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A study of the three important ambient factors; color, lighting, and noise on employees in open-plan bank offices

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ABSTRACT

In the ever-competitive world today, offices want to get the maximum work output and productivity from their employees that allow them to perceive their ambiances in a way that it gets reflected in the work they produce. This in turn helps in solving and figuring out the architectural areas that can be made different or altered to enhance the quality of workspaces which they thrive in. This paper uses four main literatures and already established models of Bitner, Vietch and Newsham, Sundstrom and Evans and Johns stress and noise theory; considering the factors that have been regarded and hence helped derive the basic parameters to be studied, observed and taken employee perceptions of. These have then been analyzed and developed into design guidelines in order to change work environments.

Keywords: Ambient, Color, Noise, Lighting, Employee

1. INTRODUCTION

“The ambient conditions in an open-plan office affect the employees in a physiological as well as a psychological way and every employee has different needs and desires of their servicescape (Bitner, 1992)”. In the fast-paced lives of people working in cities, most employees are going through stress and tension in one way or the other. While almost all people are better educated and experienced in the current scenario, most of them work in offices to earn a living. Healthy work environments hence are the need of the hour because it is a need that has continually developed from the past and will do so in the near future. As proven from researches conducted earlier, if productivity and satisfaction rates in a work environment have to be improved, there has to be a holistic development and this is where architecture and psychology comes into picture. Banks are an integral part of the working society and will always be. Considering the ever-growing shortage of available space for development, open plan offices are a design for the future and banks usually require such areas. This research focuses on private bank employees working in open-plan offices in and around Manipal, India.

2. AIM AND OBJECTIVES OF THE STUDY

2.1 Hypothesis

How the three important ambient factors in a workplace: Color, Lighting and Noise affect employee productivity in open-plan bank offices

2.2 Aim of the Research

To investigate the effects of the three most important factors in a built environment for an open-plan bank office environment and develop design guidelines for the same

2.3 Objectives

- Study established literature and models to derive parameters for each of the factors and successively use a pilot study and questionnaire as methods to derive information
- Data synthesized will be used to establish correlation and come to a conclusion
- Develop architectural design guidelines for an open plan bank office using the derived results

3. SCOPE OF THE STUDY

The ambient conditions of Color, Lighting and Noise are perceivable and substantial enough to make comprehension of the researcher as well as the subjects, easy and smooth. These elements can be developed and made amends to at a later stage of the design process as well. Thus, a study on these factors can help synthesize results and guidelines in a way that can be effective for private bank offices to refurbish and implement. Also taking into consideration the monotonous 9-5 jobs that bank employees have and the increased effort taken by private companies to provide job security and satisfaction; private bank offices seemed like the best option to study

4. LIMITATIONS

Questionnaires and qualitative studies based on perceptions of the subjects may lead to biases in the opinion. But these can be reduced with the correct phrasing of questions in the questionnaire so as to make them as appropriate as possible. For the initial pilot and observation study and for the surveys conducted, no layout specifications could be included due to shortage of time and resources.

5. LITERATURE STUDY

Referred to literature work by Arnerlöv, K., & Bengtsson, C. (2007)

5.1 The Bitner Model (1992)

The Bitner Model and theory take into account the ambient conditions and layouts of a space to an already existing required perceived servicescape on an employee as well as the customer moderator and create responses in a way that eventually help study their behavior and approach in relation to the space. This model thus provides a base for parameters including environment-holistic and physical and their reactions and behavior in the same

5.2 Veitch and Newsham (2004)

This model was selected to study particular responses in the study including task performance, satisfaction, rating the aesthetics and mood in relation to the lighting quality in the workspace. These behavioral outputs can be considered as the base psychological effects pertaining to the study and to the factor of Lighting.

5.3 Sundstrom (1986) - Workplace Environmental Psychology

The different planes of the environment including temperature, music, sound and illumination are all part of Sandstorms' book on environmental Psychology. According to his readings, these varied facets produced even varied fallouts and hence articulate mutual effects on both the human mind and body.

