

Psychological traits as an influence on architectural creation

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ABSTRACT: The objective of this study was to explore the spatial human preferences in architectural creation based on personality traits. The authors performed an experiment with students of architecture in the Faculty of Architecture at Slovak Technical University in Bratislava (FA-STU), Slovakia. This confirmed the correlation between psychological traits of personality and spatial preferences. The authors chose the Myers-Briggs type indicator (MBTI) typology. Subsequently, they created a spatial test consisting of a range of spaces and parameters - conceptual, functional, artistic, ideological and formal. Two hundred and one students at FA-STU were involved in the research. The authors found statistically significant correlations between the psychological characteristics of personality and the spatial preferences in architectural design. The results of the survey with the evaluation, discussion and limitations are the subject of this article.

INTRODUCTION

The student of architecture is the creator of space. Their work is the embodiment of external influences and a reference to inner subconscious perceptions of the world. The authors as teachers, architects and researchers, observe the variety of thinking and variety of work with spatial attributes in student projects. They observe that the students do not design according to the teachers' perspectives, but according to themselves. However, the goal of architectural education is to teach students how to think about space, to teach them about the possibilities that could be developed further by them and about the possibilities, which would be advisable to choose on the basis of their own convictions. Architecture is time-referenced and nowadays, new materials and technological innovation lead architects and theorists to think about new perspectives of space; but some may tend to be nostalgic. Each person is unique and this brings diversity and innovation to architecture. It is similar with students of architecture: they are different in nature, character and behaviour, which influences their creative approach, their architectural thinking or their selection of spatial parameters.

An aim of the article is to point to the diversity of perception of space and to create a relationship or form of communication between the student and the university. Each school has a considerable influence on the student. In May 2018, the researchers performed a psychological and spatial experiment in the Faculty of Architecture at Slovak University of Technology in Bratislava (FA-STU), Slovakia. The experiment was part of wider research about the impact of education on student creativity. The main objective of the research was to find the relationship between the psychological traits of the student of architecture and their spatial preferences in creativity. The research has focused on architectural thinking, approach to creativity and the overall design process, as well as on spatial parameters that are physical but also ephemeral.

The research partly was on the psychological process and the researchers decided to work with the Myers-Briggs type indicator (MBTI) [1]. During an experiment, the opportunity of a choice was given to students to reflect on what they tend to do in architectural creation and to gain a better understanding of themselves. The choice has shown an essential element in the personal nature of student, because the student has to think independently about the consequences of their choice. In this article the first results of the experiment are presented and they point to the importance of the student as an individual creator, who has something original to contribute.

LITERATURE REVIEW

The synergy of human and architectural space is characterised as imaginative-associative related to human memory and imagination. This psychological level of space awareness evokes the emergence of an individual's energy, whose reaction appears in a form of perception, association, memory, imagination and feelings. This can turn into a psychological state that is determined by personal memories. Therefore, the architect - and especially the space

created - is influenced by various factors, such as memories, childhood and subsequent aging, modifications in self-perception, dynamics of relationships, education process, culture and society. These external influences form an inner subconscious perception of the world and generally form human personality. There is an interconnection of the human mind and the psyche in creation [2].

Experience with space is dynamic and interactive. The space, as a result of the design, is formed by the creative imagination of the student. It is interesting to note that students do not create just realistic projects; they create ideological proposals, visionary projects, ecological or experimental projects, projects reflecting current technical trends or projects with a profound philosophical concept.

The authors observe different ways to guide students. However, the aim of architecture education is to teach students how to think and contemplate space, and options as to how to proceed. An important component is to know how to perceive the space and how to imagine it. The space is created through the rational and aesthetic principles of the physical world, but the subjective approach to architectural design signals a confidential private encounter between the creator and the space. In the education of architecture, it is appropriate to provide the opportunity for students to get to know themselves in the context of the sensory and spatial engagement with architecture [3]. It can help to explore their inner depths shown in the project, as well as their relationship with the larger world or the requirements of society.

Nowadays, new challenges require an interdisciplinary and diversity of approaches. 21st Century architecture is in the position to strongly collaborate with other disciplines [4]. Changes in society at the end of the 20th Century and the arrival of a mass-consumer economy also have increased the multidisciplinary need which, in turn, requires the adaptability of education [5]. Therefore, a large number of conferences are organised every year to talk about how to educate and how to teach architecture, in co-operation with new technologies which inevitably arise from the present environment.

