivity or performance of workers, the use of monochrome colours has been adopted by different designers without investigating on the implications of colours on human psychology, monochrome colours gives employees the same kind of mood even if their duties are different, thereby favouring only a particular group of workers. Warm colours keep employee motivated and excited while cool colours keep them relaxed and to be creative. The use of colour should be broadened enough to affect every person as regards to one's discipline.

Keywords: colour psychology, productivity, worker efficiency, workspace planning

INTRODUCTION

Colour is one of the important elements in interior design scheme. It is an integral part of our perceptual system because it helps us to identify and define the objects in space and acts as a signalling device, which is evidence of certain conditions conveying information about our surrounding. The 'adhoc' or 'careless' use of colour in the work space environment has brought on drab and dull areas, which in turn have had a negative effect on the productivity of workers. While design considerations are made to determine spatial orientation, ventilation and thermal comfort instance, architects do not always consider the psychological and aesthetical needs of the users of the space being designed. To understand how colour might be used, it is important to begin by understanding the response that colour generates, or elicits within the average human mind, how colour can alter our perception of space. Colour, a basic and vital space is lacking from the built environment, and knowledge of it is isolated and limited. Often we see an interior which would be otherwise beautiful-cheapened by the application of a colour tone that would have been better used on the exteriors. Although, designers know the aesthetical and psychological effects of colour, there has been a watering down of its importance, with designers more concerned with technicalities and objectives of designing spaces; forgetting the 'little details' including the use of colour. This study

investigates the effects of colour on productivity of workers with a view to determining the greater role of colour as a major design consideration in work space design(Bell, 2016). Colour psychology deals with the effects of colours on human behaviour; it affects the way the human mind perceives and process things. Some colours appear more pleasing than others. Table 1 outlines the psychological effect of colour on spaces; blue for instance, is suggested for high-traffic rooms, as a typically calming and serene colour, said to decrease respiration and lower blood pressure. Certain shades or tones may result in very different meanings. Bright light and warm colours represent an attraction of stimulus and a way after illuminator and cool colours represents a withdrawal from the outside world, to inspire introspection.

Table 1: The Psychological Effect of Colour on Mood

EFFECT	HUE	CONTRAST
Exerting	Bright red Bright Orange	High
Stimulating	Red Orange	Moderate
Cheering	Light Orange Yellow Warm grey	Moderate
Neutralizing	Grey Light/Off white	Low
Petering	Cool grey Light Green Light Blue	Low
Relaxing	Blue Green	Low
Subduing	Purple	Moderate
Depressing	Black	Low

Source: Waldin Faulker, Tandom (1966)

The psychology of colour is based on the mental and emotional effects colours have on people in all facets of life. There are some very subjective pieces to colour psychology as well as some more accepted and proven elements. Colour affects hormonal balance; hormonal balance or imbalance directly affects our feelings and emotions. Over the years, many organisations have tried new ideas of designs and techniques to

construct office buildings, which can increase productivity, attracting more employees. Many authors have noted that, the physical layout of the work space, along with efficient management processes which is playing a major role in boosting employees' productivity and improving organizational performance (Mendis, 2016; Uzee 1999; Leaman and Bordass, 1993; Brill, 1990). There are factors affecting worker productivity on work spaces, these factors include furniture, light, noise, temperature and spatial arrangement.

Spatial arrangement is seen as the way in which something is placed, for instance, the arrangement of the furniture and the placement of chairs without obstructions to passage or view. Architects and designers can be creative in arranging work space by providing logical workflows to develop supportive, efficient and uplifting working environments that drive culture and inspire communication and collaboration between workers, taking the organisation to the next level. According to research, employees perform better in a more organised physical working environment than those who work in an unorganised workspace. A good spatial arrangement makes provision for free flow space, there should be a relationship or connection between users and furniture, there should be proper zoning that will not affect the comfort ability and free movement of workers within a workspace, bad spatial arrangement may cause much traffic in workspaces which may slow down movement and effective communication thereby slowing down the efficiency of workers (Hameed, &Amjad, 2009; Jouglet, Piechowiak, &Vanderhaegen, 2003).