5.4 Evans And Johns Stress and Noise theory (2000)

The different origins of noise along with the varied levels of decibels can create different effects on a human mind. These thereupon associate with the annoyance and stress levels composed in the immediate environment and thus cause major mood and appraisal changes.

Factors to be surveyed and included in the form of studies to be conducted (Questionnaire and Observation templates to be derived from the literature theories)

Noise

- Equipments
- Chatting-indoor
- Noises-outdoor
- Noiseless areas
- Stress

Lighting

- Natural
- Artificial
- Glare
- Adjustable lighting
- Brightness
- Distribution
- Visual appeal

Color

- Tone
- Stress
- Texture and motivation
- Feel and ambience
- Openness

6. RESEARCH DESIGN

6.1 Reason for preference of this study

Open plans and the need for space in today's architectural world are correlated. With the increasing demand for space, the only solution is to make smaller spaces look huger and more usable. Therefore, with this style gaining popularity it only seemed right for the study. The outcomes of this study can be made useful and known to a number of people since the working population is also taking a steep growth. Manipal being a growing commercial town has a lot of new opportunities for private bank companies to invest and set up offices here and hence data collection and observation is not only made easy but also quick. Size of the population in this town is suitable for surveys and convenient samples can be collected from the bank employees to maximize output.

6.2 Topic Background

As Bitner stated, “The employee’s behavior is influenced by the servicescape in the open plan office (Bitner, 1992)”. This statement goes on to prove and validate this study and motivates to widen the possibilities of research in this area. One of the main reasons to choose Noise as an important ambient factor was in relation to Sandstrom’s, Evans and Johnson’s and Bitner’s studies considering the following statements.

“Noise is one of the most annoying ambient conditions in an open-plan office. The primary source of annoyance caused by noise is conversations by coworkers (Sundstrom, 1986)”

“Loud noise may result in physical concerns (Bitner, 1992, pp. 64)”

“Low-intensity noise may lead to physiological and motivational stress (Evans and Johnson, 2000)”

7. METHODOLOGY

7.1 Literature survey

Before conducting any field study and survey, a plethora of information has to be gathered using secondary sources of data including books, journals, internet and other research papers. This forms the base for the paper constituting the literature study.

7.2 Data collection and Pilot study

Random bank offices in the study area have to be studied and observed. This will be done with the help of an existing template made with derivations from the literature study. These will form part of the primary source data and will therefore help make the questionnaire for the further research

7.3 Perceived close ended questionnaire

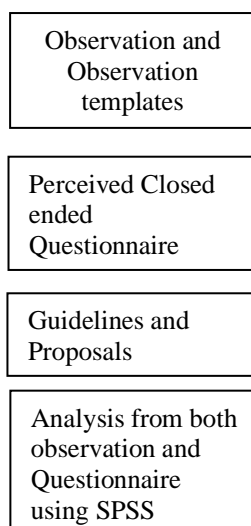
A closed ended questionnaire eliminates the chances of bias and vague outputs from the survey. Hence convenient sampling after calculation of a sample number is to be conducted to get the perception analysis of bank employees

7.4 Analysis of the questionnaire

Using SPSS (statistical package for social sciences for analysis of questionnaires) is the best software to get trusted correlations and graphs concerning human psychology

7.5 Guidelines and Proposal

Table 1: Flowchart Methodology



8. COLLECTING DATA

8.1 Primary Source

The main aim of conducting the first part of the primary data study, that is the pilot study is to gather information based on current situation and scenario. The existing awareness can help get to know how to frame questions for the questionnaire and precisely what to frame too. This study was conducted in the open plan bank office of Manipl for a one-day visit and the details were hence observed and noted with any additions or changes to be made to the previously existing list of parameters after doing the literature analysis

8.2 The layout

The floor, ceiling and other details were noted and an exact replica was created to get a basic perception of bank open plan offices. The observation factors and interview questions could then be related to the plan and then an extensive analysis could be made. The observation conducted at ICICI, Manipl was done to structure the methodology and thus shed more light on the factors and attributes.

