

WHOLENESS, VISUAL COMPLEXITY AND MATERIALITY: A Comparative Analysis Using Fractal Dimension Analysis And Mirror Of The Self-Test In The Case Of Material Imitations.

introduction

There is a notion called Biophilia hypothesis (Kellert-Wilson, 1993), which says that nature and its manifestations have beneficial effect on us humans because we have an innate connection or resonance with it. Not only biologically, but also mentally, and spiritually. Even nature evoking images have the healing effect, and even visual and spatial qualities of **diversity and coherence**, hence **complexity**. We can find them in traditional architecture and art work, but we are lacking it in the contemporary architecture of minimalistic, chaotic, or rigidly mechanical forms.

Christopher Alexander, who managed to comprehend the creative order of nature through observation and abstraction, came to a conclusion that all forms including organisms or buildings have a quality, which is the essence of that order. He calls it various names such as **wholeness**, **life**, **beauty**, and states that its presence is only a matter of intensity. By his theories collected in the book *The Nature of Order* (2002-2005) he rehabilitated a theory of architecture derived from observation of nature along with re-discovering beauty as a structural phenomenon.

Nikos Salingaros, attempted to elaborate a quantitative approach to some of the aspects of Alexander's theory by developing an analytical method for estimating of *architectonic life* (Salingaros, 1997, 2006, 2017). Another researcher Bin Jiang took a similar path developing a computational tool for "measuring *structural beauty*" (Jiang, 2015, 2019, 2021). Another indicator of complexity in natural forms or architecture is *fractal dimension*, which shows some interesting correlations between a middle value 1,4-1,6 and *biophilia effect* - stress reduction, fastening recovery, or better performance. (Salingaros, 2017, Taylor 2006)

In this paper I argue against their approach as both Salingaros and Jiang violate the notion of *wholeness* by selecting only the quantifiable aspects by purely analytical means and reducing *life* to a mere visual complexity.

research question

If we take into account the biophilia hypothesis assumption that a mere image of a natural landscape in a room can reduce physiological stress and increase comfort, then what is the case of synthetic or massively processed materials mimicking natural materials? Can a wood-like floor made from plastic have a healing effect for its nature evoking visual qualities? Is classicist façade made of polystyrene beautiful? Has melamine board with wooden décor life in it?

In this comparative study we attempt to clarify some aspects of the relationship between visual complexity and *wholeness* by questioning the *wholeness* of a material itself.

The hypothesis proposed in this paper is that inner structure of material has its own degree of *life* and that it is no less important than visual appearance on its surface. The basic assumption is that "natural materials" and the less processed ones have a higher degree of *life*. Since there is no usable distinction between natural and synthetic (unnatural) materials I propose a term defined for the purpose of this paper as:

material authenticity

a degree of preservation of inner structure and surface texture of the original material extracted from natural environment in a final material product. This shall cover
 (1) a degree of transformation (change of properties) during production - processing
 (2) a degree of incoherence between visual properties and other material characteristics - hence a "fakeness" of an imitation (level of perfection of imitation is not relevant)

materials and methods

I chose to support the argument against sole visual complexity by an empirical study. In this case we compare floor designs of different degree of visual complexity and confront the results with real material samples of different degree of material authenticity.

method no. 1 - fractal dimension analysis

For the measurement a widely used box-counting method was used with the use of program ImageJ. Any image can have its fractal dimension measured even images not necessarily having any fractal geometric qualities. Therefore, fractal dimension analysis was used primarily to provide a quantitative data about relative degree of visual complexity.

We can find recent use of this method in e.g. measuring complexity of hindu temple in Northern India (Rian et al. 2007), mosque façades (Ediz and Ostwald 2012; Ostwald and Ediz 2015), or modern public building complex in historical context (Lionar and Ediz 2020).

method no. 2 - Architectonic life according to Nikos Salingaros

Nikos Salingaros developed a method for estimation of wholeness (life) in structures according to *15 fundamental properties* (Alexander, 2002-2005) that has its numerical expression on the scale 0-100.

"1)The architectural temperature T is defined as the degree of detail, curvature, and color in architectural forms; and
 2) the architectural harmony H measures their degree of coherence and internal symmetry. This model predicts a building's emotional impact. The impression of how much life a building has is measured by the quantity $L = TH, \dots$ " (Salingaros, 1997, 2006, 2017)

method no. 3 - mirror of the self test according to Christopher Alexander

A comparative method developed by Christopher Alexander (2002-2005) to receive an universally shared subjective value judgment based on a deep feeling of a respondent. The comparison shall reveal a relative degree of *wholeness (life)* of any the two subjects. Variation of the method had been used e.g. in dissertation thesis by David Eyer (2016) from a complex perspective of building biology. Another variant provided Yodan Rofé as a method of feeling maps which he uses for evaluation of fitness of urban environment for human wellbeing. (Weinreb-Rofé, 2013)

The mirror of the self-test is approached as an in-depth interview in person, where all the samples were compared in pairs. Few of them were essential to answer the research question (1-2, 1-3, 2-3 for images, and 1-2, 2-3, 2-5, 3-4, 4-5 for material samples).

results

In the first case of comparing images of different floor designs, the results are in accordance with the assumption that higher degree of visual complexity is proportional to a degree of wholeness which was supported by considerable majority of respondents. The difference makes the comparison in pairs of samples 2-3, and 2-5, where ceramic tile floor (2) of smaller degree of visual complexity was considered as more *living* than ceramic tile floor imitating wooden parquet (3) or wood-like vinyl (5). This result supports the hypothesis that higher degree of material authenticity has more importance than visual complexity when it comes to the question of wholeness.

