

SOCIAL–PSYCHOLOGICAL RESPONSES TO TRENDS OF SUSTAINABLE ARCHITECTURE

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ABSTRACT

Sustainable development became the predominant official paradigm of planning, design, and construction policies. This concept with its environmental, social, economic and cultural dimensions has been applied to the field of architecture since the end of the 20th century. However, numerous researchers still notice one-sided technological and ecological orientation of sustainable architecture and the lack of attention to its cultural, place-based and aesthetics aspects. Nevertheless, sustainability as a design paradigm, undoubtedly encourages a change in the way people consider the notion of aesthetics. The efforts to implement sustainability ideas sometimes lead to very unusual designs – provocative experiments, futuristic solutions or re-using - recycling projects that sometimes may lead to conflicting assessments in the society. This research investigates how aesthetics of sustainable architecture is distinguished and psychologically accepted by people.

KEYWORDS

Sustainable architecture; aesthetics; architectural trends; sustainability; architecture.

1. INTRODUCTION

Relevance of research. Sustainable architecture can be broadly defined as architectural design and practice based on the paradigm and general principles of sustainability, such as the pursuit of material and intangible well-being, justice for present and future generations, justice within and between societies, protection and promotion of cultural and environmental biodiversity, precautionous decision-making, recognition of the interdependence of phenomena (Throsby, 2002), in social, cultural, economic and environmental dimensions. Sustainability must be programmed during the idea generation and development phases and manifest throughout the life cycle of the architectural object. It is maintained that sustainable architecture must not only be durable, flexible, and environmentally friendly, but also contextual, aesthetic and psychologically acceptable (Kamicaityte-Virbasiene and Grazuleviciute-Vileniske, 2011; Berardi, 2013). It is desirable, that the object of sustainable architecture would impact positively, stimulate the sustainable development of environment and society in a broader sense (Kamicaityte-Virbasiene and Grazuleviciute-Vileniske, 2011). For this broader impact to occur, sustainable architecture must be accepted and desired by the society – it must be socially and psychologically acceptable. Social and psychological acceptability of architecture is

closely linked with its aesthetic expression. However, the definitions of sustainable building (Karnicaityte-Virbasiene and Grazuleviciute-Vileniske, 2011; Berardi, 2013) do not identify the particular architectural expression. There have been attempts to categorize sustainable buildings according to their aesthetic expression (Guy and Farmer, 2001; Wines, 2000; Sauerbruch and Hutton, 2011; Di Carlo, 2016); however, the field of sustainable design is constantly evolving and expanding and new trends are emerging. Moreover, the definition of sustainability itself is constantly under debates and new notions of restorative and regenerative sustainability (Istiadji et al., 2018) are taking their grounds more firmly in the recent years. For example, U. Berardi (2013) presents definition of sustainable building related with regenerative sustainability "a building is sustainable if <...> it favors a regenerative resilience of the built environment among all the domains of sustainability". It is possible to presume, that such rapid changes in the design paradigms and constant search for corresponding architectural forms may receive very different reactions in society, which, actually is the end user of buildings and built environments. Consequently, amidst this constant change it is valuable to look at the aesthetic trends of sustainable architecture and to analyze social-psychological reactions to them.

The aim of the research was after the analysis of literature and examples to distinguish currently relevant (both predominant and marginal) aesthetic expression trends of sustainable architecture and to evaluate their social-psychological acceptability.

The methodology of the research encompasses analysis of literature and examples, comparison and systematization of literature analysis results, design and application of online sociological survey, quantitative and qualitative analysis of survey results, formulation of conclusions.

The structure of research is the following: methodological section presents structure

and details of research methodology, results section presents distinguished aesthetic expression trends of sustainable architecture with corresponding illustrative material and the quantitative and qualitative analysis of sociological survey results.

