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Sustainable Buildings for Next Generation - Between Technology, Aesthetics and Ethics

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Abstract. Sustainable development has become in the past decades the main topic of political and academic discourse at global level. Addressing the issue of sustainable buildings involves a paradigm shift and an overall change in scientific research and also in design practice, moving towards interdisciplinary approaches, but in architecture education sustainability is understood by most of the students in technical and ecological terms. A previous study of the author revealed that the same is true for most of the architects and engineers. This is a simplistic way of perception, which does not take into account all the changes that the concept of sustainable buildings has undergone over the last 20 years. For this reason, a reformulation of the problem is necessary. Beyond the issue of the pillars of sustainable development that was dealt with by the students in the discipline "Sustainable Buildings" in the previous year, in this year in the "Aesthetics" discipline a critical development of the subject continues starting from an article published in 2001, "Reinterpreting Sustainable Architecture: The Place of Technology" by S.Guy and G.Farmer. This approach relates "the image of space, the source of environmental knowledge, the building image, technologies and the idealized concept of place" in order to define what the authors define six types of competing "logics" of sustainable architecture. The authors' approach was considered the most relevant in terms of openness to diversity and questioning what is considered the status quo in sustainable buildings. The methodology aimed in the first phase to clarify the concepts and present them through specific examples. In the second phase, students were asked to individually answer the question: "In approaching sustainability in your future career as an architect, what would be the two most important logics for you and why do you think this is the right path?". By answering this question, they develop their critical thinking related to the subject. In 2025, 53 students chose to answer this questionnaire. The third phase consisted of centralizing and analyzing the results. The research has a quantitative aspect, on the one hand, because it shows trends of the younger generation, but also a qualitative aspect on the other hand, because it answers the question of why. As for the qualitative analysis, it tries to relate aspects considered important by future architects to personal opinions and, respectively, to the way architecture is taught and learned within FAUT (Faculty of Architecture and Urbanism in Timisoara). The conclusions speak for themselves and show us that we live in a world with multiple opinions, in which architecture will continue to be diverse and inclusive.

Keywords: Sustainable buildings; architecture education; aesthetics; technology; ethics; critical thinking.

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INTRODUCTION

Sustainable development has become in the past decades the main topic of political and academic discourse at global level. If there is a quasi-consensus regarding the general definition, the most cited being the one from the Brundtland Report "meeting the needs of the present without compromising the ability of future generations to meet their own needs" [1], regarding the issue of building sustainability the concept has evolved from a purely ecological aspect towards an approach that includes the three pillars: ecological, social and economic [2], which were subsequently

joined by the fourth: the cultural one. This fact is also visible in the evolution of building sustainability assessment systems [3].

In 2015, the United Nations adopted the 17 sustainable development goals, another global signal of shifting the focus from the environmental factor to the human factor, or in other words from the ecological pillar to the social pillar, which demonstrates once again that the idea of sustainable development is an evolving concept.

Following this evolution over the last two decades, for a built environment professional, whether architect, engineer or manager, the question naturally arises as to what he himself understands by sustainable architecture, beyond definitions and evaluation systems.

By questioning the foundations, the author came to the rediscovery of an article published in 2001, "Reinterpreting Sustainable Architecture: The Place of Technology" by S.Guy and G.Farmer. [4], that presents a different perspective.This approach was considered more relevant in terms of openness to diversity and questioning what is considered the status quo in sustainable buildings.

Following in recent years the architecture students in the Sustainable Buildings discipline and in the Aesthetics discipline, the author found that, although they understand the importance of technical aspects for a sustainable architecture, there is a tendency to consider these aspects mainly engineering, architects relating better to socio-cultural aspects.

A gradual shift from environmental and technical aspects was sought in the previous year in the Sustainable Buildings course to the Living Building Challenge [5], a system that encompasses all aspects of sustainability. The system was used to analyze personal projects. In the next year of study, in the Aesthetics discipline, an exercise of critical and interrogative looking at one's own future within the profession was realized. The students were asked to individually answer the question: "In approaching sustainability in your future career as an architect, what would be the two most important logics for you and why do you think this is the right path?". By answering this question, they develop their critical thinking related to the subject. A second objective of the exercise, apart from personal awareness, was to find out how the younger generation positions itself on different aspects of sustainability. The research has a quantitative aspect, on the one hand, because it shows trends of the younger generation, but also a qualitative aspect on the other hand, because it answers the question of why.