Anglim (2010) pointed out the role and perception of spatial arrangements which are: layout and design which involves size, density, walls and partitions, placement of entities. Layout objectives: includes cost; proximity to relevant others; privacy; accessibility. Job conditions and role perceptions involve: autonomy; identity; friendship opportunities; feedback; Role conflict; role ambiguity. Individual perception involves satisfaction; motivation; performance and the last is individual qualities which involves need for clarity; need for autonomy culture and adaptation. When these perceptions are given due consideration by designers of workspace, performance and productivity will improve (van Amstel, Hartmann, van der Voort, and Dewulf, 2016).

Good spatial structure encourages social interaction in a workplace which is necessary to improve performance of workers; individuals are likely to interact and communicate with others when the physical characteristics of the building and settings encourage them to do so and in turn produce positive attitudes (Uzee, 1999; El-Zeiny, 2011; Carmen, 2013). Good spatial arrangement keeps the working environment more organise than bad spatial environment; when workers use space well, they can often bring time and memory demands of their task down to workable levels. They can increase the reliability of execution and number of jobs they can handle at once. But poor use and arrangement of space makes the space look unorganised and clumsy thereby causing decrease in performance of workers using the workspace.

METHODOLOGY

The study area is the Department of Architecture, University of Jos, located in Naraguta Campus along Farin Gada Road Jos which is situated at the northern edge of a pear-shaped upland known as the Jos Plateau. The university was established in November 1971 presently runs three campuses – The Temporary Bauchi Road, The Naraguta and The Township campuses. The Bauchi Road campus currently accommodates the faculties of offering Medical Sciences (pre-clinical departments only), Natural Sciences, Pharmaceutical Sciences, Library, the Information and Communication (ICT) Directorate, the Office of Research and Development and The Administration. The Naraguta Campus-Permanent Site which is still undergoing series of physical structural development to accommodate the vast departmental requirement befitting any federal university of its kind currently houses the faculties of Arts, Education, Social Sciences, Management Sciences, and Environmental Sciences.

Plate i: Satellite Map showing Department of Architecture
Source: Google Earth (2018)

The instruments employed for data collection include the Questionnaire Design, The Survey Research Design, The Oral Interview and Discussions; Observation and Pictures. An observational study was made of the Department of Architecture, University of Jos, consisting of inventory of selected offices and studios, paying attention to the colours and their effect on lecturer and student productivity. The Department of Architecture building is a structure originally designed to house the Department of Special Education on the permanent site. The building houses the Department of Architecture on three floors. The ground and first floors house the studios (100 level to 400 level, PGDARC and MSC I and MSc II), Data Room, Computer Lab and Seminar Room, Student Secretariat, Business Centre and Professorial Office. The second floor houses the staff offices which were created from an open hall with composite fibre boards. The studios have their interior painted with two shades of white, (brilliant and off-white) brilliant white on the ceiling and off-white on the walls. The researcher's perception of the interior suggests that the colour white evokes the feeling of comfort, truthfulness, purity and peace as illustrated in Plates ii to vii.

Most of the offices have their interior painted brown and cream colour, some with white, the floors are grey, brown and red in the Secretary and Head Of Department's offices (Plates ii to ix), with furniture that are brown in colour. These colours according to the researcher evokes the feeling of cheerfulness, creative and intellectual energy, stability, comfort, brown depresses emotions, red evokes power, love and passion.

