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SCOPE AND AIMS

The review is concerned with a multi-disciplinary approach to spatial, regional and urban planning and architecture, as well as with various aspects of land use, including housing, environment and related themes and topics. It attempts to contribute to better theoretical understanding of a new spatial development processes and to improve the practice in the field.

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EDITORIAL

Dear Readers,

The past few months have been exceptionally challenging on a global level due to the Covid-19 pandemic, and confronting it still seems like a long and winding road ahead of us. The *Spatium* journal has not escaped this test either. However, the journal's mission and goals continue to move forward because of the efforts by the people who have built it to its present standard (including the publisher, editors, reviewers, technical support, and last but not least the authors themselves). Hence, our publishing regularity has not been jeopardised, nor has the quality of the papers been in question at any time. We are proud that *Spatium* has shown resilience by absorbing the stress of the situation, and even undergoing some reorganisation, but without compromising its ability to essentially keep the same function, structure, identity, and feedback.

This issue's contents include scientific research on various topics from broader fields of spatial and urban planning and sustainable development, viz.: the tourism potential of protected natural areas at the regional level; ways to enhance public space; the role of urban governance in a smart city for generating new forms of social collaboration; and the relationship between the concepts of urban metabolism and multi-functional land use. Other research is in the domains of: housing – e.g. a contemporary variant of the traditional bondruck system in residential building practice; architecture – the models of fluidity between architecture and infrastructure, and a synthesis of architecture, music and technology with other sciences; and finally, design – approaches in creating an urban lighting atmosphere and meeting the societal need for achieving the potential of light technology. The majority of the contributions to this issue of *Spatium* come from Serbia, but there are also some research topics elaborated by authors from Bulgaria, North Macedonia and even Australia.

As announced in the previous issue of the journal, in 2020, *Spatium*'s Editor-in-Chief changed. Over the past 15 years, Miodrag Vujošević has successfully run the journal, and increased *Spatium*'s prominent scientific status, both in Serbia and internationally. He will continue to work as a member of the Editorial Board, so this period marks the transition of our two roles, and harmony in our change of duties. In the case of any thematic issues of the journal in the future, guest editors may be invited depending on their expertise, including the former Editor-in-Chief.

Spatium has switched to the latest version of Open Journal Systems (OJS) as a part of the Public Knowledge Project (PKP), which is a free/open source software that will improve the quality and reach of the journal, i.e. apply state of the art in managing the entire submission, editorial workflow and publishing of the articles and issues online.

Jasna Petrić Editor-in-Chief

THE SIGNIFICANCE OF PROTECTED NATURAL AREAS FOR TOURISM IN THE VOJVODINA PROVINCE (NORTHERN SERBIA) – ANALYSIS OF SUSTAINABLE TOURISM DEVELOPMENT

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This paper presents experimental research into the attitudes of tourists towards the significance of protected areas with regard to tourism in the Autonomous Province of Vojvodina, in the northern part of the Republic of Serbia. It is an area with significant rare plant and animal resources, as well as wetlands, ecosystems, and hilly and mountainous areas. Several research methods have been used in the paper. The first method is to collect data using a written questionnaire that was completed by 215 visitors to different protected areas in AP Vojvodina. Their answers revealed their attitudes toward sustainable tourism in selected protected areas. After examining the differences in the answers using the Kruskal-Wallis test, the results of the survey conducted by the authors were examined by means of two comparative analyses of identical, related, and similar answers in selected case studies. Based on the results of the importance of activities and the forms of tourism chosen when visiting protected areas. The most important forms of tourism are ecotourism and adventure tourism. Tourists also identified hiking, cycling, and wildlife watching as the most important activities.

Key words: protected areas, sustainable tourism development, AP Vojvodina.

INTRODUCTION

The development of tourism in areas with weaker economic potential and preserved natural and ethno-social values leads to the revival and preservation of flora and fauna (Fennell, 2015a). This contributes to economic, socio-cultural and ecological prosperity (Butzmann and Job 2017; Job *et al.*, 2017) because previously non-tourism areas can become significant sightseeing destinations (Carr *et al.*, 2016). In addition, the money gained from this kind of tourism can be invested in improving environmental protection (Holden, 2016). The idea that tourism can lead to regional development has been well-documented by various researchers. According to Manente *et al.* (2014), tourism

has a multidimensional impact on the host destination. The main objectives of the tourism planning strategy are to use the high potential of tourism by developing all of its possible forms in a specific area and to preserve and conserve the environment and the tourism objectives (Oprea et al., 2015; Batman and Demirel, 2016). Tourism in protected areas can unite the three concepts of protection, economic benefit, and social well-being of the local community (Rodary and Milian, 2011; Hoang et al., 2020). The concept of sustainable tourism in protected areas and landscapes is based on this principle (Kruger et al., 2017). The European Landscape Convention defined "Landscape" as an area whose character is the result of the action and interaction of natural and/ or human factors (Polat and Demirel, 2016; Trišić, 2019). Natural areas are regions that have not been significantly altered by humankind and this equates to intact landscapes that contain their original vegetation, and are unspoiled, wild (IUCN 2017), maintained by natural processes, and

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the original biodiversity is present (Newsome *et al.*, 2013). Ecosystem-based management is required at temporal and spatial scales to maintain ecosystems and sustain human welfare (Fennell et al., 2015b; Mitchell, 2019). Therefore, when managing a destination, special models are used, such as the VICE model (Robinson et al., 2013; Štetić and Šimičević, 2015; Trišić et al., 2020). This is based on managing an area with the cooperation of all participants, in order to accept and meet the demands of tourists, to achieve positive economic effects (Leković, 2019), to benefit the local community (Holden, 2013), and to protect and improve the environment and culture (Štetić and Šimičević, 2014). Creating a promotional plan is important in preparing protected areas for visitors, to ensure the best connection between landscapes (Ali and Frew, 2013) and visitors (Pfueller et al., 2011; Štetić and Trišić, 2018). Tourists are starting to look for quiet and peaceful places far away from city centers where they can relax and use all the benefits that nature offers, complemented (Grujičić et al., 2008; Janssen, 2009; Maksin et al., 2011; Malenović-Nikolić et al., 2016) by diverse offers from farmers and landlords (Tisdell and Wilson, 2005). They have a preference for a product and an experience that is authentic, linked to local foods, culture and heritage in a destination, and a willingness to pay a premium price for such an experience (Koens et al., 2009; Ciglovska, 2016). For several tourists, the natural environment and resources constitute the main reason for traveling to a destination (Kim et al., 2015; Mowforth and Munt, 2016; Muñoz et al., 2019).

This paper defines the roles of protected natural areas in the territory of Vojvodina in terms of the development of tourism. Written data on the number of protected areas and species will also be analyzed, along with the results from a questionnaire conducted among potential travelers regarding their opinions about these areas. The results can be used to develop tourism in Vojvodina.

MATERIALS AND METHODS

Context of the study

The territory of Vojvodina covers 135 natural sites, on a total area of 141,044,65 ha under protection (Delić et al., 2017) (Figure 1). This covers 6.56% of the total area of Vojvodina. The protected natural areas include 1 national park, 2 landscapes of exceptional characteristics, 16 special nature reserves, 9 nature parks, 8 strict nature reserves, 26 natural monuments and 2 protected habitats, as well as natural sites in other categories (Sl. list AP Vojvodine, br. 10/2016; Delić et al., 2017). There are also: 8 Ramsar sites (total area of 57,255 ha), and wetlands continue to be cited as the most valuable parts of our landscape in ecosystem service assessments (Mitsch et al., 2015); 21 Important Bird Areas - IBA (354,786 ha); 27 IPA - Important Plant Areas (328,208 ha) and four Prime Butterfly Areas - PBA (91,107 ha) (Puzović et al., 2015; Stojnić et al., 2015; Delić et al., 2017; Sl. list AP Vojvodine, br. 10/2016).

Proper development of tourism can be a conservator and a catalyst for the development of protected areas in Vojvodina. Since this process starts from the aspect of the wishes and intentions of tourists, the research was conducted among

the potential users of protected areas about their attitudes towards these areas.



Figure 1. Location of Protected (Study) Areas of Vojvodina with a position in the Republic of Serbia and in respect to the European Union (Source: digitalized by Trišić, I.)