A DIFFERENT PERSPECTIVE ON SUSTAINABLE BUILDINGS

Methodology

The methodology of last year's study followed the following steps:

1. the explanation of the six types of logic in the article [4], using suggestive images and presentation of the characteristics of each typology;
2. the request to answer the question defined in the introduction;
3. the students' answer comprises two levels: defining the two most important logics around which they would build their future career as architects and respectively answering the question why they consider the two most important for them; interesting to note that there is no right or wrong answer, but it is an exercise of positioning and awareness of personal values, so from this perspective it becomes evident that the sustainability of the built environment depends directly on personal and collective values;
4. data compilation, correlations and quantitative analysis of the results;
5. data consolidation and possible qualitative correlations.

The 2025 exercise was answered by 53 students, a large number of whom had participated in the previous year in the optional course and seminar on Sustainable Buildings, where the issues were those considered "classical" in the approach to the topic.

The Six Logics of Sustainable Architecture – Short Presentation

The authors of the article [4] started from the hypothesis that sustainable architecture is more about attitude and personal approach than technical recipes. Starting from the observation that there is an extremely wide range of projects under the general umbrella of what is called sustainable architecture and questioning the idea that the problem could be solved with technical recipes, S. Guy and G. Farmer propose a reinterpretation.

What they call "logic" is a system of thinking, which has a foundation (idealized concept) that is closely linked to a certain source of knowledge and which manifests itself in form accordingly, having a certain image of space and

building, which naturally follows certain technologies. Naturally, two or three of these logics coexist in an architectural object, but treated in this way the question of sustainability becomes less rigid and is linked to a positioning of the architect in relation to certain sets of values. Table 1 presents a reinterpretation of the authors' definition for general clarification, but students were presented in detail with the assumptions that outline each type of logic - the foundations of knowledge, ethical and aesthetic values, the spatial image and the relationship with technology.

The six logics are: L1. The eco-technical logic; L2. The eco-centric logic; L3. The eco-aesthetic logic; L4. The eco-cultural logic; L5. The eco-medical logic; L6. The eco-social logic.

TABLE 1. The six logics of sustainable architecture

Logic	Concept/ knowledge	Image (space and building)	Technology
L1	Global environmental crisis can be overcome with design strategies based on science and technological progress	Global, future oriented image; The cities should be compact and dense	Energy-efficient; renewable energy; intelligent control systems
L2	The idea that the ecosystem is fragile; holistic strategies; systemic ecology	Fragile or telluric image; experiments with natural materials	Natural materials; recycled materials, low-tech
L3	Postmodern science; new age; nonlinear systems; new ecological knowledge	Strong, expressionist aesthetics; new age	Latest knowledge; new building materials for free form
L4	Phenomenology; cultural ecology; learn how to adapt to place and local culture	Authentic; harmonious; very well adapted to place and culture	Local low-tech; vernacular, simple technologies and materials
L5	The wellbeing concept; quality of life; natural environment	Natural; healthy living; use of colors; tactile materials; use of exterior space for therapy	Relationship with nature and healthy, nontoxic materials; use of knowledge from the latest research in medicine
L6	Social ecology; sociology; participatory communities	Democratic; creating a layout that community can change over time; architecture responds to real community needs	Flexible buildings; cheap, non-expensive materials

In order to clarify the concepts, the teacher presented the students some examples specific to each logic from several geographical areas, well known and awarded architects or offices, discussing different aspects involved in sustainability projects, which are not always taken into account when it comes to sustainable buildings, but which are important if we change our perspective on the subject. The examples are briefly presented in table 2.

TABLE 2. Examples of architects relevant for the six logics of sustainable architecture

Logic	Architects/ Offices/ Examples
L1	Renzo Piano, Ken Yeang, Herzog & de Meuron, Norman Foster
L2	Mike Reynold, Gernot Minke, Shigeru Ban, Junyia Ishigami
L3	Toyo Ito, Frank Gehry, Santiago Calatrava
L4	Peter Zumthor, Sir David Alan Chipperfield, Balkrishna Doshi, Glenn Murcutt
L5	Peter Schmid, Gaia Group
L6	Alejandro Aravena, Diébédo Francis Kéré

Developing a Critical Thinking About Sustainability – Discussion

As an example to teach students to ask meaningful questions in order to develop their critical thinking, an iconic building that could be considered a representative of the eco-aesthetic logic, the Bilbao Museum designed by Frank Gehry, was chosen as an introduction to the topic, considered a counterexample on the ecological pillar due to the fact that it consumed about 70% more metal than a typical building of the same volume. But the building has had the effect of completely changing the lives of Bilbao's inhabitants over the next decade, so it can be argued that from the pillars' perspective, the sustainability zone has been reached through the social and cultural pillars. And yet, these effects were not taken into account at the time of realization and certainly were not pursued in the design process.