8.3 Sample size calculation for the questionnaire distribution

Total private bank employee population in Manipal: 140
 Expected incidence: 0.07
 Expected accuracy: 0.55
 Confidence: 80%
 Therefore, sample size=33

9. ANALYSIS OF THE QUESTIONNAIRES USING SPSS

9.1 Satisfaction

During the collection of data including the Noise, Lighting and color the demographic detailed data showed an interesting correlation of age and gender with various preferences and satisfaction ratings. The employees and their various other details show their satisfaction rates and these do not go very high or very low and in fact maintain a minimum medium which shows room for improvement in every aspect

9.2 Lighting

- According to the research conducted by Sundstrom (1986) indicates that” the older the employee becomes, the higher the demand for the intensity of lighting.” According to the relations and graphs created through SPSS there is no signal or sign of any such correlation.
- Employees that are extreme aged choose to opt for bright lighting which goes to prove that preferences in lighting are not exactly based on age in bank offices.
- Rather there is a wide range of personal preferences as to which level of intensity of lighting is required among the employees with bright light being the most common one. “An adjustable desk lamp allows the employee to decide the intensity of lighting to match their personal needs and desires (Sundstrom, 1986, p)”. According to his study one of the quick fixes could be the provision of desk adjustable lamps when taking into consideration artificial lighting design.

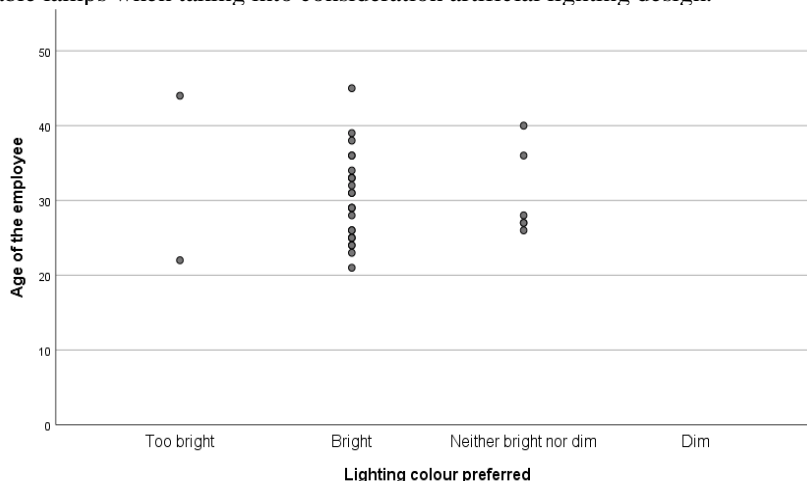


Chart-1: Simple scatter with fit line of age of employee by lighting color preferred

Table 2: Correlation Factor of Glare Annoyance with need for window near workstation

		Glare annoyance at work	Need for window near workstation
Glare annoyance at work	Pearson Correlation	1	.353*
	Sig. (2-tailed)		.044
	N	33	33
Need for window near workstation	Pearson Correlation	.353*	1
	Sig. (2-tailed)	.044	
	N	33	33

*. Correlation is significant at the 0.05 level (2-tailed).