The multi-method research approach

Each case study of a protected area can be used to analyze its management and protection and its role in the coordination of spatial planning for protected areas and their surroundings (Maksin et al., 2018). During April and May 2019, research was conducted by the authors among travelers to protected areas in Vojvodina to discover their attitudes on the importance of environmental protection and the sustainable development of tourism. The survey was conducted among 215 travelers. Tourists were surveyed after visiting protected areas, either online or by means of a written questionnaire. The structure of the respondents is shown in Table 1. All of the respondents had traveled at least once to these areas. The hometowns of the respondents (Serbia) are Smederevo, Belgrade, Kovin, Novi Sad, Pirot, Inđija, Niš, and Pančevo. The questionnaire included the following questions: Will your choice of future travel destination include any of the selected destinations...? Do you think that the inclusion of protected areas in the tourism offer can increase the quality of the destination? Which protected area have you visited? The respondents were also asked to sort the types and forms of tourism by relevance (1-irrelevant, 2-less important, 3-preferable, 4-important, 5-most important). The aim was to analyze the answers from the questionnaire to create a unique conclusion relating to the importance of integrating protected areas in Vojvodina's tourism offer. In this analysis, nature-related forms were identified, such as ecotourism and adventure tourism, and they were viewed as forms that could confirm the hypothesis about the significance of protected tourist areas, provided that they were mostly supported by respondents.

After examining the differences in the answers using the Kruskal-Wallis Test, the results of the survey were examined by two comparative analyses of identical, related, and similar answers to other selected case studies. The authors'

questionnaire and analysis of responses, as well as the two comparative studies, provide the unique conclusion of the research in this paper regarding the significance of protected natural areas for the tourism offer in the Autonomous Province of Vojvodina (Serbia).

Gender	Frequency	Pere	cent
Male	102	47.4	
Female	113	52.6	
Total	215	100.0	
Education	Frequency	Pere	cent
Primary Education	27	12.6	
Secondary Education	94	43.7	
Vocational Education	22	10.2	
Higher Education	72	33.5	
Total	215	100	
Age Structure	Ν	Min	Max
	215	18	73
	Mean	Std.	Dev.
	36.85	15.228	

Table 1. Structure of Respondents

Comparative analysis I refers to a comparison between the answers from the authors' questionnaire (Table 2, questions 1 and 2; Table 5, question 5) and the results from a similar study on the reasons for travel and the planned activities for tourists visiting a Portuguese island of untouched nature – the Azores by Queiroz *et al.* (2014). The survey was conducted using a questionnaire in 2013. The sample of respondents was 531 tourists aged between 15 and 73 years, 55.52% of whom had a university education and 40.49% a secondary education. The responses compared were: 1) Why is the Azores chosen as a travel destination?; 2) What activities do the tourists plan to do in this destination?; 3) Are they satisfied with the destination and why?; and 4) Will they visit this destination again? (That is, what is the level of the experience they gained?).

Comparative analysis II compares the data obtained based on the responses from the authors' questionnaire with the results based on the answers from a case study related to tourists visiting protected areas in the Republic of Romania and other similar destinations, by Hornoiu et al. (2014). A question from the authors' questionnaire used in the second comparative method refers to the planned and achieved forms of tourist activities in protected natural areas in Vojvodina (Serbia), (Table 2, question 4). The answers were compared with the answers from case study II (*ibid.*), based on a sample of 187 respondents (students) aged 20-25 years who were potential tourists in the protected natural areas of Romania and other surrounding countries. It should be noted that this country is a significant tourist destination for the Republic of Serbia and the Autonomous Province of Vojvodina, with which it shares a geographical border. The survey was conducted at the University of Bucharest during 2013 and 2014 (ibid.). The respondents answered questions regarding tourism activities, and their answers were ranked

by a Likert Scale (Joshi *et al.*, 2015): very low level of accuracy, low level of accuracy, medium, high level of accuracy, very high level of accuracy. This ranking of answers was identical to the answers rated in the authors' questionnaire (Table 2, question 4), i.e., with the answers ranked by relevance on the following scale: 1-irrelevant, 2-less important, 3-preferable, 4-important, 5-most important. This enabled a direct comparison of the answers given using the comparative method to identify the similarities and differences in the phenomena and processes.

Table 2. Answers of Respondent

1) What will your		Resp	Percent			
choice of future tourism destinations include?	No.		Per	cent	of Cases	
Cultural sites only	17		7.3		7.9	
It will not include site visits	5		2.2		2.3	
It will include a visit to protected natural areas, national parks or a special nature reserves	210		90.5		97.7	
Total	232		100.0		107.9	
2) Do you think that inclusion of protected		Resp	onses		Percent of Cases	
offer can contribute to an increase in the quality of the tourist destination?	No.		Percent			
Yes	215		100		100.0	
No	0		0		0	
Total	215		100.0		100.0	
3) Which protected areas have you visited?	Resp No.		onses Percent		Percent of Cases	
Fruska Gora National Park	172		50.1		80.0	
Zasavica Special Nature Reserve	82		23.9		38.1	
Obedska Bara Special Nature Reserve	58		16.9		27.0	
Other protected areas	31		9.0		14.4	
Total	343		100.0		159.5	
4) Sort the types and forms of tourism by relevance, as you would choose them during a visit to Vojvodina's tourist destinations.* Ω	No.	Min	Max	Mean	Std. Dev.	
Ecotourism	215	1	5	4.09	1.138	
Adventure tourism	215	1	5	3.58	1.231	
Sport tourism	215 1		5	3.27	1.355	
Events tourism	215 1		5	2.66	1.250	
Scientific tourism	215	1	5	2.29	1.308	
*1-irrelevant, 2-less impo important	rtant, 3	-prefer	able, 4-i	mportar	nt, 5-most	

RESULTS AND DISCUSSION

During the research, the views of potential tourists, i.e. the users of protected natural areas, were considered. Since the criteria related to the sustainability of the destination as a protected area were accepted, the next step was to identify the users of the areas in Vojvodina.

Within the written questionnaire there were also 5 questions regarding the development of sustainable tourism and the respondents' views on protected areas (Tables 2, 5).

A total of 215 respondents with an average age of 36.85 provided answers which justified the hypothesis that protected natural areas are an important part of creating a tourism offer in Vojvodina. A total of 210 respondents said that they would visit such a destination as a part of a future trip. All 215 respondents noted that the inclusion of such areas in the tourism offer in Vojvodina would increase the quality of the destination in general. A total of 172 respondents had visited Fruška Gora National Park, which can be justified by the promotion of the destination, its developed tourism program, and its infrastructure. Among the forms of tourism that the respondents would choose to practice, the highest average rates were given to ecotourism (mean 4.09) and adventure tourism (mean 3.58), which are, again, closely related to protected areas (Figure 2).



Figure 2. Types and forms of tourism sorted by relevance

Table 3. Ranking forms of tourism

Kruskal-Wallis Test	Ν	Mean Rank
Sport tourism	215	557.20
Ecotourism	215	737.84
Adventure tourism	215	621.05
Scientific tourism	215	349.91
Events tourism	215	424.00
Total	1075	

Based on the results of the Kruskal-Wallis Test (Li, 2012), it can be concluded that there is a statistically significant difference in the type of destination selected and the form of tourism selected when visiting protected areas:

 $(\chi 2 (4) = 222.539, p < 0.001).$

Therefore, these forms of tourism have great significance when choosing a travel destination and deciding which activities to take part in. By choosing ecotourism and adventure tourism, as nature-based forms of tourism, there is a very high readiness for protecting the environment and preserving its values (Rinzin *et al.*, 2007; Valdivieso *et al.*, 2015).

Table 4. Test Statistics

Analysis	Evaluation				
Chi-Square	222.539				
df	4				
Asymp. Sig.	.000				
a. Kruskal Wallis Test					
b. Grouping various forms of touri	sm Ω				

Within the questionnaire, the respondents also expressed their opinion about the activities they would practice during their visit to a protected area. The responses are ranked for relevance from 1 to 5. The results are shown in Table 5.

Table 5. Respondents' choice of activities when visiting protected areas

5) Score the activities in protected areas by relevance Ω ₁	N	Min	Max	Mean	Std. Dev.	
Hiking	215	1	5	3.92	1.157	
Cycling	215	1	5	3.50	1.245	
Wildlife watching	215	1	5	3.29	1.223	
Sports	215	1	5	2.41	1.466	
Nature photography	215	1	5	2.35	1.236	
*1-irrelevant, 2-less important, 3-preferable, 4-important, 5-most important						

The following responses had the highest average values: hiking (3.92) and cycling (3.50). They are followed by wildlife watching, sport, and nature photography. Based on the given answers, it can be concluded that tourists will practice those activities which are closely related to nature and its values. The ranked results can also be presented graphically (Figure 3).



Figure 3. Tourist activities in a protected area, ranked by relevance

We applied the Kruskal-Wallis Test (Li, 2012) to decipher whether there were differences in the responses to ranking the relevance of the activities when visiting a protected area (Tables 6, 7).

According to the results of the Kruskal-Wallis Test, there is a statistically significant difference when assessing the importance of activities when visiting protected areas:

(χ2 (4) = 202.499, p<0.001).