2. METHODS

Analysis of literature and examples. Literature analysis was focused on the publications distinguishing trends of sustainable architecture (Guy and Farmer, 2001; Wines, 2000; Sauerbruch and Hutton, 2011; Di Carlo, 2016) and design examples (implemented and projects) available online. The search keywords, such as "sustainable architecture", "sustainable design" were applied in internet search engines. Although the search was not limited to the designs explicitly labeled as sustainable, as numerous high quality nature and advanced technology inspired architectural designs may contain these qualities as well. Additionally, the search in internet resources of architectural content, such as ArchDaily, Divisare, Dezeen etc. was carried out. The collected information included descriptions, photographs, drawings of the objects. After the analysis, comparison, and systematization of collected data 10 contemporary trends of expression of sustainable architecture were distinguished and digital collages were constructed from online available material to illustrate each distinguished trend.

Design of sociological survey. Sociological survey was administered online in the months of April – May 2022. The questionnaire consisted of 27 closed and open questions. The questions were organized in three groups: social-demographical questions, questions aimed at the assessment of 10 trends of sustainable architecture and questions aimed at determining respondents' attitudes towards the distinctive aesthetic features of sustainable buildings. While evaluating each

trend of sustainable architecture, respondents were asked to indicate if the trend is acceptable to him / her, if the trend seems environmentally friendly and to leave a short comment about the trend. 240 respondents, inhabitants of Lithuania, compiled the questionnaire.

Analysis of survey results. In order to analyze emotional responses of survey respondents to the trends of sustainable architecture, qualitative and quantitative approaches were applied. Identifying emotions in written texts requires high level intelligence (Park et al., 2020), thus qualitative approach based on R. Plutchik's (2001) classification of human emotions was applied. According to R. Plutchik (2001), In English language there are few hundred words for defining emotions, thus some kind of categorization and classification is necessary; he provides circumplex model for classification of emotions analogous to a color wheel (Fig. 1), "placing similar emotions close together and opposites 180 degrees apart, like complementary colors". The comments provided by the respondents were analyzed and emotional label was attached to each individual comments using the above-mentioned classification. Quantitative

sentiment analysis, judging whether each comment has positive or negative emotion, was carried out further. As a way of recognizing emotions in sentences, the keyword-based sentiment analysis method employs emotional scores of each word (Park et al., 2020). NLTK VADER Sentiment analyzer was applied in this case. The framework of emotional analysis of responses is presented in the Figure 1.

3. RESULTS

3.1 Sustainable architecture directions

Analysis of literature and examples has revealed the wide array of sustainable design manifestations. In order to understand the interconnections of sustainable design trends, the mind map was constructed (Fig. 2) demonstrating five interconnected tendencies – high-tech and low-tech ecological aesthetics, nature-inspired aesthetics, genius loci and participation architecture – that were distinguished based on analysis of literature and examples.

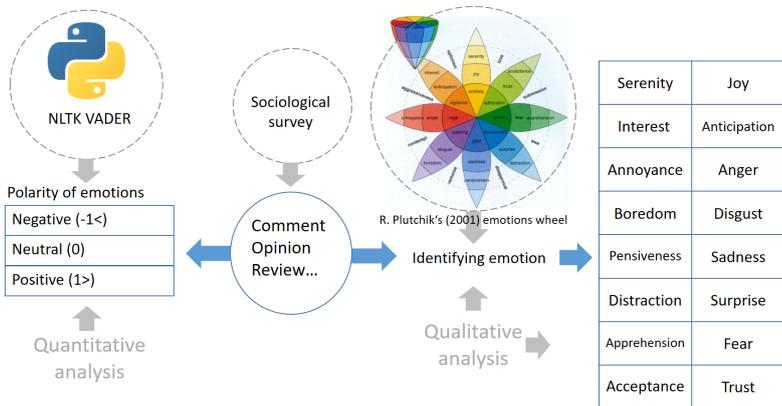


Figure 1. Framework for emotional analysis of survey responses using quantitative (NLTK VADER sentiment analysis tool) and qualitative (R. Plutchik's (2001) classification of emotions) approaches

