Application of the Ev matrix in Xanthi, Greece

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ABSTRACT

The approach of the building as a system in Time and its interrelationships with the environment, are presented as a "Matrix of Environmental Value (Ev)" that takes into account all possible aspects of "harmfulness – friendliness" towards the environment, for each possible material and/ or function of the building.

It is hoped that the proposed Ev Matrix will be a helpful guide for the architects, builders, planners and so on, besides the several helpful computer programs that already exist, at achieving a better degree of environmental friendly design of buildings.

1. THE CONTEXT

Environmental Design can be defined as man's effort to create shelter ensuring:

a) a healthy environment as far as the psychological, physiological and sociological point of view is concerned, and at the same time,
b) the minimum environmental impact.

We cannot approach this subject based upon a simple technological and linear reasoning while at the same time, we cannot refer to something that could simply be solved through the application of a specific computer program. Moreover, basic knowledge, concerns many fields and disciplines and, in this case, all relevant issues should be dealt as a whole because there are multiple interrelationships and interactions with other fields as well. It is obvious that this is an inter-disciplinary issue.

We must highlight the fact that, actually, there are no many shelters built recently that can be characterized as "truly ecological" (only some natives' dwellings are exempted).

The most recent challenge is not to try and change nature, but to learn to live again under nature's terms, namely using our ecological and cosmological intuition.

Consequently, if my initial idea is to build a tower, a skyscraper, or a glass building, then certainly the game is lost before it starts. The same will happen if I try to magnify the skeleton of a Palaeolithic animal and place it close to the Acropolis, as a modern shelter (see. Pikionis vs Calatrava).

I believe that it is wrong to treat Environmental Design as the magic wand that could heat a building from 0^oC to 22^oC or that could cool it from 50^oC to 18^oC. This can be achieved today through the existing and future high technology. However, I truly believe that in the light of environmental consideration, we must take into account what is happening beyond the simple push of a button (i.e. air condition control unit) or the use of a program in the computer that will control household appliances.

Frequently, I hear people talking about a microchip that would completely control the circuits of a building so as to regulate the energy consumption and thus achieve the maximum amount of energy saving. I wonder to whom it is addressed. What will happen with the mass housing in poor areas of the planet? What will happen with all those traditional buildings spread all over the planet? So, we talk again about a limited so-called "western" civilization… I also think about all those Silicon Valleys and the polluting industries hiding behind those microchips. It is so small you can hold it in your palm and yet it hides a whole production and polluting system for an increasingly overconsuming society.

Thus, the problem with Environmental Design is that it would be very simple and easy if we only had to face a logical mathematic equation or a logical sequence of materials and actions that could be applied and give us the desired result.

Therefore, if I accept that a building is just a shelter that encloses, protects and functions – like a seashell- and that this shelter, depending on the architect's creative imagination can change shapes so as to meet the needs of special places, then the final result is a sustainable and more acceptable building.

Based on current discussions concerning environmental planning and green architecture, the following question arises: is it possible to evaluate what we design (project phase) or is it possible to evaluate a building already built and being used? How can we support a view, first for ourselves as researchers/ builders, and then as analysts for an existing structure? It is evident that, at this point, we cannot examine closely and in terms of aesthetics the architectural work and we cannot either refer in detail to the "Form Follows Function" aim (Sullivan) so as to meet certain operating demands.

2. THE PROPOSAL

According to our aim, Environmental Design should affect as little as possible the environment, meeting at the same time the users' demands, and offering aesthetic pleasure. It is very difficult for someone to accept a building that does not affect environment but does not meet the other two aforementioned factors. This is a subject of the skills of the designer of a new building or the skills of the person who studies an already existing building.

Therefore, we present certain proposals hoping that they will be of help in the approach of issues involved in the man-made environment. These proposals will help the researcher during the phase when he designs and selects the materials, while at the same time they could support the individuals involved in the final study/ construction/ impact phases.

I. We should not forget that the final result of each man-made (or human orientated) built element of the environment has to meet the following factors:
 a) Environmental Value, E_v
 b) Functional Value, F_v
 c) Aesthetical Value, A_{ev}

II. As far as the Aesthetical Value is concerned (see Environmental Social Psychology, -A.S.S.A., Kosmopoulos 2000), and being aware of the importance of the subject, we simply underline that we must take into account and approach the following issues:
 i. main users' degree of satisfaction
 ii. frequent visitors' degree of satisfaction
 iii. persons' having visual contact with the building degree of satisfaction
 iv. degree of satisfaction of the social environment
 v. degree of satisfaction of the broader level (through photographs, TV, etc.)