The results based on the responses to the questions from

Table 2, (questions 1 and 2), after *Comparative analysis I* (Belsoy *et al.*, 2012) suggest identical reasons for choosing a tourist destination and opinions regarding protected areas. This can be seen as follows (Queiroz *et al.*, 2014):

- Question Why did you choose this destination? (Table 2, questions 1 and 2). Answers: because of the protected nature, national parks, or areas of natural beauty 210 respondents (90.5%), and other reasons (9.5%). In the first comparative article *(Comparative analysis I)*, the answers were as follows: because of the natural beauty (41.14%) and bird and whale watching (11.91%), which together makes 53.05%;
- When the respondents were asked to rank the activities in the destination from the highest to the lowest relevance (Table 5, question 5), the answers were as follows: hiking (mean 3.92), cycling (mean 3.50), bird watching (mean 3.29), sports activities (mean 2.41) and nature photography (mean 2.35). This points to the fact that key activities (bird watching, hiking, and sports activities) are predominant, just like in the article in *comparative analysis I*: whale watching (32.4%), hiking (31.6%), diving (7%), sports (5.1%) and other activities (24%); and
- Regarding the experience gained and the potential to repeat the visit, 210 of the respondents will visit these areas again (90.5%), (Table 2, question 1), which is similar to the responses in the first comparative article, where the same answer was given by 82.92% of the respondents (13.37% of them answered with "maybe"). There is no "maybe" option in the authors' questionnaire.

Kruskal-Wallis Test	N	Mean Rank
Hiking	215	715.73
Cycling	215	624.68
Wildlife watching	215	577.80
Sports	215	349.25
Nature photography	215	377.54
Total	1075	

Table 6. Kruskal-Wallis test ranking the relevance of the activities

Table 7. Test Statistics ",	Table	7.	Test Statistics	a,i
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Analysis	Evaluation				
Chi-Square	202.499				
df	4				
Asymp. Sig.	.000				
a. Kruskal Wallis Test					
b. Grouping variable: relevance of the activities $\Omega_{_1}$					

Comparative analysis II shows that the authors' questionnaire and the comparative article (Hornoiu *et al.,* 2014) have identical reasons for choosing the forms of tourist activities in protected natural areas. This can be seen as follows:

• When the respondents were asked to rank forms of tourism in the protected areas of Vojvodina, the answers were (Table 2, question 4): ecotourism (mean 4.09), adventure (mean 3.58), sports (mean 3.27), events (mean 2.66) and scientific tourism (2.29). The students' answers in the second comparative article (*Comparative analysis II*) were: ecotourism 33% of the respondents (average 4.1377), adventure/nature-based tourism 33% of the respondents (average 3.0722), event/ culture 25% of the respondents (average 2.7087), hiking/sports 26% of the respondents (average 2.475) and scientific tourism 26% (average 2.2874).

CONCLUSION AND FUTURE RESEARCH

Some protected areas in Vojvodina have national and international status and regimes of protection. Compared with the total area of the Province it is concluded that the protected area is still extremely small. Increased use of the protected areas of Vojvodina in tourism also contributes to an increase in the number of endangered plant and animal species. On the other hand, this kind of protection can raise the attractiveness of destinations in Vojvodina. This is indicated by the results of this study, in which the respondents voted for those forms of tourism that support the protection and improvement of natural areas. Therefore, the tourist sector of Vojvodina must create tourist products that will satisfy this demand. To provide the best protection and improvement of protected areas in Vojvodina, tourism must be a significant activity. The only model that can be acceptable to all parties including the local community is the development of sustainable tourism in Vojvodina. Its proper implementation will secure sociocultural, economic, and ecological benefits for the tourist destination.

The northern part of Serbia is rich in nature reserves that need to be preserved from destruction and preserving them will develop tourism. The concept of protection allows the use of natural sites, but only in a sustainable manner, with the basics of renewal. Ecological, economic, and sociocultural benefits for all members of this system can be distinguished as the final results of protecting natural areas (Vinueza *et al.*, 2014). The conclusion is that the protected areas on the territory of Vojvodina are of great importance for developing tourism. By analyzing data from world practice and the results of the survey in this paper, it can be concluded that the role and importance of protected areas are significantly present in the development of tourism.

The significance of the natural areas of Vojvodina and their natural elements impact the reasons for choosing these destinations and the activities planned within them. The results obtained by the analysis of the data from the authors' questionnaire are confirmed by two comparative analyses of selected case studies. By this, the hypothesis of the paper is confirmed. It is necessary to introduce regular surveys of tourist satisfaction and to use the method applied here to evaluate the results, as a basic input for the development, review, and innovation of the tourism offer in Vojvodina as well as Serbia's destinations with their protected and valuable natural heritage.

REFERENCES

- Ali, A., Frew, A.J. (2013). *Information and communication technologies for sustainable tourism*. London and New York: Taylor & Francis Group.
- Batman, Z.P., Demirel, O. (2016). Importance of ecology-based tourism and tourism planning approach in Meryemana Creek (Macka-Trabzon) Route, *Journal of Environmental Protection and Ecology*, Vol. 17, No. 3, pp. 1084-1094.
- Belsoy, J., Korir, J., Yego, J. (2012). Environmental impacts of tourism in protected areas, *Journal of Environment and Earth Science*, Vol. 2, No. 10, pp. 64-73.
- Butzmann, E., Job, H. (2017). Developing a typology of sustainable protected area tourism products, *Journal of Sustainable Tourism*, Vol. 25, No. 12, pp. 1736-1755.
- Carr, A., Ruhanen, L., Whitford, M. (2016). Indigenous peoples and tourism: the challenges and opportunities for sustainable tourism, *Journal of Sustainable Tourism*, Vol. 24, No. 8-9, pp. 1067-1079.
- Ciglovska, B. (2016). Agroecology and agrotourism as a new cash cow for the farmers the crisis: the case of FYROM, *Journal of Environmental Protection and Ecology*, Vol. 17, No. 1, pp. 276-283.
- Delić, D., Cvijanović, D., Prentović, R. (2017). *Uticaj lovnog turizma na zaštićena područja* (in Serbian). Vrnjačka Banja: Univerzitet u Kragujevcu, Fakultet za hotelijerstvo i turizam.
- Fennell, D.A. (2015a). Ecotourism. London & New York: Routledge.
- Fennell, D.A. (2015b). Tourism and the precautionary principle in theory and practice. In C.M. Hall, S. Gössling, D. Scott (Eds.), *The Routledge Handbook of Tourism and Sustainability.* London & New York: Routledge, Taylor & Francis Group, pp. 67-77.
- Grujičić, I., Milijić, V., Nonić, D. (2008). Conflict management in protected areas: the Lazar Canyon Natural monument, eastern Serbia, *International Journal of Biodiversity Science and Management*, Vol. 4, No. 4, pp. 219-229.
- Hoang, T.T.H., Rompaey, A.V., Meyfroidt, P., Govers, G., Vu, K.C., Nguyen, A.T., Hens, L., Vanacker, V. (2020). Impact of tourism development on the local livelihoods and land cover change in the northern Vietnamese highlands, *Environment*, *Development and Sustainability*, Vol. 22, pp. 1371-1395.
- Holden, A. (2013). Protected areas and tourism. In A. Holden, D. Fennell (Eds.), *The Routledge Handbook of Tourism and the Environment*. London and New York: Taylor & Francis Group, pp. 276-284.
- Holden, A. (2016). *Environment and tourism*. London & New York: Routledge.
- Hornoiu, R.I., Pădurean, M.A., Nica, A., Maha, L. (2014). Tourism consumpion behavior in natural protected areas, *Amfiteatru Economic*, Vol. 16, No. 8, pp. 1178-1190.
- IUCN (2017). IUCN Annual Report for 2017. Gland: IUCN.
- Janssen, J. (2009). Sustainable development and protected landscapes: the case of The Netherlands, *International Journal of Sustainable Development & World Ecology*, Vol. 16, No. 1, pp. 37-47.
- Job, H., Becken, S., Lane, B. (2017). Protected areas in a neoliberal world and the role of tourism in supporting conservation and sustainable development: an assessment of strategic planning, zoning, impact monitoring, and tourism management at natural World Heritage Sites, *Journal of Sustainable Tourism*, Vol. 25, No. 12, pp. 1697-1718.
- Joshi, A., Kale, S., Chandel, S., Pal, D.K. (2015). Likert scale:

explored and explained, *British Journal of Applied Science & Technology*, Vol. 7, No. 4, pp. 396-403.