Understanding the relationship between space and humans is a subject of environmental psychology (Stokols [6]). This relationship between human behaviour and the physical environment is more complex. In different fields there are multidisciplinary studies by psychologists, sociologists, cultural geographers, engineers, artists, architects and designers (Yi-Fu Tuan [7], Matthews [8], Blunt [9]), who explore how a person perceives their surroundings and how they are influenced by it. To underline the research in environmental psychology, human-environment optimisation should be mentioned [6].

The concept of environmental optimisation is based on a cyclical, feedback model of human cognition and behaviour and pertains broadly to human transactions with the physical environment. These transactions can be characterised in terms of two basic dimensions: firstly cognitive (or symbolic) and behavioural (or physical) forms of transaction, and secondly as active or reactive phases of the transaction. These dimensions essentially concern the extent to which cognitive representations (e.g. beliefs, attitudes, cognitive maps) or physical and social features of the environment (e.g. material objects, other people and rules) either influence or are modified by the individual [6].

In environmental psychology a number of areas can be explored as environmental interpretation, environmental behaviour and environmental assessment. In the research presented, the authors understand the physical environment as a built form or more accurately as an architectural form that does not have to be built in a real world. In general, the relationship operates in two ways: influence of human on environment (by design) and influence of environment on human (by designed space).

There has been more research carried out that deals with space as a built environment, with human relationships and with personality differences. An experiment, in the United States of America, through collaboration between the University of Texas at Austin and the University of Nebraska - Lincoln used an MBTI typology to study the design decisions of students of interior design. The authors, Matthews et al [5] examined the relationship between the personality and the form of family houses, specifically design characteristics of the house and its organisational principles, as defined by Ching [10] and *A Pattern Language* defined by Alexander [11].

Another example of an experiment with personality differences opens up the idea of development of various types of *makerspace* across the United States and the world to enable people to create and innovate [12]. The education community has recognised the potential for makerspaces as learning environments that can foster interdisciplinary collaboration and self-directed learning. One part of the project focused on the design of such spaces by applying the environmental preferences predictors psychology construct. The study surveyed 276 students from art and design, engineering, and liberal arts majors to understand their preferences as related to images of eight different makerspaces.

The last example was a study of Cleridou and Furnham [13]. The study investigated the relationship between aesthetic preferences and personality dimensions across the three domains of art, architecture and music. In this study, gender, ethnicity and artistic experience were also found to exert some influence on aesthetic preferences.

The inspiration for this research was a *Scheme of Spatial Symbolism as an Orientation Aid for Art Processes Interpretation* drawn by Anette and Lutz Müller [14]. The scheme identifies the creator's direction in artistic processes.

Based on the scheme, it is possible to ascertain the artist's inclination, whether to transcendence to inner private images, to the unconscious mind, to external reality or to themselves. On the one hand, there is art, which exactly simulates the real world and refers to visible stimuli; on the other hand, there is art as abstraction with inner thinking and vision, as well as the artist's own reflection. These are a reference to the author's subjective preference. The MBTI method is also used in other sectors, such as fashion, interior design and painting.

METHOD AND MATERIAL

The main objective of this work was to quantify the statistically significant correlations between the predominant properties of personality type and the attributes of architectural space, and subsequently to characterise the spatial preferences according to the MBTI personality grouping by temperament. The focus in the article is on the interpretation of environment based on spatial knowledge, and the diversity of perception captured in the relation between the personality and the environment. It is a research of subjective human preferences related to architectural space.

At the Faculty of Architecture STU in Bratislava, the researchers performed an experiment in May 2018 and the students of architecture were asked to participate. The research sample was 201 students. Based on the fill-in timeframe parameter, four participants were excluded from the research sample. The total number of respondents decreased to 197, including 31% men and 69% women. The prevalence of Slovak nationality was 96.4%. The majority of students, 81.7%, were aged between 18 and 25; 17.8% were between 26 and 30 years and 0.5% were between 36 and 45 years.

The authors have performed the same experiment in Europe; first, at the Centre for Information Technology and Architecture, part of The Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation in Copenhagen; second, at the Faculty of Architecture at Technische Universität Dresden in Germany; and third, at Universidad Politécnica de Madrid in Spain. Data are still being collected. After the data collection process is completed, the authors will proceed to analysis and they will then compare results from different cultural contexts.

