

Artificial Lighting on the Circadian Cycle of the Urban Ecosystem

EDUARDO LINHARES QUALHARINI

D.Sc., Eng., Prof. COPPE/FAU/EE-UFRJ
Caixa Postal 68 529, RJ/RJ. Brasil CEP 21 945-970. Tel/Fax; +55 21 260 1092

MÁRCIA MOTTA PIMENTA VELLOSO

M.Sc., Physicist, Prof. UFF/ Doctorate student COPPE-UFRJ
Rua Toulouse Lautrec, 120, Niterói/RJ, Brasil. CEP 24.322-120
Tel/Fax: +55 21 616 1781, veloso@nitnet.com.br,

ORLANDO NUNES COSENZA

Ph.D., COPPE/UFRJ - Programa de Engenharia de Produção
Caixa Postal 68.512, RJ/RJ. Brasil. CEP 21.945-970

ABSTRACT

The advent of efficient and economically viable artificial illumination has permitted expansion of working hours and consequently has amplified the hours of vigil in a continually expanding process.

Thus the influence of artificial lighting on circadian cycles of urban ecosystems has become an object of study. Our aim is to obtain conditions that minimise the deleterious effects without eliminating the advantages obtained by artificial lighting.

This paper analyses the necessities and expectations of the population where they want public lighting on their street, district and city, and was done using a modified priority matrix technique. The methodological contents uses as basis the qualitative forecasting method, in which is used a priority matrix and applied on groups of non specialists in meetings, in order to obtain a hierarchy between the different alternatives. To guarantee the aim of this work our proposal was to hear a relatively large number of people. Instead of working with a selected group and a coordinator, we developed a questionnaire which was possible to distribute and afterwards be collected comprising the most heterogeneous universe possible. Thus we transformed the standard questionnaire (matrix) to a cursive form, taking care not to induce answers, facilitating and speeding the fulfilment, as well as the data treatment.

The questionnaire was elaborated through informal and verbal questions made to a group of non specialists about the aspects which most calls their attention when public lighting is changed, we obtained the alternatives which will be analysed: beauty, intensity, and functionality. The criterias comfort, safety, environmental impact, and costs were assumed by us taking in account our final aim.

At the end of this work we will have the clients voice, with the conclusions which will tell us the order of precedence of the available alternatives, and shed light over the influence of artificial lighting on the circadian cycle of the urban ecosystem.

INITIAL CONSIDERATION

In the elaboration of a work that's used the main technique of priority, the qualifying method of prevision, having as the problematic the public illumination, it appeared some troubles in the elaboration of the questionnaire:

As our objective was hearing a great number of people, now that, this is the beginning of a more complex work, the original technique has suffered some modification (adaptation). Instead of work in a room with a selected group and one co-ordinator, we thought to elaborate a questionnaire that should be distributed and after gathered, to enclose the more possible heterogeneous universe:

The initial presentation of the questionnaire was in it (matrix) original form (annexed I) and we verified with three person a lot of difficulties to fill it up.

With the new modification (adaptation), we changed the same questionnaire for a cursive form (annexed II) having the care to no induce the answers. We verified with other three different person the difficulties to fill it up. Within the alternatives to be analysed (ahead explained) the term adequacy create doubts of interpretation and it was changed to functionality. Guide lines were increased to the filled up of the answers. The types were much bigger, but we kept the questionnaire in only one sheet.

Before to do a new experiment, we made new modification in the shape of the questionnaire. Instead of to fill up

the questionnaire with one of the five pattern answers, we wrote the answers to be market, to facilitate and be fast the filling. On this same point, we solved to include other questions which are out of the initial matrix. How the questionnaires would be answered for people who we don't know and, it was possible we had no more access, we include Age, Profession and another two questions. The Age if it will be necessary to catch answers from different band of age. Profession as the indirect way to measure the school rate. The two questions are referred, respectively, to the way of dislocation and to the position of the rooms according to public illumination. The first question has a near future (utilization) finality, if necessary, to verify the existence or no existence to different ways to fell the public illumination between pedestrian and driver (motorist); the second one, also to near future finality, if it will be necessary about the public illumination reaching people during the period of sleeping.