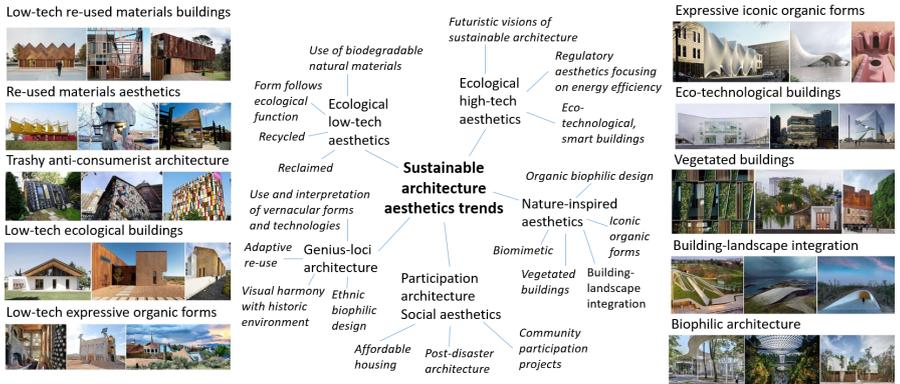


Figure 2. Mind map of contemporary trends of sustainable architecture development and expression and digital collages representing 10 trends selected for the further evaluation of social-psychological acceptability

Researchers still notice one-sided technological and ecological orientation of sustainable architecture (Guy and Farmer, 2001; Wines, 2000), thus distinguishing the expression trends of sustainable architecture for further evaluation, intermediary and marginal trends, that could be beneficial in diversifying the expression of sustainable buildings were given special attention. The following trends were distinguished:

- 1) *low-tech re-used materials buildings* - the trend towards the use of recycled or re-used materials to create a modern architectural expression;
- 2) *dictated by re-used materials aesthetics* - the trend, where aesthetics of buildings is dictated by what materials have been obtained for re-use;
- 3) *trashy anti-consumerist architecture* - the trend where a building can be created from anything that is discarded using secondary raw materials. In this way, the opposition to modern consumerism is demonstrated;
- 4) *low-tech expressive organic forms* - the tendency to create a particularly mannerly architectural expression using natural, recycled or reused materials;

- 5) *low-tech ecological buildings* - the trend dominated by local, natural materials (straw-clay mixture, hemp concrete, etc.), although a modern expression is being developed;
- 6) *eco-technological buildings* - the trend dominated by glass and metal, integrating the latest eco-technological advances, often using innovative materials;
- 7) *vegetated buildings* - the trend dominated by greenery (planted facades, roofs or otherwise integrated plants);
- 8) *building-landscape integration* - the trend where the building blends in with the landscape;
- 9) *expressive iconic organic forms* - the trend in which the aesthetics of a building is expressed in distinctive organic, plastic forms;
- 10) *biophilic architecture* - the tendency to deliberately reproduce certain features of natural environments in buildings.

Digital illustrative collages were created for each trend. The collages and the clustering of distinguished trends are presented in the figure 2.

3.2. Results of the survey

The study analyzed 1816 comments related with opinion about the sustainable architecture trends and analyzed them using quantitative (NLTK VADER sentiment analysis tool) and qualitative (R. Plutchik's (2001) classification of emotions) – see fig. 3 and fig. 4 for summarized results. Table 1 represents the summary of the most preferred architectural trends, which are Vegetated, Low-tech ecological, Biophilic, Building-landscape, Low-tech re-used. The first three architectural trends (*low-tech re-used materials buildings, re-used materials aesthetics and trashy anti-consumerist architecture*) were selected for the survey to test the level of acceptance of the unusual and experimental aesthetics arranged from quite unnoticeable to extreme re-using projects as protest against consumerism form (Fig. 2). The results showed the more extreme expression was, the less it was acceptable (Fig. 3). Although those buildings were created

from the recycled or re-used materials, it was not considered as environmentally friendly. Respondents raised awareness of the environmental pollution of re-used materials such as plastics which decays into micro-plastics and creates the further pollution. Also, important question was visual aesthetics. The insights of the survey showed that the most acceptable and encouraged solution of re-using materials would be recycling them to new materials to be used in the construction. The most moderate recycling trend - *low-tech re-used materials buildings* was accepted quite emotionally positively. Majority of the respondents considered this trend as environmentally friendly. Some respondents showed apprehension towards possible threats of the recycled materials such as environmental friendliness of the used materials, like micro-plastic pollution, decomposing materials and their effect on human health, fire safety, structural issues and material compliance with the legal