- Kim, H., Lee, S., Uysal, M., Kim, J., Ahn, K. (2015). Nature-based tourism: Motivation and subjective well-being, *Journal of Travel & Tourism Marketing*, Vol. 32, No. 1, pp. 576-598.
- Koens, J.F., Dieperink, C., Miranda, M. (2009). Ecotourism as a development strategy: experiences from Costa Rica, *Environment Development and Sustainability*, Vol. 11, pp. 1225–1237.
- Kruger, M., Viljoen, A., Saayman, M. (2017). Who visits the Kruger National Park and Why? Identifying target markets, *Journal of Travel & Tourism Marketing*, Vol. 35, No. 3, pp. 312-340.
- Leković, M. (2019). Behavioral portfolio theory and behavioral asset pricing model as an alternative to standard finance concepts, *Economic Horizons*, Vol. 21, No. 3, pp. 255-271.
- Li, G. (2012). Statistical testing techniques. In L. Dwyer, A. Gill, N. Seetaram (Eds.), *Handbook of Research Methods in Tourism, Quantitative and Qualitative Approaches*. Cheltenham: Edward Elgar, pp. 13-30.
- Maksin, M., Pucar, M., Milijić, S. Korać, M. (2011). *Održivi razvoj turizma u Evropskoj Uniji i Srbiji* (in Serbian). Beograd: Institut za arhitekturu i urbanizam Srbije.
- Maksin, M., Ristić, V., Nenković-Riznić, M., Mićić, S. (2018). The role of zoning in the strategic planning of protected areas: Lessons learnt from EU countries and Serbia, *European Planning Studies*, Vol. 26, No. 4, pp. 838-872.
- Malenović-Nikolić, J., Vasović, D., Janaćković, G., Ilić-Petković, A., Ilić-Krstić, I. (2016). Improving the management system of mining and energy complexes based on risk assessment, environmental law and principles of sustainable development, *Journal of Environmental Protection and Ecology*, Vol. 17, No. 3, pp. 1066-1075.
- Manente, M., Minghetti, V., Mingotto, E. (2014). Responsible tourism and CSR, assessment systems for sustainable development of SMEs in tourism. New York: Springer.
- Mitchell, B. (2019). *Resource and environmental management*. Oxford: University Press.
- Mitsch, W.J., Bernal, B., Hernandez, M.E. (2015). Ecosystem services of wetlands, *International Journal of Biodiversity Science, Ecosystem Services & Management*, Vol. 11, No. 1, pp. 1-4.
- Mowforth, M., Munt, I. (2016). *Tourism and sustainability: development, globalization and new tourism in the third world.* London and New York: Taylor & Francis Group.
- Muñoz, L., Hausner, V., Brown, G., Runge, C., Fauchald, P. (2019). Identifying spatial overlap in the values of locals, domestic and international tourists to protected areas, *Tourism Management*, Vol. 71, pp. 259-271.
- Newsome, D., Moore, S.A., Dowling, R.K. (2013). *Natural area tourism ecology, impacts and management*. Toronto: Channel View Publications.
- Oprea, L., Ienciu, I., Tudorascu, M., Filip, L. (2015). Implications of topography and cadastre in tourism planning and sustainable development of "Alba Carolina" Vauban citadel, *Journal of Environmental Protection and Ecology*, Vol. 16, No. 3, pp. 1016-1023.
- Pfueller, S.L., Lee, D., Laing, J. (2011). Tourism partnerships in protected areas: Exploring contributions to sustainability, *Environmental Management*, Vol. 48, pp. 734–749.
- Polat, Z., Demirel, O. (2016). Evaluation of alternative tourism

in the light of natural, cultural and visual resources in Turkey landscape, *Journal of Environmental Protection and Ecology*, Vol. 17, No. 3, pp. 1220-1228.

- Puzović, S., Panjković, B., Tucakov, M., Stojnić, N., Sabadoš, K., Stojanović, T., Vig, L., Marić, B., Tešić, O., Kiš, A., Galamboš, L., Pil, N., Kicošev, V., Stojšić, V., Timotić, D., Perić, R., Bošnjak, T., Delić, J., Dobretić, V., Stanišić, J. (2015). *Upravljanje prirodnom baštinom u Vojvodini* (in Serbian). Novi Sad: Republika Srbija, Autonomna Pokrajina Vojvodina, Pokrajinski sekretarijat za urbanizam, graditeljstvo i zaštitu životne sredine, Pokrajinski zavod za zaštitu prirode.
- Queiroz, R.E., Guerreiro, J., Ventura, M.A. (2014). Demand of the tourists visiting protected areas in small oceanic islands: the Azores case-study (Portugal), *Environment, Development and Sustainability*, Vol. 16, pp. 1119–1135.
- Rinzin, C., Vermeulen, W.J., Glasbergen, P. (2007). Ecotourism as a mechanism for sustainable development: The case of Bhutan, *Environmental Sciences*, Vol. 4, No. 2, pp. 109-125.
- Robinson, P., Lück, M., Smith, S.L.J. (2013). *Tourism*. Oxfordshire: CABI.
- Rodary, E., Milian, J. (2011). Expansion and diversification of protected areas: Rupture or continuity?. In C. Aubertin, E. Rodary (Eds.), *Protected Areas, Sustainable Land?*. Farnham: Ashgate, pp. 13-29.
- Sl. list AP Vojvodine (br. 10/2016). Program zaštite životne sredine Autonomne pokrajine Vojvodine za period 2016-2025. godine (in Serbian). Novi Sad: Pokrajinski sekretarijat za obrazovanje, propise, upravu i nacionalne manjine – nacionalne zajednice.
- Stojnić, N., Panjković, B., Sabadoš, K., Kicošev, V., Timotić, D., Kiš, A., Galamboš, L., Delić, J., Dobretić, V., Milenić, B., Perić, R., Stojšić, V., Pil, N., Stanišić, J., Plemić, Z., Predojević, J., Bošnjak, T., Mihajlović, N., Fojkar, O., Došenović, B., Marinković, L., Krnčević, G., Borčić, S., Novaković, S., Rilak, S., Dragaš, K., Pivaš, B. (2015). *Izveštaj o stanju životne sredine za period* 2010-2014. godine (in Serbian). Novi Sad: Pokrajinski zavod za zaštitu prirode.
- Štetić, S., Šimičević, D. (2014). *Menadžment turističke destinacije* (in Serbian). Beograd: Visoka turistička škola strukovnih studija.
- Štetić, S., Šimičević, D. (2015). *Turistička geografija* (in Serbian). Visoka turistička škola strukovnih studija.
- Štetić, S., Trišić, I. (2018). The role and importance of ecosystems in creating tourism activities, *Hotel and Tourism Management*, Vol. 6, No. 2, pp. 35-46.
- Tisdell, C., Wilson, C. (2005). Perceived impacts of ecotourism on environmental learning and conservation: turtle watching as a case study, *Environment, Development and Sustainability*, Vol. 7, pp. 291-302.
- Trišić, I. (2019). Opportunities for sustainable tourism development and nature conservation in Special Nature Reserve "Deliblatska Peščara", *Hotel and Tourism Management*, Vol. 7, No. 1, pp. 83-93.
- Trišić, I., Štetić, S., Privitera, D., Nedelcu, A. (2020). Wine routes in Vojvodina Province, Northern Serbia - a tool for sustainable tourism development, *Sustainability*, Vol. 12, No. 1, pp. 82.
- Valdivieso, J.C., Eagles, P.F.J., Gil, J.C. (2015). Efficient management capacity evaluation of tourism in protected areas, *Journal of Environmental Planning and Management*, Vol. 58, No. 9, pp. 1544-1561.
- Vinueza, L., Post, A., Guarderas, P., Smith, F., Idrovo, F. (2014). Ecosystem-based management for rocky shores of the

Galapagos Islands. In J. Denkinger, V. Luis (Eds.), *The Galapagos Marine Reserve, A Dynamic Social–Ecological System*. New York: Springer, pp. 81-107.

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PUBLICLY SHARED DOMESTIC-RELATED AMENITIES: POCKETS OF PRIVACY ENHANCING PUBLIC SPACE

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This article discusses amenities that are shared by anyone in public space, such as public barbecues in Australia. The idea is generalized to a range of domestic-related amenities, from kitchen-related to bathroom-related, etc. As these domestic-related amenities relate to usage that is typically conducted within a dwelling, the amenity and its architecture can be considered a "pocket of privacy" in public space (Pocket). Our discussion explores how these publicly shared domestic-related amenities can address particular needs of society in the context of their economic, symbolic, aesthetic and ethical value. Specifically, we suggest that Pockets productively address the politics of public space and private place in three key ways: through the negotiation of the presence of people in public space, through the negotiation of individual and collective usage of the amenity, and through the gap between the symbolic and economic power created by the usage of these amenities. We conclude by proposing planning principles that may enable the economic, symbolic, aesthetic and ethical value of these amenities to be fully realized in ways that balance the politics of public space and private place.