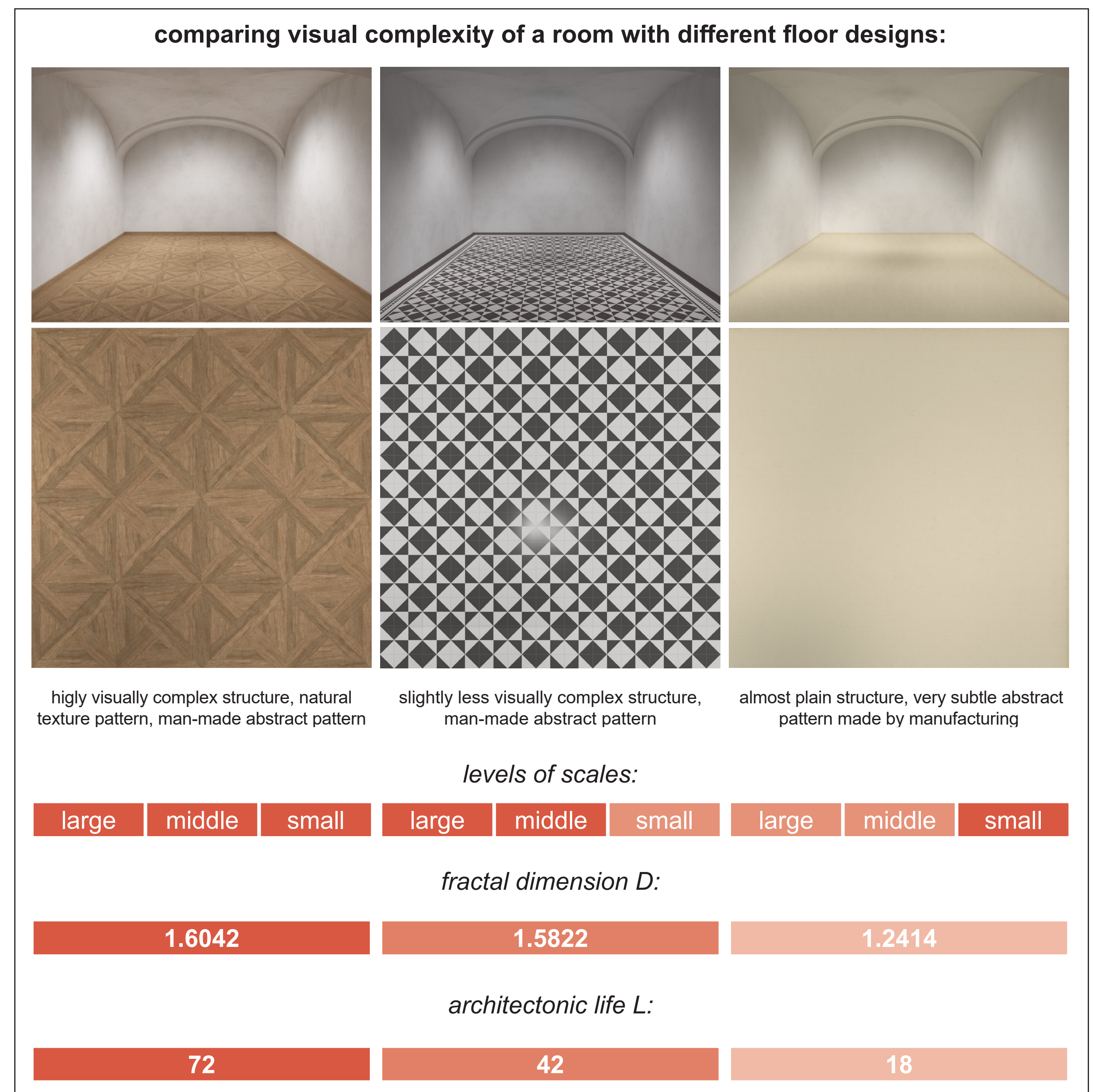
The implications of this result challenge the attempts for quantifying beauty by measuring visual complexity. It also broadens the discussion on the material substance and its own wholeness. The discussion of the paper opens the question of biophilia effect caused by nature evoking images such as synthetic imitations and calls for further research applying proper somatic response tools.

conclusion

The study confirmed a correlation between visual complexity and wholeness in cases comparing images. However, when the real material samples were compared, the results from the qualitative approach were in contradiction with the previous complexity-wholeness correlation. The results confirmed the hypothesis that material authenticity has considerable importance in the evaluation of wholeness. Therefore, the answer to the research question is that wholeness is not reducible to a mere visual complexity.

research question

Is wholeness of structures reducible to the visual complexity?



comparing wholeness of particular material samples by mirror of the self test:



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