 These factors will give us an A_{ev} coefficient.

III. As far as the Functional Value of the building or complex of buildings is concerned, which can be examined by several disciplines such as ergonomy, interior design, environmental psychology, systems engineering and more, we should take into account the following issues:
 i. main users' degree of satisfaction
 ii. specific users' degree of satisfaction
 iii. visitors' degree of satisfaction
 iv. the fact that the building does not reduce the degree of satisfaction of other persons (for example neighbors) even if they are not proper users.

 These factors will give us an F_v coefficient.

IV. As far as the Environmental Value is concerned, -which is also the main subject of this paper-, when approaching each study or work we should take into account that the following flow chart may be observed:

INPUT → FUNCTION → OUTPUT

Consequently, our evaluation should include an estimation of factors concerning the diachronicity of planning and construction during the three phases.

IVa. Planning/construction phase. The following points have to be examined: (marked, minimum- maximum).

- Slight alteration/intervention in the local environment
- Selection of natural materials
- Energy for the consumed production of selected materials
- Transportation of materials
- Energy used for the construction
- Re-use of the already existing shelter
- Use of recycled materials
- Use of conventional materials
- Re-formation of the surrounding area
- Use of very expensive materials
- Poisonous emissions / material rejections
- and so on

IVb. Functional phase. The following points have to be examined: (marked., minimum-maximum).

- Functional independence resulting from the design and the use of renewable resources
- Partial use of renewable resources
- Use of local, natural fuels, found in the area (resources)
- Use of local mineral fuels (resources)
- Use of waterpower
- Preservation of the surrounding area (tree-planting etc)
- Use of energy by exhausting resources found at a distance and polluting during their production and/ or consumption
- Use of electricity from dams or from polluting combustion
- Lifespan of the shelter and possibility to re-use it without great cost
- Poisonous emissions/ rejections (rubbish, wastes, sewage water and greasy wastes, exhaust gases, etc.)

IVc. End of functional phase (abandonment/ destruction or demolition). The following have to be examined:

- Possibility to re-incorporate materials/ elements in the natural environment (time needed)
- Possibility to reuse materials
- Possibility to recycle materials with low cost
- End of poisonous emissions/ rejections
- (It is obvious that during this phase, the initial precautions are of great importance as far as the possibility to reuse /change the use of the shelter is concerned).

V. In conclusion, our approach should include the environmental estimation E_v:

$$E_v = \text{Input} + \text{Function} + \text{Output}$$

Assuming that the aforementioned factors are estimated from 0 to 10, it is clear that we must pursue the best sum.

However, we can achieve a total evaluation of the project only if we take into account the Social Value (the social acceptance of each shelter) examining at the same time the Environmental Value (E_v), the Functional Value (F_v), and the Aesthetical Value (A_{ev}).

Thus, the total estimation of each case is directly related to the three factors:

$$f = E_v + F_v + A_{ev}$$

What to do with E_v Matrix

Each of the boxes can accept a mark from the minimum to maximum, (E.g. from 0 to 10) depending on the degree for each factor's intensity.

It is obvious that the more persons –coming from different disciplines- that complete the Matrix for any specific example project, the more successful the results will be, since each person will note different details.

The parallel use of proper software such as "method 5000", "Ecotect", "Βιοκλιματικά" etc., will only be of even more help to complete in detail the Matrix.

It is not at all an intention, the replacement of any of the existing computer programs specializing in building energy saving, with the use of the E_v Matrix.

The Matrix can only be seen as the main general guide towards whether a piece of the man-made environment (e.g. a building) is- or can be- environmental friendly.

Of course, it is very difficult to define calibrations, scales and estimations that should be widely accepted. This is not our aim either. However, we think it is self-evident that each one of us, acting either as an engineer/constructor or as a user can estimate the way each shelter responds in relation to the three aforementioned factors. Depending on each person's environmental role, we must underline the fact that the factors that are not known should not be underestimated. We cannot neglect that just like an environmentalist has read hundreds of books about air pollution, the architect has read hundreds of books for the aesthetics of the built environment. Simplified approaches can be very direct but, they usually result in the disappearance of quality elements.

For example, as far as the approach of Social Value (Sv) is concerned, we can use the Theory of S-Topos and the methodological approach of A.S.S.A. (Applied Socio-Semiotic Analysis, Kosmopoulos 1991), which helps us understand how the public deals with the built environment (Kosmopoulos, 1994).