Table 3: Correlation Factor of Glare Annoyance with need for manually adjustable light fixtures

		Glare annoyance at work	Need for manually adjustable lighting fixtures
Glare annoyance at work	Pearson Correlation	1	-.286
	Sig. (2-tailed)		.107
	N	33	33
Need for manually adjustable lighting fixtures	Pearson Correlation	-.286	1
	Sig. (2-tailed)	.107	
	N	33	33

- According to the correlation reports related to the glare annoyance at the workspace, with
 1. Need for manually adjustable lighting fixtures
 2. Need for window near workstation
- The correlation factors are -0.286 and 0.353, the highest positive factor being need for window near workstation. This shows that the glare annoyance factor and the need for windows near workstations are significantly positively correlated and are both required to be solved in order to improve lighting in the workspace.
- The need for manually adjustable lighting fixtures and glare annoyance also have opposite effects on each other, but being still correlated linearly in the negative direction. Individual and manual lighting controls are thus an important feature to be included in architectural design

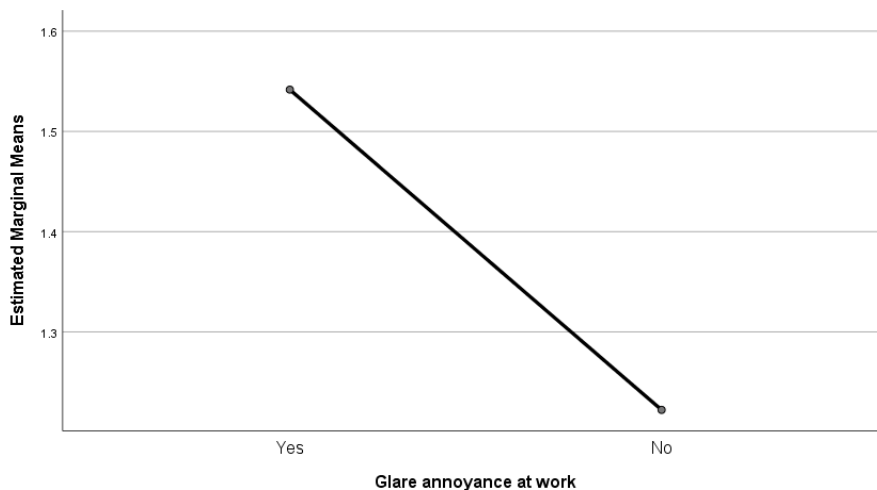


Chart 2: Estimated Marginal means of the need for manually adjustable lighting fixtures

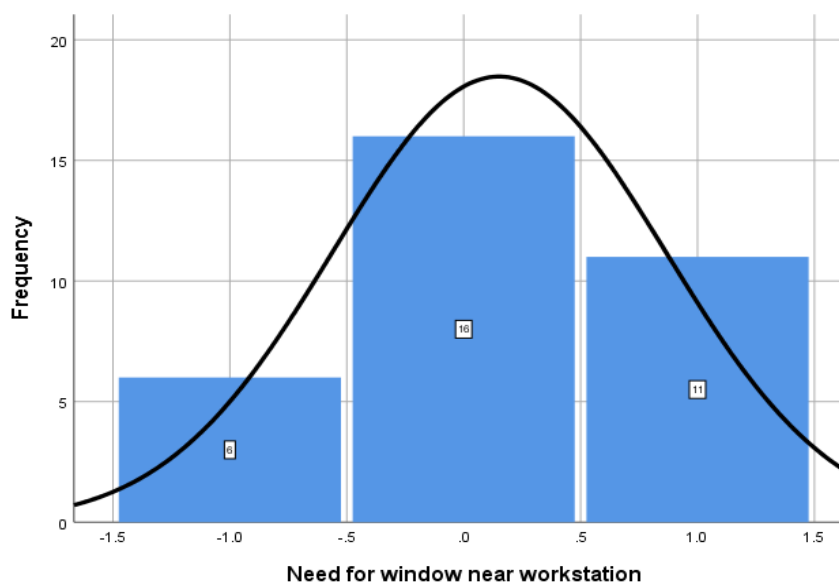


Chart 3: Histogram for showing frequency among employees in need of windows near workstations

- The glare annoyance at work and the need for manually adjustable lighting fixtures at work line diagram clearly shows that employees prefer manually adjustable lighting when they suffer because of glare and do not require them in case of no glare
- Also, the satisfaction rates of existing lighting show that 93% of the respondents are satisfied and very satisfied. Only 7% are dissatisfied.
- A majority of the employees (15) find the need for windows necessary while a critical (11) find it to be very important thus emphasizing on the need for natural light.