Key words: public space, private usage, domestic, amenity, social interactions.

INTRODUCTION

With the rise in value of real estate in big cities, there is a corresponding tendency for urban residents to only afford increasingly smaller dwellings. For small dwellings with high occupancy levels, both the size of common and private places tends to be smaller. Sharing dwellings amongst more than two families or between many families in a housing block (strata) is a common way to share amenities, space and costs. Further, solutions for the "extension" of dwelling space and its amenities can be made outside the private space of the dwelling. For even more flexible use, this extension of the dwelling can be into public space. The use of these amenities is not restricted to a group of inhabitants. This requires innovative solutions conceived at the intersection of urban planning, architecture and design. This article explores the manner in which domestic-related amenities may be shared publicly in this regard. The concept is discussed in its financial, social and political dimensions, and thus in terms of its feasibility.

An example of publicly shared domestic-related amenities in Australia is the public barbecue available at many city beaches and parks. These are popular amenities in the Australian cultural context. They provide opportunities for families that lack private space and facilities. The amenities enable social interactions with passers-by and other groups using adjacent barbecues. The typical public barbecue occupies a small area of the existing overall public space, so that public space keeps its necessary characteristics of spatial looseness, spatial openness and functional openness, enabling a diversity of use. Spatial looseness means that public space is large enough to welcome a crowd of people, and that the design does not restrict the use of public space to one or a few determined uses. Spatial openness means that public space is open-air and easily accessible from pathways. Functional openness adds to spatial looseness and means that the size, design and urban context of the public space enable a wide range of uses, especially strangers hanging around without being noticed.

The example of the Australian public barbecue can be generalized to other types of amenities that are commonly present in the domestic sphere but bear different potential for social interactions when transferred to public space. The size and setting of these varied amenities can be adapted to enhance potential social interaction. The size and settings for these will be explored in this article, which will further define the concept of "pockets of privacy" in public space (Pockets) and the type of publicly shared domestic-related amenities that can enhance public space.

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Numerous historical examples exist of domestic-related amenities shared in public space. The public baths of ancient Greece and ancient Rome, Turkish baths from the Ottoman Empire, the Gellert Baths in Budapest operating since the 15th century, and the public baths in Paris, were all public spaces and at the same time, places of private use. In the late 18th century, the City of Bath's waters are described by Sigfried Giedion as a place of socialization between people of different social status (albeit restricted to one gender) (Giedion, 1961: 147).

Recent social phenomena require a holistic approach to private place and public space:

- Increased inhabitation density and the loss of privacy. Living in a dense urban environment, where rents are high and, as a result, dwellings are small and densely inhabited, the lack of opportunities to be "private" in private places increases the need to activate other places as alternative settings to carry out private and domestic activities. Leaving the confines of a small dwelling also adds an element of relief and freedom. While emerging in Western countries, this sentiment is not new in other cultural contexts, for example in Vietnam, as described by Lisa Drummond in the article "Inside-out: Practices of Private–Public Space in Contemporary Urban Vietnam" (Drummond, 2000);
- Poverty-induced loss of privacy and amenities. People subject to poverty find it challenging to access typically available amenities. Moreover, the amenities currently available in public space are commonly insufficient for a person that relies on public amenities for regular, ongoing support; and
- The need for social interactions in a modern context. In a world where social media is an increasingly central mode of social interaction, encounters in "real life" remain an important catalyst of social life, underscoring the need for public space to accommodate "real life" encounters (Ujang *et al.*, 2018: 117).

A holistic approach to large-scale space and small-scale place enhances the sustainability of the city. According to Douglas M. Cotner's Unified Field Theory of Adapted Space, sustainability requires unification of the micro and macro scales of human settlement and activity (Cotner, 2009).

The question raised in this article is: can Pockets enhance social interactions, and thus "real" public space? A subquestion refers to the architectural aspect of the "pocket": is there a spatial display and a shape of the Pocket that would enhance public space more than another? The implications of these three phenomena make the potential for Pockets to enhance social interactions, and thus real public space, significant and impactful.

The research underpinning this discussion is primarily based on a review of literature at the interface between psychology of the individual and sociology of the collective. The second method employed is design-based research of the concept of Pockets in the pedagogical context. For this, industrial design students at UNSW Sydney designed a range of Pocket projects. These projects, and especially the choices they made for their selected amenities, were analysed to develop knowledge of the array of domesticrelated amenities that could be considered for Pockets.

DEFINITIONS OF KEY TERMS

Immutable definitions of "private place" and "public space" do not exist. McDowell argues that "the division between the public and private is a socially constructed and gendered division" (McDowell, 1999: 149). However, a general sense of the meaning of these terms is necessary.

In this article, the term "public space" refers to larger open-air public areas whose boundaries are buildings and/or roads, or other large scale natural or artificial features. In line with the analyses of Habermas (1989), Lefebvre (1991: 83-195), Harvey (1989: 212), and Davis (1990: 222-263), public space has characteristics of spatial looseness, spatial openness and functional openness, which enables a diversity of usages. Another fundamental characteristic of public space, as understood in this article, is its unfettered accessibility: it is publicly accessible to anyone, not ticketed, and accordingly, means no one feels like a stranger (Toloudi, 2016). In this article, public space is owned by a public institution.

A Pocket is a place. The term "place" is understood here to describe the area "used for a specified purpose or activity" (Delbridge *et al.*, 1991: 1352) by one person or a group of persons. "Privacy" is a notion that is linked to a series of related categories such as private sphere, intimacy, secrecy, interiority, and subjectivity. Anthropologist Morton H. Levine defines privacy as "the maintenance of a personal life-space within which the individual has a chance to be an individual, to exercise and experience his (sic) own uniqueness" (Levine, 1980: 11). This first definition suggests that this experience can occur in the context of social interaction with other people. Three gradients of privacy are adopted in this article: the "area of privacy" as a place in which a solitary person undertakes an activity; the "sphere of private contacts with friends and family"; and the "sphere of private contacts with strangers" (Figure 1). The exercise or experience of "private place" in this article comprises the domestic-related activities that are usually undertaken in the interior of a dwelling. The meaning of "private place" is therefore based on the possibility of private usage, rather than private ownership.

From the above description of various gradients of privacy, in contrast with traditional, functionally defined architecture, Pockets:

- Do not relate to a fixed function: neither strictly individual nor strictly collective, Pockets question the definitions of "individual" and "collective" for a given period and a given context; and
- Do not related to a fixed status: neither strictly private nor strictly public, Pockets question the definition of "private" and "public" for a given period and a given context.

In this sense, Pockets create new links, both between the individual and the collective, and between public and private life.

There are two reasons why the term "pocket" is adopted in this discussion:

• First, the customary definition of a pocket is a small container in which something may be kept. It is the space between the inner (interior of the pocket) and the

exterior (clothing); an interior that is in direct formal connection with the exterior, and thus not totally closed. It can vary in its size and level of openness. In this sense, a pocket symbolises the threshold between the public and the private; and

· Secondly, the word "pocket" is associated with the French word poché, which describes the areas of an architectural section that reveals some detail of the structure or character of the boundary between the interior and the exterior. These are often drawn as filled-in areas of the section, often with cross-hatching or solid black, to show wall thicknesses. Lois Weinthal in Toward a New Interior suggests that the poché is a metaphor for the "bridging" between the interior and exterior (Weinthal, 2011: 576). The concept of the poché expresses the spatial potential of Pockets to reveal relationships between private place and public space. The notion of a "pocket" is an apt metaphor for a Pocket as a designed artefact that defines a place (open or not totally enclosed) with a usage that relates to domestic practices which are usually private, but is immersed in public space. The pocket intertwines interior and exterior, and yet both remain distinct.

Pockets question orthodox notions of the public and private. When well designed, they enhance the potential for interactions between public space and private place, without confusingly merging the two domains. 2017 studio context: The aim of the studio was to design a more inclusive and effective public food preparation facility that both enhances public park amenities for a wider and more diverse range of user groups, and considers a broader range of usages than just the cooking activity on its own. The brief given to the students comprised the following requirements: study how public park environments can be enabled, activated, re-configured and improved through Pockets; accommodate and service the various needs of culturally and socially diverse users; develop a design approach that caters to these wider needs associated with a diverse range of foods being prepared and consumed in public; and develop innovative product design solutions to support this aim.