Statistical answers (certainly acceptable + acceptable)			Polarity (NLKT Vader) -1 to 1			R. Plutchik's wheel of emotions (The least of negative feelings -disapproval, disgust, contempt)		
No.	Trend	Evaluation	No.	Trend	Evaluation	No.	Trend	Evaluation
1	Vegetated	93.4 %	1	Vegetated	0.3512	1	Biophilic	4.1 %
2	Low-tech ecological	92.5 %	2	Building-landscape	0.3252	2	Low-tech ecological	4.9 %
3	Biophilic	91 %	3	Biophilic	0.3236	3	Vegetated	4.9 %
4	Building-landscape	88.5 %	4	Low-tech ecological	0.3209	4	Building-landscape	4.9 %
5	Low-tech re-used	78.6 %	5	Low-tech expressive organic	0.2605	5	Expressive iconic organic	14.4 %
6	Low-tech expressive organic	64.2 %	6	Low-tech re-used	0.2179	6	Low-tech expressive organic	16 %
7	Expressive iconic organic	52 %	7	Expressive iconic organic	0.2073	7	Low-tech re-used	21 %
8	Eco-technological	49.1 %	8	Eco-technological	0.1602	8	Eco-technological	23.5 %
9	Dictated by re-used	46.1 %	9	Dictated by re-used	0.0920	9	Dictated by re-used	29.6 %
10	Trashy anti-consumerist	27.2 %	10	Trashy anti-consumerist	0.0202	10	Trashy anti-consumerist	42.8 %

Table 1. Evaluation of priorities (the most accepted to the least accepted) of sustainable architecture trends using different methodologies. Source: (Author 2022)

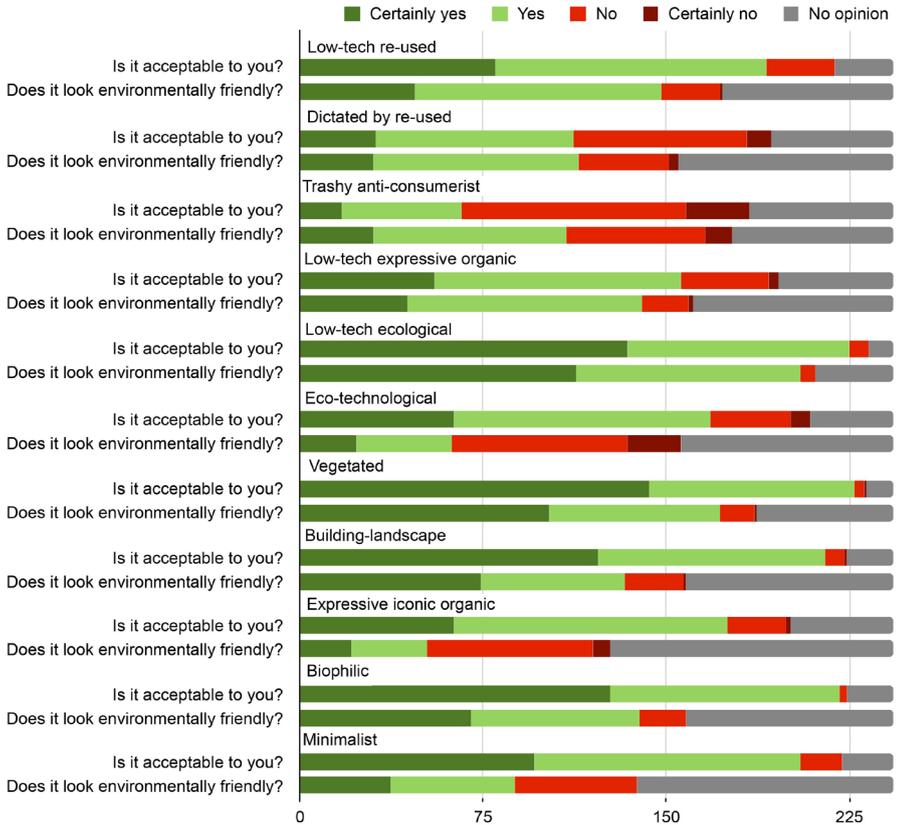


Figure 3. Summarized evaluation of the trends of the acceptance of sustainable architecture. Source: (Author 2022)