Plate ii: Department of Architecture

Plate iii: H.O.D's office

Plate iv: Lecturer's office

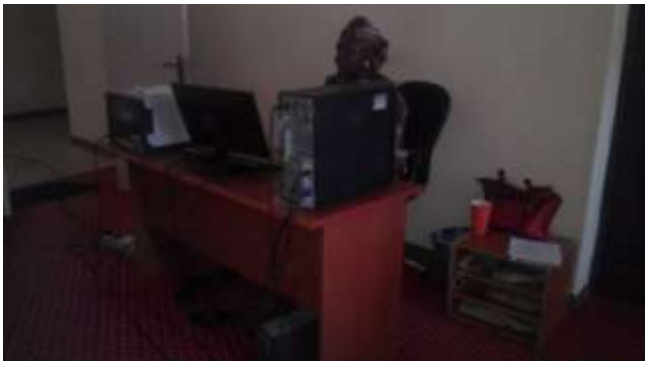

Plate v: Secretary's office

Plate vi: Undergraduate Studio

Plate vii: Postgraduate Studio

Plate viii: Hallway showing offices

Plate ix: Reception

The study hypothesis that the use of colour has an effect on learning was tested through the structured questionnaire survey. Table 2 shows that 35 or 97.2% of the respondents have used their office/studio for about 0 to 5 years, while only 1 or 2.8% of the respondents have used his office for about 20 years. Table 3shows that 16 or 44.4% of the respondents presently have white colour in their offices/studios; while 5 or 13.9% have mixed colours, and 15 or 41.7% others have other colours in their offices and studios. Table 4 shows that that colour of the office make 4 or 11.1% of the respondents feel agile (alert), 1 or 2.8% depressed, 25 or 69.4% relaxed, 1 or 2.8% tense, and 5 or 13.9% feel otherwise. Table 5 shows that 7 or 19.4% of the respondents have the intention of changing the colour of their interior workspace, while 29 or 80.6% of them do not have any intention of changing it. Table 6 shows that the texture of the interior wall of 3 or 8.3% of the respondents is rough, that of 24 or 66.7% others smooth, 2 or 5.6% coarse, while 7 or 19.4% fine. Table 7 shows that 30 or 83.3% of the respondents feel comfortable with the present texture of their interior wall, while 6 or 16.7% do not. Table 8 shows that 35 or 97.2% of the respondents believed that colour affect the way they feel as far as interior workspace is concerned. Table 9 shows that 33 or 91.7% of the respondents are agreed that colour affect their mental well-being psychologically and hence influence their mood. Table 10 shows that show the respondents according to the nature of colour that make them feel relaxed and calm. Table 11 shows the frequency distribution of the respondents according to what colour would they prefer in the walls of their workplace. From the response, majority of them preferred white. Table 12 shows the frequency distribution of the respondents according

to what colour would they prefer to use for floor of their interior workspace. Table 13 shows the frequency distribution of the respondents according to what colour would they prefer to use for the curtain of their interior workspace. Table 14 shows the frequency distribution of the respondents according to what colour would they prefer to use for the furniture of their workspace.

Table 2: Response to Question 5: How long have you used your office/studio?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5 years	36	97.2	97.2	97.2
	16-20 years	1	2.8	2.8	100.0
	Total	37	100.0	100.0	

Table 3: Response to Question 6: What colour do you presently have in your office/studio?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	17	44.4	44.4	44.4
	Mixed	5	13.9	13.9	58.3
	Others	15	41.7	41.7	100.0
	Total	37	100.0	100.0	

Table 4: Response to Question 7: How does the colour make you feel?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agile (alert)	5	11.1	11.1	11.1
	Depressed	1	2.8	2.8	13.9
	Relaxed	25	69.4	69.4	83.3
	Tense	1	2.8	2.8	86.1
	Others	5	13.9	13.9	100.0
	Total	37	100.0	100.0	

Table 5: Response to Question 8: Do you have any intention of changing the colour of your interior workspace?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	19.4	19.4	19.4
	No	29	80.6	80.6	100.0
	Total	37	100.0	100.0	