So, one can ask a legitimate question: is it relevant to judge the sustainability of buildings from a pillar perspective? Can the complexity of architecture be reduced to accumulating points in rating systems? Or is the six logics perspective more valid for architects and their values?

In the same way, many of Renzo Piano's buildings, which could be considered at the confluence of eco-aesthetic and eco-technical logic, can be seen in a different light. As a survey of architects and sustainability specialists in the United States about 15 years ago showed, if Gehry's building was considered iconic, the building considered as a prime example of sustainable architecture was Renzo Piano's California Academy of Science Building Workshop [6], [7], [8].

From a historical perspective, we can see a shift of emphasis in recent years from the celebrated and award-winning eco-aesthetic and eco-technical zone at the beginning of the 21st century to architecture with a strong eco-social and eco-cultural logic, from the hard zone to a soft zone of architecture, from an area where image and technology are the dominant features to an area that is more attentive to the needs of people, culture and sensitivity of the place. The eco-cultural logic that Kenneth Frampton [9] defines as critical regionalism is constantly evolving and finding increasingly creative expression in recent years in different regions around the globe. In fact it can be said that almost all the Pritzker Prize winners of the last 20 years feed their creativity from the spirit of place. The Pritzker Prize, the most prestigious trophy for architects and the equivalent of the Nobel Prize, is awarded annually, "in acknowledgement of those qualities of talent vision and commitment, which have persistently produced significant contributions to humanity and the built environment through the art of architecture" [10].

For example Sir David Alan Chipperfield, the 2023 winner of the prestigious award, is a unique example of simplicity and elegance whose constant quest has been what makes architecture endure beyond fashion and form. Instead, each of his projects is deeply rooted in the genius loci - the spirit of place - and while his imprint of subtle elegance is recognizable, the design thinking is specific to each circumstance. Although unique and beyond definition, we can from this perspective consider Chipperfield as a representative of eco-cultural logic.

Diébédo Francis Kéré, winner of the Pritzker Prize in 2022, is an example that falls perfectly between eco-cultural and eco-social logic according to his own statement, although we can identify obvious elements of eco-centric logic in the use of local materials with low embodied energy. As he says on the personal website [11], "Architecture has given us a tool to shape people's needs and dreams… Informed by tradition, our practice explores new modes of construction for which the foundations have long been laid. Innovative uses of local resources and participatory design methods allow us to work beyond the boundaries of most established design practices."

Beyond the examples given in 2001 by the two authors, creative approaches to the eco-centric logic, using natural materials in an expressive form with minimal consumption, have emerged in the last 20 years, an example that would be at the confluence between the eco-centric and eco-aesthetic logic being Shigeru Ban (Pritzker 2014), with his expressive bamboo and paper-tube structures, structural systems constructed of shipping containers, wooden structures without metal connectors.

Alejandro Aravena, Pritzker Prize Laureat in 2016, becoming world famous after designing the Quinta Monroy Housing [12], is the representative of a generation of more socially engaged architects especially committed to solving the global house crisis and striving for a better urban environment for all social classes. These architects have a deep understanding of civil society and are usually activists, having as an anchor of values the eco-social logic. What is interesting to see is how these kind of projects evolve over time, how people are using them, how they take possession of their spaces and there are some interesting researches on this topic [13].

A Surprising Result? – Quantitative Analysis of the Survey

Building on the previous discussion, an introspective exercise followed. The exercise had in fact four objectives:

1. to increase students' self-awareness;

2. to track what is the trend of reporting on sustainability among the young generation of future architects (this may lead further to rethinking the Sustainable Buildings course);

3. to correlate the responses of the majority of students (if a majority is formed) with what lies behind their answers (either a personal preference or the changes they undergo during their university studies) and

4. to make the voice of the young generation heard.

In 2025 a number of 53 students form the fifth year of study answered the question: "In approaching sustainability in your future career as an architect, what would be the two most important logics for you and why do you think this is the right path?". By answering this question, they develop their critical thinking related to the subject.

The quantitative results are presented in Figure 1, Figure 2 and table 3.