In this contribution, the authors present the data from FA-STU in Bratislava. The experiment consisted of two parts. The first part is called the psychological part. In the psychological section, the authors decided to use the Myers-Briggs Type Indicator known as MBTI. In the selection process of psychological typology, the authors went through the analysis of several psychological tests, such as the Keirsey temperament sorter, the Big Five model, emotional quotient and the Myers-Briggs type indicator (MBTI), need for cognition scale and faith in intuition [15].

For the comparison of psychological tests, the criteria were: usability and availability; simple implementation for the general public; complexity and extensiveness of the model; the exactness of the model in predictions of behaviour; critical public opinion and compliance with research objectives. Considering all the criteria, the authors have chosen the MBTI psychological test in accordance with the research objectives. This model is suitable for the research propositions; the application of it is to examine human feelings and thinking, and perception of the space. The terminology of MBTI is related to architectural terminology often used at the schools of architecture [16]. Therefore, the data interpretation is more understandable for architects. The model has the largest representation in connection with spatial creation and it tends to be quite specific. The authors take into consideration some limitations of the personality test, i.e. people cannot exactly see and identify the inner subconscious perception of the world.

By using the MBTI test, the psychological type of personality of each respondent was obtained. Each type of personality is defined by four predominant properties (see Table 1); hence, there are 16 different combinations. Each of them is included in the research sample. Four pairs of preferences, also called dichotomies, describe four activities. The first pair describes the way a person is energised between the dichotomy extroversion (E) and the introversion (I). The second pair describes the way of perceiving, awareness and understanding, between the dichotomy sensing (S) and intuition (N). The third pair describes the decision-making process (processing of information), between the dichotomy thinking (T) and feeling (F). The fourth pair reflects the way of living (lifestyle), between the dichotomy judgment (J) and perception (P) [1].

The authors have divided the research sample according to the combination of characteristics: extroversion - 34.52%, introversion - 65.48%; sensing - 42.13%, intuition - 57.87%; thinking - 66.50%, feeling - 33.50%; judgment - 71.07% and perception - 28.93% of students. On the basis of the individual characteristics, MBTI typology provides groupings by temperament [16] (see Table 2): SJ (guardians, traditionalists); SP (artisans, practitioners); NT (rationalists); NF (idealists) [16].

The most common groupings in the research sample were NT (rationalists) represented by 35.53% and SJ (guardians, traditionalists) represented by 35.03%; NF (idealists) were represented by 22.34% and SP (artisans, practitioners) had the lowest representation at 7.11%.

Table 1: The survey sample group by four dichotomies (definitions in the text).

Percent	I	E	S	N	T	F	J	P
%	65.48	34.52	42.13	57.87	66.50	33.50	71.07	28.93

Table 2: Survey sample group by temperament (definitions in the text).

Percent	SJ	SP	NT	NF
%	35.03	7.11	35.53	22.34

The second part of the experiment was called the spatial test. The authors used the theory of architects and theoreticians of architecture from Cornell University, Simitch and Warke, which is presented in the book, *Language of Architecture* [17]. The authors of the book clearly separate and define the categories and the components that the architects use to create the space which is later perceived by the space user. The spatial test was divided into categories: elements (concept, representation); givens (context, environment); physical substances (mass, structure, surface, materials); ephemeral substances (space, scale, light, movement); conceptual devices; organisational devices (infrastructure, order, grid, geometry); constructive possibilities (fabrication, prefabrication). The authors worked with a set of nominal data from the results. When processing the final matrix of nominal data, they created contingency tables. Each internal cell of this table represents a definite specification of the categories that has allowed the authors to determine the number of respondents who fall into each category. A chi-squared test was used to determine the confidence level of the two variables. It is a nonparametric statistical test based on the contingency table that verifies statistically significant differences between observed and expected frequencies. In order to determine statistically significant relationships and according to the nature of the data, Cramer's coefficient V and phi coefficient were used. The results were processed in MS Excel and the statistical program SPSS.

RESULTS AND DISCUSSION

The results are presented for the Faculty of Architecture, STU. As art, architecture has a polarity of properties - abstract and concrete. The abstract idea, the essence, is preserved in every architectural work, which is eventually transformed into a specific form. The process of space creating offers a wide range of options. The decision or choice of options is rooted in human psyche. These decisions are often conscious, but often subconscious as well. The research sample was divided into MBTI grouping by temperament [1][16], which mostly reflects perception and subsequent acquisition of information. This division primarily is based on observable models of behaviour that can be considered models of activity, and describe differences between people that have been documented in different cultures throughout history. Data analysis revealed statistically significant correlations from weak to moderate. Results are presented in subcategories, such as concept, mass, materials, light and scale. All results refer to the space designed by the student.