Table 6: Response to Question 11: What is the texture of your interior wall?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rough	3	8.3	8.3	8.3
	Smooth	25	66.7	66.7	75.0
	Coarse	2	5.6	5.6	80.6
	Fine	7	19.4	19.4	100.0
	Total	37	100.0	100.0	

Table 7: Response to Question 12: Do you feel comfortable with the present texture?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	31	83.3	83.3	83.3
	No	6	16.7	16.7	100.0
	Total	37	100.0	100.0	

Table 8: Response to Question 15: Doescolour affect the way you feel in an interior workspace?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	36	97.2	97.2	97.2
	Not sure	1	2.8	2.8	100.0
	Total	37	100.0	100.0	

Table 9: Response to Question 16: Do colours affect the mental well-being psychologically and hence influence your mood?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	91.7	91.7	91.7
	No	1	2.8	2.8	94.4
	Not sure	2	5.6	5.6	100.0
	Total	37	100.0	100.0	

Table 10: Response to Question 17: What colour make you feel relaxed?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Pink	1	2.8	2.8	2.8
	Blue	9	25.0	25.0	27.8
	Green	7	16.7	16.7	44.4
	Others	20	55.6	55.6	100.0
	Total	37	100.0	100.0	

Table 11: Response to Question 19: What colours would you prefer in the walls of your workplace Office/Studio?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Brown	2	5.6	5.6	5.6
	White	21	58.3	58.3	63.9
	Yellow	2	5.6	5.6	69.4
	Blue	3	8.3	8.3	77.8
	Green	3	8.3	8.3	86.1
	Others	6	13.9	13.9	100.0
	Total	37	100.0	100.0	

Table 12: Response to Question 20: What colours would you prefer to use for the floor of your interior workspace?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	5	13.9	13.9	13.9
	Brown	9	25.0	25.0	38.9
	Grey	16	44.4	44.4	83.3
	Black	3	8.3	8.3	91.7
	Others	4	8.3	8.3	100.0
	Total	37	100.0	100.0	

Table 13: Response to Question 21: What colours would you prefer to use for the curtains ofyou workspace?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Brown	4	11.1	11.1	38.9
	Blue	9	22.2	22.2	61.1
	Green	7	19.4	19.4	80.6
	Others	7	19.4	19.4	100.0
	Total	37	100.0	100.0	

Table 14: Response to Question 22: What colours would you prefer to use for the furniture of your workspace?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Brown	16	44.4	44.4	44.4
	Black	7	16.7	16.7	61.1
	White	3	8.3	8.3	69.4
	Grey	4	11.1	11.1	80.6
	Others	7	19.4	19.4	100.0
	Total	37	100.0	100.0	

To test hypothesis for the effect of colour on worker's productivity, the researcher made use of question 15 and 16 which are considered relevant to the effect of colour on worker productivity. The cross tabulation is presented in Table 15 while the chi-square result is shown in Table16 From the chi-square result in table 16, the asymptotic significance shows that the effect of colour on workers' productivity is statistically significant at 5% level of significance with degree of freedom.

Table 15: Cross-tabulation of the effect of colour on workers' productivity

		Question 16: Do colours affect the mental well-being psychologically and hence influence your mood?			
		Yes	No	Not sure	Total
Question 15: Do colours affect the way you feel in an interior workspace?	Yes	34	1	1	36
	Not sure	0	0	1	1
Total		34	1	2	37

Table 16: Chi-Square Tests Output

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.486[a]	2	.000
Likelihood Ratio	6.366	2	.041
Linear-by-Linear Association	15.013	1	.000
N of Valid Cases	37		

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .03.

DISCUSSION

The strategy for colour selection and categorization in work spaces was based upon the contrasting relationships of function, hue, value and upon objective criteria that may lead to certain colour combinations. This study applied quantitative analysis strategy; the findings provided evidence to support principles of colour organization that are intuitively understood by designers. Much of the literature related to colour effects on productivity, visual communication and colour selection has been criticised as having a weak scientific basis with little predictive value. The intent of the literature may not be scientific but it gives insight, shade light, and it is useful and credible. Many times, scientific researchers doubt the existence of a simple law of colour structuring, suggesting that colour factors are skewed by human subjective responsiveness.