requirements for the built environment. The second trend *re-used materials aesthetics* was selected as more intense re-using expression. It was evaluated less positive as the first one, and its acceptance is questionable. Emotional response was hardly positive – disapproval (25.1%) was the dominant answer and was led by the disgust (2.9%) and contempt (1.6%). The third group in the survey *trashy anti-consumerist architecture* was selected as an extreme re-use example which is actually a form of a protest rather than architectural trend.

It was interesting that respondents noticed this difference. The results showed that the greater whole of respondents didn't want to accept this kind of projects. The comments were rich of keywords such as "manifesto", "slum", "trash", "landfill", etc. Two comments greatly illustrates the disagreement towards this trend – „genius“ and „shit“. Negative emotions, such as disapproval (32.5%), contempt (9.5%), disgust (0.8%) were obviously more expressed than positive feeling such as acceptance (7.0%), interest (2.5%) and surprise (0.8%).

Respondents raised questions towards the quality of aesthetics and architecture itself. Many respondents noticed the colorfulness.

While evaluating *low-tech expressive organic forms* architecture, three groups of answers were noticed: 1 - appreciated as beautiful and sustainable, 2 - disliked because of strongly expressed mannerism, 3 - thought that this style is quite oriental and more appropriate for Eastern part of the world. Integration with the environment was noticed as a frequent remark. This architectural direction was acceptable for the much larger group of respondents and was considered environmentally friendly more often. More positive feelings were noticed such as admiration (15.6%), acceptance (14.8%), interest (9.1%) and surprise (0.4%), rather than negative, such as disapproval (14.8%), contempt (0.8%) and disgust (0.4%). People that expressed pensiveness (9.5%) raised question about the importance of the context, durability, sustainability and appropriateness of this trend to the Lithuanian context.

Low-tech ecological buildings that express contemporary architectural form was accepted really well. Several respondents even expressed the wish to live in this kind of building. The most common keywords in their comments were sustainable, beautiful, ecological, traditional and local. The majority of respondents also noticed that this trends looks environmentally friendly. Some respondents expressed apprehension (0.8%) and pensiveness (5.3%) towards the question if these type of buildings are durable and long-lasting. Acceptance (34.6%), admiration (29.6%) and interest (2.1%) were the dominant positive emotions while negative were only (4.9%) of disapproval.

Evaluation of *eco-technological buildings* was not as good as expected. Although it was evaluated as acceptable, results of emotional analysis showed that positive and negative feelings in the comments balanced quite equally ((acceptance – 26.7% and admiration– 9.5%, while disapproval 20.6%). A lot of respondents noted that the trend is appropriate only for the city center, and only for public and commercial

use such as offices. Some comments were that the style looks acceptable, however, it is hardly compatible with the protection of the environment. Expensive and complicated construction, requiring innovative and expensive technology, delivery of the materials extends the supply chain and in this way increases carbon footprint. Apprehension towards the complicated and expensive maintenance of the building such as huge heating and cooling costs, difficult window cleaning, frequent replacement of ventilation filters, and even threats to health such as faster spread of diseases, raising air temperatures in cities. "Lifeless", "deadless" and "disastrous to birds" – was one of the reasons why this type of architecture was disliked. Other features such as non-human scale, aggressive domination, endangering animals and local landscapes, uncozy appearance were the aesthetical reasons of unacceptance. Also, the use of glass in large amounts was one of the unaesthetical features. On the other hand, many respondents agreed that this type of building may be indirectly sustainable, which depends totally on the technology used for saving resources and energy. The larger group of respondents stated that this type of architecture doesn't look sustainable.