One of the strongest correlations was found in the category called concept, where the authors asked for approach to design and way of thinking when designing. The concept of space was created by the architect during the design process, and it is one of the basic elements of architectural thinking that are necessary for the further development of visual language and critical thinking. On the one hand, it was found that students with a predominant trait of sensing in the way they perceive (in MBTI typology called guardian, traditionalist, artisan, practitioner), work to find a practical solution that is rational and technical ($0.319, p = 0.000$). On the other hand, students with a predominant trait of intuition in the way they perceive (in the MBTI typology called rationalists and idealists), perceive the concept as searching for the philosophical depth of space, looking for poetry and art ($0.319, p = 0.000$). Of course, architecture requires a combination of both. These results are just a reflection of work preferences. These results reflect the second pair of MBTI dichotomies, asking how people perceive.

Expression of architecture can be divided into physical and ephemeral substances. For physical substances there are preferences in mass and materials. The authors have found a moderately strong statistically significant correlation for preference of form. The majority of people are inclined to create simple orthogonal buildings and elements, but students with the predominant trait of intuition in the way they perceive, and with predominant trait of feeling in the way they decide (idealist), prefer to work in a combination of forms ($0.290, p = 0.011$) - orthogonal and obliquity. Up to 70.6% of students incline to local traditional materials and according to them experimental materials are still in the future. Therefore, the authors decided not to explore the relationship between the personality type and the preference of a particular material, but rather the material properties. These results could be later applied to new experimental innovative materials, too.

The research was focused on areas of matt and gloss, smooth and structured surface, lightness of material, transparency of material or quantity of materials used in one space. The statistically significant low correlation was found in the relationship between personality type and preferred surface of material. The authors claim students who are perceptive, usually deciding according to their feelings (artisan, idealist), tend to structured material, haptic communication and perception of material not through visual senses ($0.217, p = 0.026$). From ephemeral substances, there are preferences in light and scale. Light is a matter of time, how the time changes; the atmosphere changes, too. With light, ideas can become visible. Light can point to symbols, promote perception, create light optical works.

The authors have studied light's basic properties, such as intensity, direction, source, colour and properties, such as directness, diffusion and the relationship of light and shadow. The statistically significant correlation with low intensity was found between students with a predominant trait of sensing in the way they perceive and with the predominant trait of judging in the way they live (guardians, traditionalists); and a preference for direct intensive light ($0.240, p = 0.010$).

In the subcategory called scale, the authors found that students with a predominant trait of intuition tend to design at a larger scale and with larger areas, while students with a predominant trait of sensing tend to design on a smaller scale with smaller spaces (0.275, $p = 0.002$). No significant correlations were detected in the subcategory of movement. Very interesting was the finding in the subcategory of materials especially for matt versus gloss. Nearly 89.8% of students tend toward opaque materials. However, trends in mainstream design can influence preferences. In the subcategory of colour, the majority decided on white or grey to keep it neutral. A selection of the results is shown in Table 3.

Table 3: A selection of results: preferences in spatial creation.

Spatial definition	SJ	SP	NT	NF
Concept as a practical solution	0.319 ($p = 0.000$)	0.319 ($p = 0.000$)		
... philosophical depth of space			0.319 ($p = 0.000$)	0.319 ($p = 0.000$)
Primary is the physical part	0.242 ($p = 0.001$)			
... perceptual part		0.242 ($p = 0.001$)	0.242 ($p = 0.001$)	0.242 ($p = 0.001$)
Spatial perception as movement in space				
... wow effect				
Environment as city	0.243 ($p = 0.001$)	0.243 ($p = 0.001$)	0.243 ($p = 0.001$)	
... countryside				0.243 ($p = 0.001$)
Land as flat	0.174 ($p = 0.015$)			
... oblique		0.174 ($p = 0.015$)	0.174 ($p = 0.015$)	
Mass - obliquity				
orthogonality	0.290 ($p = 0.011$)	0.290 ($p = 0.011$)	0.290 ($p = 0.011$)	
combination				0.290 ($p = 0.011$)
- lightness		0.187 ($p = 0.009$)		0.187 ($p = 0.009$)
massiveness	0.187 ($p = 0.009$)		0.187 ($p = 0.009$)	
Material - smooth	0.217 ($p = 0.026$)		0.217 ($p = 0.026$)	
structured		0.217 ($p = 0.026$)		0.217 ($p = 0.026$)
Scale - small	0.275 ($p = 0.002$)	0.275 ($p = 0.002$)		
big			0.275 ($p = 0.002$)	0.275 ($p = 0.002$)
Light - intensive	0.240 ($p = 0.010$)			
diffuse		0.240 ($p = 0.010$)	0.240 ($p = 0.010$)	0.240 ($p = 0.010$)
- side light	0.247 ($p = 0.002$)		0.247 ($p = 0.002$)	0.247 ($p = 0.002$)
light from above		0.247 ($p = 0.002$)		
light from below				
- direct	0.258 ($p = 0.001$)		0.258 ($p = 0.001$)	
diffusion		0.258 ($p = 0.001$)		0.258 ($p = 0.001$)
reflected				