From the results, majority of the respondents preferred colours that made them feel relaxed in their studio and office workspaces these colours are green and blue. Majority of the respondents also believed that colour has effect on the way they feel, it has effects on their mental well-being psychologically and hence influence their mood That implies that, good choice of colour in a workspace keeps workers in the appropriate mood for the work task which can help keep them calm, increase their performance and hence boost productivity.

However, these results have not provided much insight for colour application methodology. Many of the principles of colour for productivity of worker can be scientifically tested. The research conducted in this study incorporates quality measures, demonstrating and supporting explicit evidence that colour-coding, colour categorization and colour selection can be objectively derived. This definitive and objective analysis of hierarchical colour patterns is useful to all Architects, Interior designers, design educators, and design practitioners. The entire study also serves the purpose of relating colour principles to colour application as it affects the productivity of workers in schools, firms, private and public organizations and all workspaces as far as productivity is concerned. This highlights better understanding on colour usage in interior workspace presently and the need for further study on colour to enhance and buttress what is in play now to avoid future grey. Colour scheme/harmony is also discussed enabling the designer to see the need of careful selection when arriving at colour schemes.

Colours are associated with mood; they evoke emotional responses in most people. However, it depends on culture from people to people, some culture's interpretation of colour is different from other cultures but there are general similarities and basic generalities about how colours evoke certain emotional and behavioural response. Monotonous colours are believed to send weak signals which cause depressions, dullness, retardation and redundancy, these colours are monochromatic harmonies, achromatic colours and weak colour contrast. On the other hand, sensory overload which over stimulates is known to send confusing signals, they result in changes in breathing rate, increase in blood pressure and pulse rate, these are strong colour intensities, complex colours or highly saturated colours. There are many preconceptions about colours which are used in communicating emotional depth of feeling; warm colours like red, orange, yellow and pink are more arousing than cool colours, warm colours gives feelings of joy, excitement, and makes the workspace lively but cool colours like blue and green on the other hand expresses calmness, focused, relaxing and soothing atmosphere. The psychology of colour takes the environment into consideration in a complex way it affects different professions, designers and even non designers employ the use of colour to maximise the intended effect and function of a space. Places like banks, cafeterias or eateries, hospitals even supermarkets use colour psychology principles in their layout selection.

CONCLUSION

Colour defines the nature of a workspace psychologically. Light values and cool lines make workspace appear larger, dark values and warm colours make workspace appear smaller. Workers perceive spaces to be more attractive when large areas are covered with colours of low intensity. The larger the areas of colour, the more intense it appears. A good colour scheme can help improve worker productivity depending on the colour scheme if it fits the function which is originally meant for.

RECOMMENDATIONS

1 When selecting a colour for a particular workspace, consideration should be given for what the space is to function and also its size. Bright colours should be used where the mind is to be alert and agile while dull colours to be used where the mind is to go to rest.

2 It should be noted that monotonous colours which under stimulate the mood and performance or colours that over stimulate mood and

performance within a space should be avoided because it affects performance thereby affecting productivity negatively.

3 Colours that create the required emotions for a particular function of a space should be used to provide lively or relaxed atmosphere.

4 To achieve the mood and activity required for a particular function of a workspace, the appropriate colour combination should be used.

5 Architects, interior designers and clients or the space users should have the knowledge of colour and its effects on different perceptions of life as it affects humans.

6 In creating a psychological mood and atmosphere for a particular function or space, the rightful colour associated with the mood should be used.

7 The designer or Architect should have the knowledge that evoked responses that go with the hormonal system, and produce the best possibilities for the welfare of humans.

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