Vegetated architecture trend collected the great majority of the positive answers. The results showed its great acceptance to the city environment which lacks nature a lot. Many answers were related to the purified air, beauty and vitality. The apprehension and pensiveness were referred mostly to the maintenance and installation issues as well as concerns regarding to the impact for the building structure. If these questions were solved, this trend would be one of the best accepted.

Building-landscape architecture was also accepted very well but it was related more to natural suburban environments and for places where was important to preserve the view of the landscape. The probable disadvantage of this type of buildings was noted as changes of the natural terrain and possible lack of the sunlight. Respondents noticed that it looks visually

sustainable, however the real sustainability depends on the materials and technological solutions used in the construction.

Although *expressive iconic organic forms* was accepted positively and evaluated as exceptional, interesting and eye-catching, the form itself was not related to environmental sustainability and even in some cases this construction was noted as costly solutions that are complicated to implement and require much more resources. Also, this trend was

more acceptable for public buildings rather than individual houses.

Biophilic architecture trend was considered as acceptable and environmentally friendly and was one of the most favorite trends. On one hand, biophilic trend was acceptable through the connection between human and nature, on the other representation of nature and connection to it was criticized as not sustainable enough without sustainability in construction and materials. (Fig. 4)



Figure 4. Summary of motional evaluation of the trends of the sustainable architecture. Source: (Author 2022)

4. CONCLUSIONS

The concept of sustainability, even though currently acknowledged as the paradigm of development of societies, is not stable and is constantly evolving, currently embracing the notions of restorative, regenerative sustainability and resilience. The expression of sustainable buildings similarly varies between techno-centric, eco-centric solutions and sometimes provocative experiments, futuristic solutions or re-using - recycling projects. For the paradigm of sustainability to succeed social and psychological acceptance is of crucial importance and aesthetic expression of sustainable architecture can play an important role here.

Analysis of literature and examples has revealed the wide array of sustainable design manifestations focusing on high-tech, low-tech solutions, inspired by the characteristics of natural systems and genius loci of the locality, focused on social sustainability. The following trends were distinguished as having potential for diversifying the expression of sustainable buildings: low-tech re-used materials buildings, re-used materials aesthetics, trashy anti-consumerist architecture, low-tech expressive organic forms, low-tech ecological buildings, eco-technological buildings, vegetated buildings, building-landscape integration, expressive iconic organic forms, biophilic architecture.

The study analyzed 1816 comments related with opinion about the sustainable architecture trends and analyzed them using quantitative (NLTK VADER sentiment analysis tool) and qualitative (R. Plutchik's (2001) classification of emotions). The most acceptable and environmentally friendly looking trends were low-tech ecological, vegetated, building-landscape and biophilic buildings. The least acceptable was trashy anti-consumerist, however it was understood as awareness raising project. Many of the respondents welcomed the idea of recycling and reusing, however noticed that the architectural

expression is not aesthetically pleasing enough and showed concern to the ecology of the materials used, structural and environmental qualities, impact for the health, material compliance with the legal requirements. Low-tech ecological buildings was one of the most positively evaluated trends, although raised several questions if these type of buildings are durable and long-lasting. Many of the respondents expressed wish to live in this type of house. Although eco-technological trend demonstrates the implementation of environmental friendly technology, it was one of the least related to the environmental protection.

The study showed that sustainability is understood as the wholeness of architectural and engineering solutions, were visual appearance of the building plays and important role. The best appreciated trends were related to naturalness and durability, used environmentally friendly solutions, such as protection of trees and landscape, saving resources, reducing carbon footprint, using sustainable engineering solutions and use patterns.

The study may be concluded by one quote of unknown person of the study:

Style must follow an idea and modern humanity has the ability and means to implement almost any idea in a variety of styles. Style, I think, occurs of what technology is used to extract a particular form of art, and even what material, what function it performs - a pragmatic goal is the essence, it dictates the form as a consequence, not as a goal!

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