9.3 Noise

- Machines and coworkers chatting with each other rank second and telephone talk ranks number one according to statistics of sources of noise. It is to be noted here that a bank office at peak hours needs designated spaces for conversing and communicating.
- The bar graph below forms a relation between quiet spaces and satisfaction with noise and more 60% employees, who have a very good satisfaction rating, also would opt for specific quiet spaces. And since the significance factor of quiet spaces is 0.540 which is very close to 1, the aspect is one which has to be looked at in terms of design.
- The scatter plot with the number of work years and satisfaction with noise disturbances in the workspaces shows a gradual decrease thus indicating a possibility of difficult working conditions and an urgent need for improvement

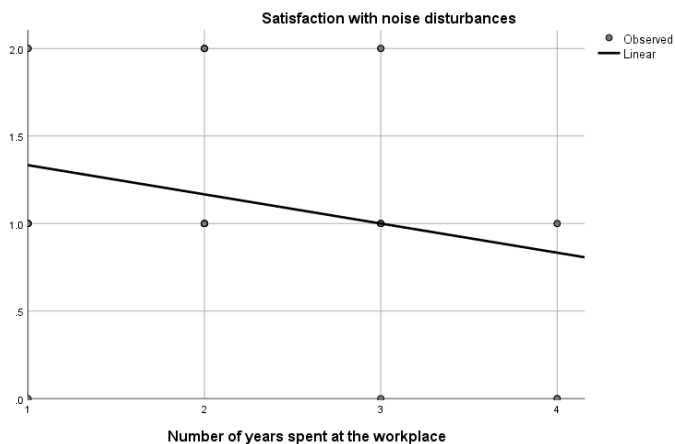


Chart 4: Linear diagram showing the satisfaction with noise disturbances in relation with number of years spent at work

Table 3: Correlation Factor of Glare Annoyance with need for manually adjustable light fixtures

Scheffe^{a,b,c}

Satisfaction with noise disturbances	N	Subset 1
Satisfactory	21	.19
Very good	8	.38
Dissatisfied	4	.50
Sig.		.540

Means for groups in homogeneous subsets are displayed.
 Based on observed means.
 The error term is Mean Square(Error) = .270.