This "final"(ended) questionnaire (annexed I) was presented to twenty people and now it is identified in blocks of ten with the numbers A1, A2...A10, B1, B2...B10 respectively separating in "modulus" of different groups. Approved the model, the identification will be kept by sequence in a total of 120 questionnaires.

The alternatives to be analysed (Beauty, Intensity and Functionality) were chosen through informal questions and verbal questions to a group of approximately 20 people about what called them more attention when of one move of public illumination. The three items were commented practically for everybody, but unhappily by our fault we didn't register in ink this first passage.

The criterion of functionality was considered as global maintenance, clearance, change of bulls, local adaptation and so on...

The criterions Comfort, Security, Behaviour Impact and Prices (Costs) were undertaken by ourselves having in mind the final (ended) objectives of our work.

Because of the intricacy to the questionnaire, it was distributed to one universe compounds of person with the second level study completed, at least. From of one hundred and fifty distributed models, we obtained the return of only 88 questionnaires.

METHODOLOGY PORTRAYAL (DESCRIPTION)

According Cosenza [1], this is a technique turned to the priority of the options, with the goal to solve problems, with a crucial approach and a hard complexity. It is pertinent to a situation where a group of people fall across several alternatives, ordering them according to its importance to the solution of one specific situation.

Techniques to Analyse the Matrix

Providing the criterion matrix-criterion, we compute the summation of the lines and the percents that corresponds to each criterion. Having in mind that in the construction of the matrix, the criterions are compared two by two, attributing the following values in this scale; 10 (too much important), 5 (more important), 1 (equally important), 0,2 (less important) and 0,1 (not so important).

The relation is always done estimating the criterions

placed on vertical (column 1) with that one on the horizontal (line 1).

	A	B	C		%
A					
B					
C					

Matrix

Criterion-Criterion

	Option 1	Option 2	Option 3		%
Option 1					
Option 2					
Option 3					

Matrix Alternative-Alternative

Analogically, we mount the alternative matrix-alternative and we realised the same computation of the first showed above, that is, we compute the summation of the lines and the percents corresponding to each alternative.

However the decision is not based upon only one criterion we must now construct one alternative matrix-alternative to each one select criterion, then adopted criterions. For each one of these matrix, we have to maintain the anterior procedure of summation and percents.

Reaching this point, we will be able to construct (to mount, to build) the final (last) matrix. This matrix will have the following shape:

	Option 1	Option 2	Option 3		%
Option 1				1	1/ t
Option 2				2	2/ t
Option 3				3	3/ t
				t	1,00

Final (last, ended) matrix

To fill up the final (last, ended) matrix, it is enough to multiply the weight of each criterion (obtained values as percents of the criterion matrix-criterion) by the weight of each alternative in relation with that criterion. Completed this step, we begin (start) the process to analyse the results.

In the questionnaire the questions are repeated according to the under board (picture) and they serve to test the confiability of the answers.

1a	2a
1b	3a
1c	4a
2b	3b
2c	4b
3c	4c

1a	2a
1b	3a
1c	4a
2b	3b
2c	4b
3c	4c

1a	2a
1b	3a
1c	4a
2b	3b
2c	4b
3c	4c

RESULTS

When we obtained the results, we first worked in all of the 88 answered questionnaires. Following, we separated them

into two groups – drivers (motorists) (37) and pedestrian (51), to verify the existence of different answers according to the category.

Alternatives	All	Motorist	Pedestrian
Functionality	43	43	43
Intensity	35	34	35
Beauty	22	23	22

Criterion	All	Motorist	Pedestrian
Safety	41	37	43
Behaviour Impact	26	28	25
Comfort	20	23	18
Price (Costs)	13	12	14

Safety	All	Motorist	Pedestrian
Functionality	42	47	32
Intensity	39	37	36
Beauty	19	17	22

Behaviour Impact	All	Motorist	Pedestrian
Functionality	43	43	43
Intensity	33	33	33
Beauty	24	25	24

Comfort	All	Motorist	Pedestrian
Functionality	41	40	41
Intensity	34	33	35
Beauty	25	27	24

Price (Costs)	All	Motorist	Pedestrian
Functionality	45	39	48
Intensity	32	31	32
Beauty	23	29	20

ANALYSIS OF THE RESULTS

It is significant to observe that for the three categories (all, drivers(motorists), pedestrians) we obtained the same order in the appreciation of the items, as to the alternatives as to the criterions.