2018 studio context: If a person is sharing a room with someone they do not know, or do not know well, especially on a temporary basis, this shared room is unlikely to feel like their home. As noted above, one solution to the problem of loss of privacy is for public space to accommodate some of the requirements of a home. If it is not possible to comfortably spend time in the privacy of one's home, this time is likely to be spent in public. As a result, public space may be considered for hosting some of the typical domestic activities, such as cooking, eating, meeting friends and entertainment. The question for the participating students is: how is it possible to effectively enable this? The course convener formed partnerships with industry to interact



Figure 1. Example of evolution in time, in and around a Pocket, of place and space of different statuses. From the core of the Pocket towards its periphery in this example: area of "privacy", "sphere of private contacts with friends and family", "sphere of private contacts with strangers" and public space. (Source: authors)

AN EXPERIMENT IN THE PEDAGOGICAL CONTEXT

The question of how to best activate public space through private place (domestic-related) activities was posed to 3rd year undergraduate students enrolled in the Industrial Design Studio course at UNSW Sydney, in the form of two related assignment briefs during the first semester of 2017 and in a revised form in 2018. In 2017, the brief title was "Improving Public Park Amenities for Personal/Group Food Preparation"; in 2018 it was "Room Sharing with Strangers", which involved the transfer of one domestic-related amenity into public space. Pockets were developed in both studios (the two subjects being akin to two sides of the same coin). with the students to give these projects a "real life" feel to the course task. Four industry participants were engaged: Emerdyn (the oldest street furniture company in Sydney), the Place Manager of Georges River Council, an experienced landscape architect, and the CEO of Cocoon (a room sharing business). All agreed to provide feedback at concept level and at students' final presentations. Factory visits and field trips were also part of the students' activities.

In total, 13 groups of students participated in 2017 and 2018. They proposed a variety of conceptual solutions (listed in the table below).

Projects concept		Type of amenity			
			working	cooking	living room
2017 Studio:	1	Remy		mobile cooking	
POP for Public Cooking	2	Cosea		ultimate social centre	
Tublic Cooking	3	Roundus		connecting generations	
	4	Wallaby		inclusive socialising	
	5	Insel		social integration	
	6	Open Space		ad hoc BBQ kit	
	7	Scintilla		varying forms of cooking	
	8	Social		mobile app	
2018 Studio:	9	Between 2		public microwave	
Room sharing: associated Pocket	10	Cocoon Pod	outdoor workspace		
	11	Byta	portable work top		side table
	12	Coogee			public living room
	13	Pebble			outdoor cinema

Table 1. Description of Pockets designed by UNSW Industrial Design students in 2017 and 2018

For all of the kitchen-related Pockets, the approaches taken by the students can be grouped into two categories: fixed or mobile. Two example projects illustrate these different design approaches.

Project 1 *Remy* (Figure 2) is a mobile unit that allows users to create either publicly exposed positions, or a more intimate position (for example, under a tree or adjacent to another park feature such as close to the edge of a lake or reservoir).

For Project 2 *Cosea* (Figure 3), the students explored the concomitant activities associated with cooking and accordingly provided amenities to meet these, such as access to water and temporary storage of associated equipment. This design is intended to serve not only the purpose of cooking, but also amenities for spending time outside, charging electronic devices, providing shade, a rest to lean against while cooking, and a wind break. The students created an environment that incorporates some of the conveniences that can be found at home, and adapted them for outside public use.

The main research findings from the 2017 and 2018 Industrial Design Studio projects were:

- When creating a Pocket, it is very viable, even for students, to consider a connection to place, a connection to the "other" in public space and the "openness" of public space;
- Small-scale facilities are adequate to create Pockets: students concluded that Pockets at a small scale preserve the integrity of public space while performing their intended function. Students revealed that larger-scale Pockets, while performing as a functional area, resulted in a loss of the sense of public space. Maintaining the integrity of public space is one reason some students developed mobile Pockets. This idea was unexpected and emerged from experimentation; and
- When given the opportunity, students developed a variety of amenities from the range of typical domestic activities. Some of the chosen amenities were unexpected. The students creating only one project

related to cooking in 2018 reveals the potential for other domestic-related Pockets, and their needs.

This last finding leads to ideas that are developed in the next section, comparing different types of domestic-related amenities and their potential to enhance public space.



Figure 2. Project 1: Remy - Roving Cooktop, by Digby Ayton, Dayna Kohn, Benjamin Le, Sean Pataki. 2017 UNSW Industrial Design Studio: Pocket for Public Cooking



Figure 3. Project 2: Cosea - Public BBQ, by Chenming Li, Josephine Wilandouw, Jeremy Hizikia, Ibrahim Diaz, Fave Chen. 2017 UNSW Industrial Design Studio: Pocket for Public Cooking

THE RANGE OF AMENITIES

Using rooms found in a typical Western society apartment, the range of domestic-related Pockets can be expanded beyond the kitchen:

- Bedroom-related. Bedroom-related Pockets are useful for people in need. There is also a need for people who would like to have a short rest (in train stations, for example). In this case, respect for privacy is sensitive; hence Pockets need to be designed taking into account boundaries of "privacy". Social interactions around these Pockets mostly occur before and after sleep, in the "sphere of private contacts with strangers" (Figure 1). The protection of privacy and the connection with public space improve user safety. For example, "architectural designer James Furzer has developed a modular homeless shelter that would hang off the sides of existing buildings and launched a campaign on crowdfunding platform Indiegogo to finance a prototype" (Mairs, 2015);
- Washing room-related. This amenity includes shower and/or bath facilities. This type of amenity could provide utility to people who want to use washingroom-related services during their away-from-home day, such as after cycling to work, or at the end of a work day before heading elsewhere, etc. As with bedroomrelated Pockets, respect for privacy is sensitive, and therefore, washing room-related Pockets need to be designed taking into account boundaries of "privacy". There are numerous examples from the past, such as the Paris public baths;
- Study room (home office)-related. This type of Pocket is very relevant to modern life as people are more mobile and enabled by technology to use various places for work and study purposes. There are numerous related architectural experimentations, such as the accessorising of public benches and tables with power points and USB charging ports. Student Karen Kong designed an example called Cocoon Pod; and
- Living room-related: As this Pocket is related to the sharing of conversations, entertainment and play, it

is very useful for improved social interactions. This type of amenity is particularly relevant for people who wish to access home cinema devices with high quality sound systems, or other entertainment devices such as video games (Figure 4). Although "entertainment" is frequently linked to commercial interests, the living room-related Pockets envisaged offer entertainment facilities for free, aligning this type of Pocket with the principles of this article.



Figure 4. Pebble, by Zhiquan Zhang, Yaxuan Li, Luoning Dai, Jiachen Lu, Ningjin Li. 2018 UNSW Industrial Design Studio: Room sharing: associated Pocket

The potential for Pockets to enhance public space differs depending on the type of domestic-related function in question. The Pockets chosen by the students during the 2017 and 2018 Industrial Design Studio experimentation were living-room, kitchen, and workplace-related. These three kinds of Pockets bear the highest potential to enhance social interactions. The range of domestic-related amenities can be organised on a spectrum, from the lowest to the highest potential to enhance public space (Table 2).

Importantly, the economic, symbolic, aesthetic and ethical values of Pockets also differ depending on the type of amenity in question.

Lowest			→	Highest		
	Bedroom-related	Bathroom-related	Study room-related	Kitchen-related	Living room-related	
Potential of enhancement of public space	No	Mostly no, as bathroom-related activities relate to intimacy and/or nudity (Culturally specific)	Medium No when work requires concentration, solitary activity	Rarely no	Rarely no	
	Rarely yes	Yes if activities relate to care, without excessive intimacy	Yes for co-working, or if person is available for social interaction while working	Mostly Yes As the dining table is a social place of the inhabitation	Yes As it is the most social place of the inhabitation	

Table 2. Comparison of different types of domestic-related Pockets

SHARING AN AMENITY: SOCIAL BENEFIT CREATED BY ECONOMIC, SYMBOLIC, AESTHETIC AND ETHICAL VALUES

As Pockets are an enabler of performing private activities in public space, their key contribution lies in their social value for the community. Other potential values of the amenity are studied in this section: a quantitative economic value of the amenity, a symbolic value, an aesthetic value, and an ethical value.

There is an economic aspect to sharing a valuable amenity in public space, as some persons would not be able to afford this amenity otherwise. This economic value differs from commercial interests, as it excludes any sense of another party's commercial interest. The Pocket is not privately owned, and is part of public space.

There is a symbolic value of the amenity: it potentially valorises the area (Gieryn, 2000: 465), the urban setting, and the people who use it. David Engwicht is an urban planner who focuses on adding symbolic value to public space in order to gain a social benefit (Engwicht, 1999; Engwicht, 2015). The precise symbolic value depends on the context, but is especially noticeable in disadvantaged contexts.