Chart 5: Simple bar of satisfaction with noise distribution

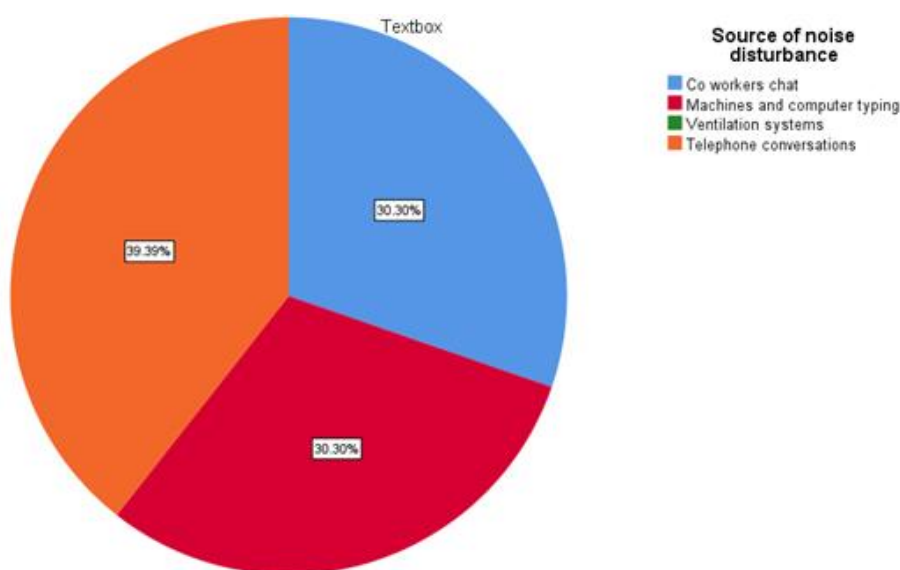


Chart 6: Pie Chart count of source of noise disturbance

- 43 percent of the employees perceived the general level of noise as neither good nor bad.
- According to the results shown by Sundstrom 1986, the questionnaire produced answers where the perceptions were good enough when according to previous research, “20 to 50 percent of employees in an open-plan office generally perceive disturbance from noise (Sundstrom 1986)”, and none of the surveyed employees perceived the level of noise as being very bad.
- The level of noise in the open-plan office still needs to be decreased because there is a minimum 12% still dissatisfied.

9.4 Color

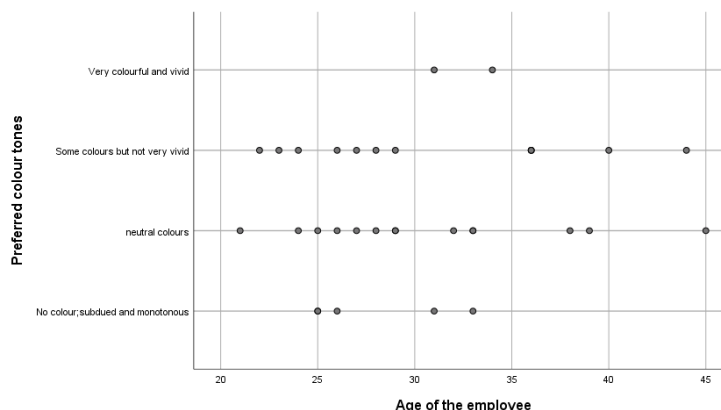


Chart 7: Simple scatter with fit line of preferred color tones

Table 4: Preferred color palette

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Warm(red,orange,yellow)	4	12.1	12.1	12.1
	Cool(navy blue,Green, light blue)	29	87.9	87.9	100.0
	Total	33	100.0	100.0	

- “The colors of the servicescape in an open-plan office play an important role in how employees perceive the temperature of the room (Sundstrom, 1986, p. 182)”
- 88% of the bank employees in Manipal prefer the cool color tones over 12% of those who chose warm because of the influence of outside temperature too. Also, a neutral color tone palette is rated the highest followed by some people choosing few colors but not very colorful.
- Most of the groups choosing these are in the age group of 25-30.

10. CONCLUSION

The main experiment of the study was to qualitatively study how Color, Lighting and Sound affect the employees and the analysis goes on to prove that all have significant effects in different scenarios. The occupancy of a space, the layout and the climatic conditions of a place are also important features to consider while designing a space. The design parameters for a project although, cannot be solely based on this qualitative study. Demographics for color preference show variances whereas for noise these are not very important according to the study.

11. REFERENCES

[1] Arnerlöv, K., & Bengtsson, C. (2007). Open-Plan Offices: The Importance of the Ambient Conditions’ Characteristics for Employee Satisfaction (Dissertation). Handelshögskolan vid Umeå universitet, Umeå. [online].
 [2] Bitner, M. J., 1992. Servicescapes: The Impact of Physical Surroundings on Customers and Employees. *Journal of Marketing*.
 [3] Evans, G.W. and Johnson, D., 2000. Stress and Open-Office Noise. *Journal of Applied Psychology*, [online].
 [4] Sundstrom, E., 1986. *Work Places, The psychology of the Physical Environment in Offices and Factories*. Cambridge University Press.
 [5] Veitch, J.A., Charles, K.E. and Newsham, G.R., 2004. *Workstation Design for the Open-Plan Office*. Construction Technology Update.