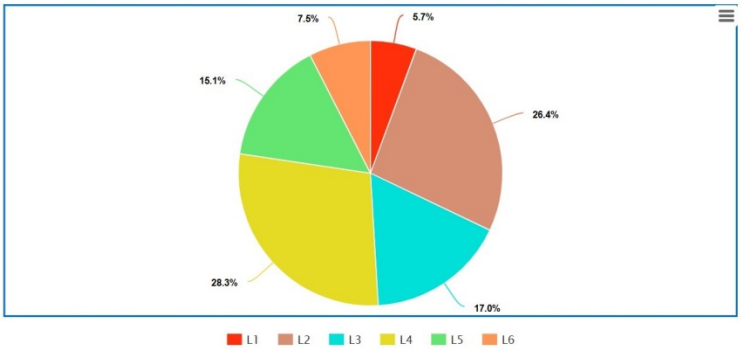

FIGURE 1. First choice of the students.

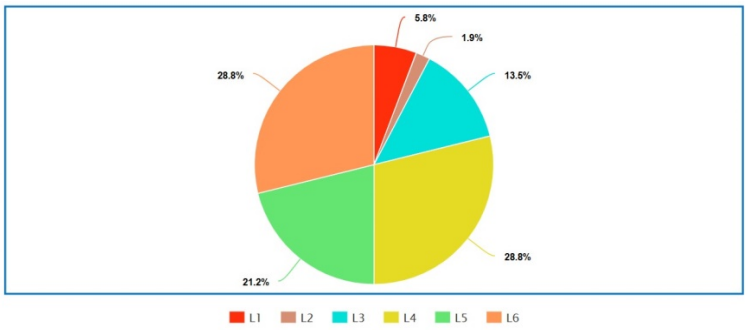

FIGURE 2. Second choice of the students.

TABLE 3. The six logics of sustainable architecture

Logic	Name of logic	First choice	Second choice
L1	Eco-technical	3	3
L2	Eco-centric	14	1
L3	Eco-aesthetic	9	7
L4	Eco-cultural	15	15
L5	Eco-medical	8	12
L6	Eco-social	4	15
	Total	**53**	**53**

The trends are obvious from the table and the figures: L4 – the eco-cultural logic has the highest score, both as the first and the second choice meaning 30 out of 53 students consider that this logic will define their path as future architects and at a closer look one can see that 15 more have L2 – the eco-centric in first place, the one that is the

closest conceptually to L4. The result can also be interpreted in the following way: 44 out of 53 future architects, i.e. 83%, see sustainable architecture in terms of place identity and closeness to nature, soft and low-tech rather than high-tech or standardized.

There was another level of quantitative analysis, to find out which is the second most popular vote for the two majority choices (L4 and L2), presented in Figure 3 and Figure 4. Of the 15 students who chose L4 - eco-cultural logic first, 6 have eco-social logic second and 5 the eco-medical logic. Of the 14 students who chose L2 - eco-centric logic first, 6 have the second pillar of their future devolution the eco-cultural logic and 5 the eco-social logic, which reinforces the previous observations.

A possible conclusion would be that if certain regulations and technologies regarding sustainability of buildings will constitute the standards, future architects are rather looking for values beyond norms, sustainability assessment and life cycle assessment.

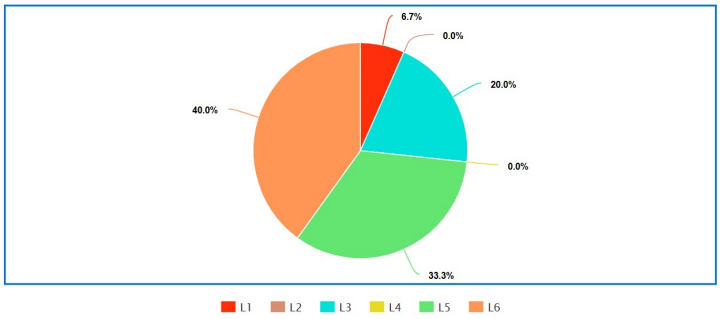

FIGURE 3. Second choice of the students with L4 on the first place.

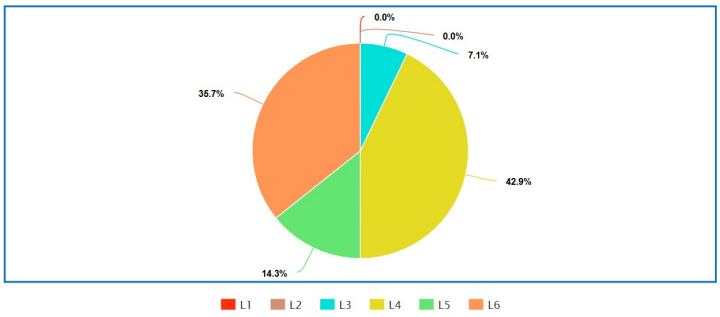

FIGURE 4. Second choice of the students with L2 on the first place.