3. APPLICATION EXAMPLES

In order to test the E_v Matrix, we have used the following scale:

IN RELATION TO THE ENVIRONMENT

No harm	Little harm	Moderate harm	Much harm	Excessive harm
1	2	3	4	5
(not applied ø)				

As the Functional and Aesthetical Evaluation tables are concerned, we use the following marks:

Rejected	Bad	Moderate	Good enough	Excellent
5	4	3	2	1

Forty post-graduate engineers have marked the examples shown in the appendix.

4. CONCLUSIONS

The above examples, have given a clear aspect of the application possibilities of the Ev Matrix. It is also considered that the approach of Environmental Psychology, which applies the interdisciplinary approach with the cooperation of other specialties, can be indeed useful so as to help us realize the fact that the environment could and should be approached by individuals with a wide scope of knowledge and views.

In modern design, we try to shape the building in a way to profit from the natural forces of Sun and wind. In order to achieve this, architects, engineers, and builders must have a wide focus of views and knowledge. It is clear however that there are no defined and strict directions to apply so as the building will have great performances during both winter and summer. In addition, it is obvious that there are many issues involved and many things that could be done in personal level so as to end up in better ideas and applications for buildings that will be in harmony with the environment.

I hope and wish that all engineers dealing with the man-made environment will understand that an interdisciplinary cooperation is required in order to face the existing problems. Each engineer should achieve self-control in order to offer the best possible conditions for man, ensuring at the same time the minimum environmental impact.

I also hope that the Matrix of Environmental Evaluation Table (Ev) –which is proposed in order to be used as a self-controlling and self-understanding element of the researcher-, will help in the formation of personal views and opinions for a more environmental friendly man-made environment, especially since we anxiously await the application of KOXEE.

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APPENDIX

1. Tepee (Buffalo skins, wood)
Mark: 1 (no harm to the environment).
All participants.

Table 1: TEPEE - MATRIX OF ENVIRONMENTAL ASSESSMENT

Environmental Value Ev						**Functional evaluation**		**Aesthetical evaluation**	
Project Phase		Functional Phase		End of use phase		Functional Value	Fv	Aesthetic Value	Aev
Minor alteration/ intervention in the local environment	1	Full independence resulting from the design and the use of renewable resources	Ø	Possibility to re-incorporate materials/ elements in the natural environment	1	Main users’ degree of satisfaction	1	Main users’ degree of satisfaction	1
Selection of building materials	1	Partial use of renewable resources	Ø	Possibility to reuse materials	1	Specific users’ degree of satisfaction	1	Main users’ and visitors’ degree of aesthetical satisfaction	1
Energy for the manufacture of building materials	1	Use of local, natural energy sources, found in the area	1	Possibility to recycle materials in low cost	Ø	Visitors’ degree of satisfaction	Ø	Aesthetical satisfaction at view	1
Material transportation	1	Use of local energy sources (e.g. gazers, wood)	1	Stopping of poisonous emissions/ rejections from materials used.	ø	The fact that the building does not limit the degree of satisfaction of other persons even if they are not common users (e.g. neighbors)	1	Degree of satisfaction of the social environment	1
Energy for the construction phase	1	Use of waterpower (hydroelectric)	Ø			Local and broader area satisfaction.	1	Degree of satisfaction at a broader level (TV, photos etc)	
Reuse of an already existing shelter	1	Maintenance cost	Ø						
Use of recycled materials	Ø	Preservation of the surrounding area (tree-planting etc).	1						
Use of conventional materials	Ø	Use of energy by exhausted resources found at a distance and polluting during their production and/ or consumption.	Ø						
Re-formation of the surrounding area	Ø	Use of electricity from dams or by polluting combustion	Ø						
Use of very expensive and rare materials	Ø	Operating life of shelter and possibility to re-use it without great cost	1						
Poisonous emissions/ material rejections	ø	Poisonous emissions/ rejections during function	1						

$$f = Ev + Fv + Aev$$ (Kosmopoulos, 2001)

2. Office building
(Reinforced concrete, aluminium, air-conditioned, chemical glass, chemical paints, carpets, insulation).