The precise symbolic and aesthetic value of a Pocket depends on its successful integration in context. There are two design strategies for Pockets: they are either integrated in the initial stages of the design of public space, or they are an intervention in the existing public space. Advantages and disadvantages differ for each in terms of aesthetic value to public space and to the urban fabric. In the case of a Pocket inserted into existing public space, the advantage is that the context, the actual usages, and thus the potential for social interactions, are known in advance (thus assisting the selection of an appropriate Pocket design). The disadvantage of this strategy is that the introduction of an inserted Pocket can be incongruous, as the initial public space was not designed by taking its presence into account. In the case of a Pocket designed concomitantly with the design of public space, the advantage is that the location can be more freely chosen so that the coherence of the public space as a whole, including the Pocket, is enhanced. There are no direct disadvantages to this strategy if the Pocket is well designed. Therefore, the planning and design of Pockets is preferably integrated in the design of the public space itself, from the first stages of the planning and design process, to ensure the coherence of public space, and the adequate integration of the Pocket. The addition of Pockets to an existing public space is still of benefit, however, provided there is no resulting incongruence with the existing urban fabric and no consequential overabundance of artefacts in the public space.

The qualitative aesthetic value of Pockets is linked to their ethical value by virtue of an allied concern regarding public utility. The quality of public space relies not only on its formal characteristics, but on the fact that it is possible to interact with others. That the very purpose of Pockets is to not restrict the forms of possible social interaction, and moreover that this purpose is not commercially-focused, enhances its ethical value. One specific ethical value of Pockets is the increased participation of minorities in public space. When a Pocket enhances real public space, everyone feels welcome. The amenity itself can be a driver for the increased presence of people usually absent (or not visible) in public space. This provides an important social benefit: it enhances equality, sympathy, fraternity, and awareness of diversity and difference in society. In particular, Pockets can be a valuable resource for those in need, providing the homeless with support for everyday life. Due to their location in public space, Pockets avoid overt social segregation for those in need. People in need – who are usually not visible in public space – can avail themselves of Pockets not only to support their daily needs but to create opportunities to engage in public space via the anchor in domestic-related amenities.

POCKETS CATALYSING POLITICS: THE GAP BETWEEN SYMBOLIC AND ECONOMIC POWER

The economic dimension to sharing a valuable amenity in public space has political implications. Pockets transgress the usual hierarchy of access to available amenities according to given economic and social status. According to Rancière, this is a characteristic manifestation of politics. In *Disagreement*, Rancière identifies the beginning of social emancipation with the reforms led by Solon (Athens, 594

BC) that conferred citizenship as a result of the abolition of debts. Democracy, and thus politics, emerges with the "irruption" of the poor into a world controlled by (and for) the wealthy. Before the reforms led by Solon and Cleisthenes, the aristocratic order of things was based on the symbolic dignity of a class as related to their economic status. Now as then, "politics" arises when this identification between symbolic and economic power is interrupted - when a power is instituted that cannot be linked to the power of elders, founders, the wealthy and the knowledgeable (Rancière, 1999: 74). According to Rancière, it is the gap between symbolic power and economic power - the assertion of different hierarchies - that creates a rupture. This rupture creates a public "scene", where new modes of citizenship are introduced governing the relations between rulers and those being ruled, and thus a change concerning symbolic identities (Rancière, 1999: 36). The gap - the rupture with previous hierarchies - creates politics.

In the case of Pockets, a shift is created in social hierarchies, as lower economic demographies have access to highly valuable amenities – mini cinemas, barbecues, etc. – amenities not available at home but access to which in the public domain confers symbolic power. Politics in the context of Pockets arises through the gap between symbolic and economic order created by enlarged social participation in public space. In this sense, the ideas around symbolic value developed in the work of David Engwicht exemplify the significant political potential of Pockets.

POCKETS CATALYSING POLITICS: MULTIPLE POCKETS ENHANCING THE NEGOTIATION OF SPACE

Any assessment of the value of Pockets needs to consider the number of Pockets that are built in one public space. Skateparks exemplify the way users negotiate their presence in an array of different platforms and areas. While skateparks cannot, per se, be considered Pockets (they are too large to be a "pocket" immersed in public space), the smaller platforms are, akin to Pockets, places of social interactions. Skateparks enable freedom of usage in time (e.g. being active, taking a break) and in space (e.g. active areas, resting/watching areas) and thus a freedom of interaction with others. Skateparks are open-air areas, contiguous with urban space (when there is no fence), and open to the general public, even if the sport is typically associated with a certain level of fitness linked to age. Furthermore, other than local "rules" underlying social interactions and the dynamics of community cohesion, there are no laws that significantly restrict the public character of skateparks. This confers on skateparks a high social benefit. The Guardian insists on the positive role skateboarding can play in community cohesion (Borden, 2015b). According to Iain Borden, "there are signs of architects doing more to engage people with spaces" (Borden, 2015a), as the benefits to the community become tangible.

Similar to the placement of resting and observing areas inside a skatepark, setting Pockets at a distance from each other in public space is an efficient way to initiate and develop dynamics involved in the negotiation of space. Instead of providing just one amenity, providing three or more amenities theoretically enhances the negotiation of space and thus the social benefits of Pockets which, in turn, enhances public space. While the specific distance between amenities needs to be tailored to the type of amenities proposed in the context of individual sites, a system combining three amenities (or more) in a spatial relationship is suggested to maximise an open and fluid system of social interactions (Figure 5).



Figure 5. Diagram showing one example at one moment in time of areas of "privacy", "sphere of private contacts with friends and family", "sphere of private contacts with strangers", and public space in the case of multiple Pockets (Source: authors)

The potential for social interactions depends on the type of amenity. As mentioned above, a mini cinema enhances public space less than a kitchen-related amenity. But the benefits of setting three mini cinemas in a system (for example) manifest in the configuration's ability to enhance conversations before and after screenings, well in excess of the social potential of a single mini cinema. Additionally, a system of multiple amenities serves to draw users' attention away from the amenity itself, and onto the social dimension of collective interaction. Drawing on the efficacy of skateparks to enhance public space, multiple closely located amenities are considered more likely to enhance public space than multiple isolated amenities.

CONCLUSION

The concept of publicly shared, domestic-related amenities addresses the needs of contemporary Western societies faced with a range of social challenges, from those linked to historically entrenched relationships between the public and private realms, to those associated with current urban density levels.

In relation to these former needs, when adequately located, planned and designed, Pockets offer significant economic, symbolic, aesthetic and ethical value to our urban communities, including the ethical distinction of elevating the visibility of minority community members typically under-represented in public space. Equally, Pockets act productively on the politics of public space, in two key aspects:

- By providing access to valuable amenities otherwise not available to all, Pockets disrupt the conventional alignment between social status and access to resources, creating a gap between symbolic and economic orders; and
- By causing a recalibration of boundaries between public space and private place, Pockets facilitate a negotiation between individual and collective usage, both at the scale of the Pocket, and at the scale of multiple Pockets when set at adequate distance from each other. The space around the amenities is negotiated continuously, by continuously different configurations of people. This negotiation of presence and usage significantly enhances public space.

In relation to the needs associated with current urban density levels, Pockets offer ways to ameliorate increased inhabitation density and the loss of privacy; povertyinduced loss of privacy and amenities; and the loss of "real" social interactions in a modern context.

In each case, considered planning and design of Pockets – preferably integrated in the design of public space itself – is needed to ensure that the lines between public and private space are maintained, that public space retains its essential "public" quality and is not overwhelmed, and that design quality is maintained to avoid (socially and economically) costly Pocket maintenance. Recent studio experimentation in the pedagogical context continues to inform understanding of the benefits of Pockets, particularly regarding Pocket types, numbers, and optimal system configurations. Future experimentation promises greater understanding of the potential for the concept to enhance the social fabric of our public spaces.

REFERENCES

- Borden, I. (2015a). An Interview with Professor Iain Borden on the "Long Live Southbank" Campaign and Skatepark Design from the 1970s to the Present, Fakie Hill Bomb, https:// fakiehillbomb.wordpress.com/2015/07/22/an-interviewwith-professor-iain-borden-on-the-long-live-southbankcampaign-and-skatepark-design-from-the-1970s-to-thepresent, accessed 25th July 2019.
- Borden, I. (2015b). The new skate city: how skateboarders are joining the urban mainstream, The Guardian, https:// www.theguardian.com/cities/2015/apr/20/skate-cityskateboarders-developers-bans-defensive-architecture, accessed 25th July 2019.
- Cotner, D. M. (2009). Livable human communities: A sustainable narrative, *Spatium*, No. 19, pp. 1–7.
- Davis, M. (1990). Fortress LA. In M. Davis (Ed.), *City of quartz: excavating the future in Los Angeles*. London, New York: Verso, pp. 222-263.
- Delbridge, A., Bernard, JRL., Blair, D., Peters, P., Butler, S. (1991). *The Macquarie Dictionary*. Macquarie University: The Macquarie Library.
- Drummond, L. B. W. (2000). Street Scenes: Practices of Public and Private Space in Urban Vietnam, *Urban Studies*, Vol. 37, No. 12, pp. 2377–2391.
- Engwicht, D. (1999). *Street Reclaiming: Creating Liveable Streets and Vibrant Communities*. Sydney: Pluto Press.
- Engwicht, D. (2015). TED, https://www.youtube.com/

watch?v=USmTQeKRaP4, accessed 25th July 2019.