Voice of the Young Generation – Qualitative Analysis

The students observed in their answers that the preference for one or another of the logics has in some cases to do with the way they were educated in their families, but in most cases the response was that over the years in college they had moved from a star architect's vision of architect of form to an architect who wants to respond to the real needs of people. In general it can be concluded that the emphasis in the responses is on the idea of being close to nature, as the way cities are built is seen as negatively affecting wellbeing in general and also physical, mental and spiritual health. A second pattern that emerges in the answers to the question “Why?” is the search for meaning, meaning in personal life and meaning as members of the community.

Here's an excerpt from the exercise of introspection for the future architects. No one knows know what the future will bring, but there is a hope that, with these answers, it will not be dystopian.

- "For me the spirit of place and conveying a message through architecture comes first... Architecture is the ID card of a community and expresses certain values... For me it has become important over time what architecture offers to people and the 'wow factor' that I was looking for in my first year of study has disappeared realizing that it has to respond to certain needs."(L4)

- "I believe that architecture has the power to shape social interactions; cohesion between people and collaboration between people is very important..." (L6)
- "The choice for L5 is a personal one, the lack of natural elements in the city I live in affects me strongly... it's too hot, too dry, too much concrete, too much sky, but too little fruit and bees compared to how it was was in my childhood." (L5)
- "In my vision, sustainable architecture is not a mere collection of technical solutions meant to tick a box in environmental reports... On the contrary, I see it as a profoundly cultural, artistic and ethical act, through which space, nature and man rediscover each other... I believe that architecture has the responsibility to navigate intelligently and sensitively between the different levels of reality." (L2)
- "Nature is for me the zero point of any project. Not as a resource, but as a living entity with its own rhythms and memory... This is why I don't propose to integrate nature into the project in a demiurgic gesture, but on the contrary I want to listen to its subtleties and make them heard, to let it assert its presence organically, perhaps even wildly." (L2)
- "In an ideal world I see architecture as a translator of context, and I find myself in the role of the storyteller of place." (L4)
- "Architecture must necessarily contain stories, messages, symbols, in other words: identity. The biggest crisis of our generation, I think, is a crisis of identity... So we in our projects should tell the story of the place, the story of the time we live in and the story of the people of the place. And I think that once people will feel represented and will love the buildings, the other aspects of sustainability will be solved." (L4)
- "I chose as my first logic L5, the eco-medical one, because I think architecture can take on the role of a healer... the place that heals... in that way I could change people's lives little by little, every day." (L5)
- "... In conclusion, I hope to become an architect who puts people's needs first, build from the soul for souls and leave behind if not buildings, at least ideas and values." (instead of conclusion)

CONCLUSION

An earlier study by the author on understanding building sustainability assessment systems [14] shows that not only architects, but also engineers and project managers and other sustainability specialists with a technical background agree that a quantitative assessment is not really relevant if it is not complemented by qualitative aspects. The present study does not aim to question the predominantly quantitative evaluation systems in use, nor to offer an alternative to them, but to demonstrate the complexity of the subject and to add the qualitative element.

As the authors of the article from which this research started argued, understanding these different logics is a particularly valuable exercise in an educational context, in order to open young people's minds to the multitude of possible approaches and to the awareness of the relationship between sustainability, concept, image, ethics, aesthetics and technology.

The answers given by the students were slightly surprising, especially through the quantitative component, because, regarding the students' way of relating to their personal projects, it seems that the effort is focused on concept, aesthetic expression and technology. The results show, from the teacher's perspective, that a change in the way certain information is presented to the students or a different emphasis in the architectural project could open more easily a personal path for each student.

The majority result that refers to the soft approaches, eco-cultural, eco-centered and eco-medical may be a mirror of their generation, as some of the students responded, or of the changes that have taken place in our perception as architects and as a faculty community in recent years. The fact that the eco-cultural logic comes first in the students' choice, shows on the one hand an attempt to find an identity in the architecture of the place or the search for an identity of their own that is better related to the values that define the genius loci.

It can be said that revisiting this perspective convinces once again that sustainability is neither a consensus, nor a list of technical prescriptions, and is not a point to be reached, but rather a process. How the stakeholders involved in the construction process understand the concept will determine the outcome. It is to be expected that in the future people will become more and more aware that the visible green - the green related to rules, technical components, etc. - will be a mandatory standard, but what will change the way we design and relate to buildings and the city is what is called the invisible green, the green related to values. This is why it is important for future architects to undertake this exercise of introspection and choice.

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