Analysing the result of the alternatives, we observed that the bigger worry is with the Functionality and the half of the Functionality.

When we analyse only the criterions, instead of the same order, we observed that the motorist was much worried with the Comfort than the pedestrian. Could we conclude anything?

The low relative importance observed to the items Prices(Costs) could indicate the loss of conscience that the last price is really concerned to the beneficiary?

When we worked with cross matrix and analysed the

item Safety, we observed that the factor Intensity had the same weight to all the categories, but we saw a bigger worry from the driver (motorists) in relation to the pedestrian as to the Functionality, and a bigger worry from the pedestrian in relation to the driver (motorist) as to the Functionality.

In the item Behaviour Impact and Comfort the answers are equivalent.

In the item Prices (Costs) there is one distinct inversion at the item Safety concerning to drivers(motorists) and pedestrian as this moment we can see a bigger worry from the pedestrian in relation to the driver(motorists) as to Functionality and one bigger worry from the driver(motorist) in relation to the pedestrian as to Functionality. Would this indicate a bigger worry of the pedestrian with the continuity of the service than with the continuity of the service than with the Prices(Costs)?

CONCLUSIONS

Why as to functionality the driver (motorist) is worrier than the pedestrian in the query Safety, and the pedestrian is worried than the driver in the query safety? Is there any relation between these conclusions?

Why as to Beauty the driver is worried than the pedestrian in the query Safety? Is there any relation between these conclusions?

Safety being the principal worry among the criterions looks so logic in a big center, but the Price having so less importance in view of the other items it shows the insouciance from one part of the population as to public consumption?

The functionality with a higher weight than the intensity does involve that assiduity of the public illumination is one worry?

As a final conclusion, can we say that the public administrators must worry themselves about to provide more safety conditions, principally, conciliating a efficient maintenance of the system? ●

BIBLIOGRAPHY

- [1] Cosenza, Orlando Nunes e outros. Manual de Técnicas de Conclaves, DNER, 1996
- [2] Velloso, Márcia Motta Pimenta. Notas de aula
- [3] Gil, Antônio Carlos. Métodos e Técnicas de Pesquisa Social, 4a ed. São Paulo. Ed. Atlas, 1994

ANNEXES

Márcia Motta Pimenta Velloso – Doutoranda
COPPE/UFRJ

This questionnaire is to collect condition to my thesis of doctorate about public illumination at COPPE/UFRJ. It has the purpose to hear what a crowd, want like public illumination in their street, quarter and city(town).

Thanks for your participation and collaboration. It is fundamental (so important).

ALL THE IDENTIFICATION IS SECRET.

name :

address:

problem: To develop a program that results in a collection of ideas to a Project of Public Illumination.

Question 1: In our displacement (moving) what normally you make use of:

Car

Bus

Question 2: In your bedroom does the window face the street.

Yes

No

Evaluation: Please evaluate according to the bellow criterion

Too much important

Equally important

less important

Much important

not so important

CRITERION MATRIX-CRITERION

	Comfort	Safety	Behaviour Impact	Costs	Amount
Comfort					
Safety					
Behaviour Impact					
Costs					

ALTERNATIVE MATRIX-ALTERNATIVE

Comfort

	Beauty	Intensity	Funcionality	Amount
Beauty				
Intensity				
Funcionality				

Safety

	Beauty	Intensity	Funcionality	Amount
Beauty				
Intensity				
Funcionality				

Behavior

	Beauty	Intensity	Funcionality	Amount
Beauty				
Intensity				
Funcionality				

Costs

	Beauty	Intensity	Funcionality	Amount
Beauty				
Intensity				
Funcionality				

Alternatives to be Analysed

Criteria

Weight

Beauty

Comfort

10 - too much important

Intensity

Safety

5 - much important

Funcionality

Behaviour Impact

1 - equally important

Price (Costs)

0,2 - less important

0,1 - not so important