CONCLUSIONS

The experiment resulted in statistically significant correlations between the psychological type measured by MBTI and spatial preferences in architectural creation. The authors grouped the research sample by temperament and quantified their relation to the defined categories: elements; givens; physical substances; ephemeral substances; organisational devices; and constructive possibilities. Specifically, the authors found that students with a predominant quality of intuition tend to more philosophically oriented projects, while students with predominantly sensing attributes tend to practical architectural solutions. Students with a predominant quality of perception through sensing, and with the quality of perception as an automatic innate activity, tend to orthogonality and structured material. Students with a predominant attribute of intuition prefer to create spaces of a larger scale, unlike students with sensing attributes who prefer smaller scales. The last selection from the results was that students with a predominant quality of perception prioritise manually controlled space, unlike students with a predominant quality of intuition, who tend to technologically automated space. It is just an example to show diversity in architectural creation, based on the character of the creator.

These results are applicable to students of architecture at FA-STU. Students are partly influenced by the educational process, as well as the working experience in the cultural context of Slovakia. Therefore, the authors intend to verify the results further in equivalent experiments with different samples and with different nationalities or ages. Immediately after the termination of data collection in Europe, specifically at the Centre for Information Technology and Architecture at the Royal Danish Academy of Fine Arts, the Faculty of Architecture at Technische Universität Dresden in Germany and at Universidad Politécnica de Madrid in Spain, the authors are going to analyse the data and subsequently, compare preferences of architectural students according to their psychological traits in different cultural contexts. The authors believe this will make the data applicable for at least European students of architecture.

Various limitations have been identified in the research process. The testing captures the current state that can change over time. Therefore, the authors are planning to rerun the experiment in successive years with the same research sample. They will start with a sample of first year students and continue with the same sample of students through the sixth year of study at FA-STU. The authors aim to identify the influence of education on their architectural creations.

The next limitation is that the MBTI typology does not point to inner, deeper subjective dimensions of human thinking and feeling. The MBTI typology categorises a research sample into defined types. In preparing the test, it was necessary to define the spatial parameters in advance. The experiment has identified spatial preferences, but the general space has spatial parameters for the whole, and not separately. Would the outcome be confirmed with overlapping parameters in the real space? The authors assume the results of this research can be verified by an EEG (electroencephalogram) tool. The authors view the results reported here as providing directions for further research. They made a comparison of the results with research at the University of Texas at Austin and the University of Nebraska-Lincoln called, *Personal Bias: the Influence of Personality Profile on Residential Design Decisions*. Multiple results overlap, many of them were shown as similar, despite working with students from another cultural context.

The authors believe the results can bring developmental opportunities in architectural practice and in the education of architecture. The identifying of statistically significant correlations between the psychological type of student and their spatial preferences can create a system of communication. After a long-term review of the same group of students, the university has the opportunity to obtain feedback about the teaching process. The authors think this way can direct the process of education and subsequently can contribute to future development, especially through self-knowledge and a focus on an individual approach to the student. Subsequently, the authors would like to find a new system of teaching to develop an experiment in architectural composition [18].

At the school of architecture, students should draw mainly what they perceive subjectively, and through the process of embodying the idea into the project they will gradually become rational and constructive. This experiment is also an attempt to understand human diversity, to approach the student as an individual creator, to seek out more information about how and where this variety of creation is most manifest.

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