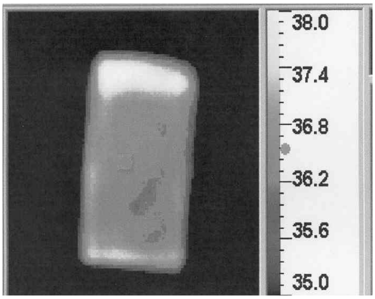

Table 2: CONTEMPORARY OFFICE BUILDING - MATRIX OF ENVIRONMENTAL ASSESSMENT

Environmental Value Ev						**Functional evaluation**		**Aesthetical evaluation**	
Project Phase		Functional Phase		End of use phase		Functional Value	Fv	Aesthetic Value	Aev
Minor alteration/ intervention in the local environment	4	Full independence resulting from the design and the use of renewable resources	4	Possibility to re-incorporate materials/ elements in the natural environment	4	Main users' degree of satisfaction	3	Main users' degree of satisfaction	3
Selection of building materials	4	Partial use of renewable resources	-	Possibility to reuse materials	3	Specific users' degree of satisfaction	3	Main users' and visitors' degree of aesthetical satisfaction	2
Energy for the manufacture of building materials	4	Use of local, natural energy sources, found in the area	-	Possibility to recycle materials in low cost	3	Visitors' degree of satisfaction	2	Aesthetical satisfaction at view	2
Material transportation	4	Use of local energy sources (e.g. gazers, wood)	-	Stopping of poisonous emissions/ rejections from materials used.	2	The fact that the building does not limit the degree of satisfaction of other persons even if they are not common users (e.g. neighbors)	3	Degree of satisfaction of the social environment	2
Energy for the construction phase	3	Use of waterpower (hydroelectric)				Local and broader area satisfaction.	3	Degree of satisfaction at a broader level (TV, photos etc)	2
Reuse of an already existing shelter	Ø	Maintenance cost	3						
Use of recycled materials	4	Preservation of the surrounding area (tree-planting etc).	3						
Use of conventional materials	4	Use of energy by exhausted resources found at a distance and polluting during their production and/ or consumption.	3						
Re-formation of the surrounding area	3	Use of electricity from dams or by polluting combustion	4						
Use of very expensive and rare materials	4	Operating life of shelter and possibility to re-use it without great cost	3						
Poisonous emissions/ material rejections	4	Poisonous emissions/ rejections during function	3						

$$f = Ev + Fv + Ae$$ (Kosmopoulos, 2001)

1. Contemporary residence building
(Reinforced concrete, bricks, wood, insulations, central heating).

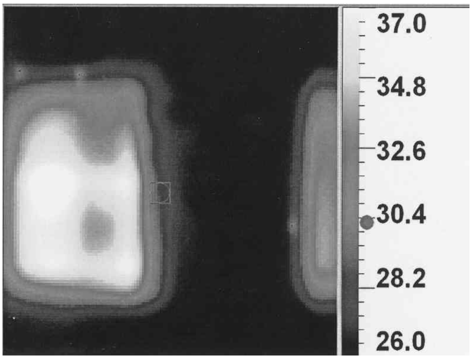

Table 3: RESIDENCE BUILDING - MATRIX OF ENVIRONMENTAL ASSESSMENT

Environmental Value Ev						**Functional evaluation**		**Aesthetical evaluation**	
Project Phase		Functional Phase		End of use phase		Functional Value	Fv	Aesthetic Value	Aev
Minor alteration/ intervention in the local environment	4	Full independence resulting from the design and the use of renewable resources	4 -	Possibility to re-incorporate materials/ elements in the natural environment	4	Main users' degree of satisfaction	3	Main users' degree of satisfaction	2
Selection of building materials	4	Partial use of renewable resources	-	Possibility to reuse materials	3	Specific users' degree of satisfaction	3	Main users' and visitors' degree of aesthetical satisfaction	2
Energy for the manufacture of building materials	4	Use of local, natural energy sources, found in the area	-	Possibility to recycle materials in low cost	3	Visitors' degree of satisfaction	3	Aesthetical satisfaction at view	2
Material transportation	4	Use of local energy sources (e.g. gazers, wood)	-	Stopping of poisonous emissions/ rejections from materials used.	2	The fact that the building does not limit the degree of satisfaction of other persons even if they are not common users (e.g. neighbors)	3	Degree of satisfaction of the social environment	2
Energy for the construction phase	4	Use of waterpower (hydroelectric)	-			Local and broader area satisfaction.	3	Degree of satisfaction at a broader level (TV, photos etc)	3
Reuse of an already existing shelter	-	Maintenance cost	3						
Use of recycled materials	4	Preservation of the surrounding area (tree-planting etc).	3						
Use of conventional materials	4	Use of energy by exhausted resources found at a distance and polluting during their production and/ or consumption.	4						
Re-formation of the surrounding area	3	Use of electricity from dams or by polluting combustion	4						
Use of very expensive and rare materials	2	Operating life of shelter and possibility to re-use it without great cost	3						
Poisonous emissions/ material rejections	4	Poisonous emissions/ rejections during function	3						

$$f = Ev + Fv + Aev$$ (Kosmopoulos, 2001)