- Giedion, S. (1961). *Space, time and architecture*. Cambridge, Mass.: Harvard University Press.
- Gieryn, T. F. (2000). A Space for Place in Sociology, *Annual Review of Sociology*, No. 26, pp. 463–496.
- Habermas, J. (1989). *The structural transformation of the public sphere* [1962]. Cambridge, MA: The MIT Press.
- Harvey, D. (1989). *The condition of postmodernity: An Enquiry into the Origins of Cultural Change*. Oxford: B. Blackwell.
- Lefebvre, H. (1991). *The production of space* [1974]. Oxford: Blackwell.
- Levine, M. H. (1980). Privacy in the tradition of the Western World. In W.C. Bier (Ed.), *Privacy, a vanishing value?*. New York: Fordham University Press.
- Mairs, J. (2015). James Furzer to crowdfund parasitic sleeping pods for London's homeless, Dezeen. https://www.dezeen. com/2015/08/19/james-furzer-crowdfund-parasiticsleeping-pods-london-homeless-indiegogo/, accessed 25th July 2019.
- McDowell, L. (1999). *Gender, Identity and Place: Understanding Feminist Geographies*. Cambridge: Polity Press.
- Rancière, J. (1999). *Disagreement: politics and philosophy*. Minneapolis, London: University of Minnesota Press.
- Toloudi, Z. (2016). Are we in the midst of a public space crisis?, The Conversation, https://theconversation.com/are-we-inthe-midst-of-a-public-space-crisis-56124, accessed 25th July 2019.
- Ujang, N., Kozlowski M., Maulan S. (2018). Linking place attachment and social interaction: towards meaningful public places, *Journal of Place Management and Development*, Vol. 11, No. 1, pp. 115-129.
- Weinthal, L. (2011). *Toward a New Interior, An Anthology of Interior Design Theory*. New York: Princeton Architectural Press.

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METHODOLOGICAL APPROACH TO CREATING AN URBAN LIGHTING ATMOSPHERE WITH REGARD TO HUMAN NEEDS

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The purpose of this paper is to assess how lighting correlates with human needs and emotions and to examine the implications for lighting design. The complex variables of urban lighting include practical, social, cultural and semantic elements of the urban environment. The research identified the most promising opportunities for using lighting technologies responsive to the basic levels of the human need for lighting. The dynamics of "LIGHT-VIEWER-ATMOSPHERE" were applied in order to explore critical areas of interdependence. To determine the most critical areas, the hierarchical principles of A. H. Maslow's pyramid of needs were adapted and applied to the data. The authors studied the interaction between the viewer and light technologies in order to determine the most likely enhancements to the emotional impact of lighting. The "Expanded hierarchy of needs with regard to the presence of light" illustrates the issues considered here. The classification of societal needs is based on an analysis of the emotional impact of examples of lighting solutions in architectural environments within a clear social context. A morphological analysis was carried out using the cross-consistency assessment method (CCA). Criteria for evaluating the effects of light were considered on 4 basic levels of needs following Maslow's pyramid configuration.

Key words: lighting design, urban lighting, needs of society, concepts and city lighting programs.

INTRODUCTION

Examining the purpose of a design is an important tool for implementing architectural concepts of "light architecture". Light architecture is a holistic system that solves compositional and planning tasks related to lighting decisions.

This article introduces the term "light effect". It is the influence of a light source on the perception of the illuminated architectural environment on one or a group of viewers, with the subsequent emergence of an emotional response. Qualitative indicators of this effect are brought together by the concept of "atmosphere created by the light effect", which determines the emotional state of the audience. Human needs with regard to lighting depend on the individual's need for the presence of light in essential everyday activities.

Technical outdoor lighting systems for urban spaces are rapidly changing. Their use in the urban environment requires a special methodology for lighting open spaces, which is of interest to the suppliers and developers of lighting systems, designers, architects, and urban environmental authorities (Zielinska-Dabkowska, 2019). The technical capabilities of lighting technologies to create high impact effects remain under-developed. The unsystematic use of light configurations leads to visual discomfort (Efimov, 1990).

The development of an integrated approach to forming the luminous environment of the city includes identifying the missing criteria and determining the factors influencing the construction of the hierarchy of interaction for types of lighting, with the task of artistic harmonization in the urban space. For the modern urban environment, it has become important to use creative concepts, i.e., visual and decorative

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principles of lighting arrangement to enhance the emotional impact.

The psychology of light perception and light's influence on the emotions is thoroughly considered in the work of philosopher G. Böhme (1993). According to his theory, in the interaction between an individual and a spectacle, the atmosphere has fundamental meaning for the emotional perception of the viewer. Böhme gives an original interpretation of "atmosphere", implying the physical presence of the viewer in the "space that concentrates mood, emotions and affects".

An emotionally-saturated environment, that is, an atmosphere filled with the viewer's reaction to works of art, and to the totality of the natural and design materials used, including the use of light effects, is the main factor in the perception of beauty and its contemplation (Ingold, 2016).

From the point of view of M. Bille, the atmosphere produced by light architecture is the main "starting point of an analysis of socio-material life where lighting acquires an important position" (Bille, 2019).

In turn, Edensor (2017) describes light as the creator of the interaction space for people, saying that the light atmosphere has special unifying and "aestheticizing" roles.

Based on the psychological aspects of the research into the atmosphere mentioned above, interaction between the three main elements in the process of perceiving light effects in architecture is considered: the atmosphere, viewer and light (Figure 1).

The main research focus is illustrated by the diagram of a hypothetical "LIGHT-VIEWER-ATMOSPHERE" relationship. The authors' philosophical approach is in the theoretical assumption that when the viewer contemplates a light source, a special emotional space is formed and transmitted to neighboring observers. Light should be regarded as a living element, which plays a key underlining role with darkness. In total, both elements envelop the impact area.

The light effect is one of the conditions for creating a special atmosphere, presented in the form of glowing visual images,

illuminating graphic drawings, video sequences or any other application of light art. The viewer's contact with the atmosphere created by the light effect evokes an emotional response in him, expressed by various feelings (wow effect, delight, a sense of happiness, distraction from problems). The influence level of the light effect most often depends on one's preparedness for the perception of that effect. The main focal point of the research is based on the interaction between the light, the viewer and the atmosphere. It is the basis for creating productive lighting decisions in an architectural environment. For the viewer, the reactions to light effects are determined by various needs (practical, social, visual, sacral).

METHODOLOGY AND SOLUTIONS

In order to determine the range of societal needs and requirements for achieving the potential of light technology, this study uses the hierarchical description in the theoretical pyramid of human needs proposed by psychologist A.H. Maslow (1943). Maslow developed a theory based on the degree of human needs, describing the living requirements of an individual in society.

The choice of Maslow's theory has the advantage of applying the scientific concept and adjusting it to the needs of an individual in relation to light. A.H. Maslow's unique hierarchical concept has seven levels of needs. Here, the seven levels were combined into four (Figure 2).

The general philosophical hierarchy of categories of human needs formulated by A.H. Maslow allows us to suggest guidelines for the development of lighting technologies and to give a qualitative assessment of the perception of light effects in the urban environment (Figure 1).

Despite the theoretical nature of the hierarchy of his pyramid, it is often used in market research to explore people's needs (Novatorov, 2016), and could also be used to determine the need for lighting. The task of the research is to use the four main levels of the diagram of needs to describe the effects of light: practical, socio-communicative, visual (aesthetic) and spiritual (sacral) (Figures 2, 3).



Figure 1. "LIGHT-VIEWER-ATMOSPHERE", the relationship between the viewer and the light observed (Source: authors)



Figure 2. Hierarchy of needs in relation to the presence of light, based on the principles of A.H. Maslow's pyramid (Source: authors)

The distribution of needs over the hierarchical pyramid is based on the fact that a person cannot experience "highlevel" needs as long as he needs things that are more primitive. The first "need for light" in a society lies in the area of satisfying physiological needs of a practical nature (Fisher, 2014). The need for security also depends on the presence of light, both natural and artificial (Böhme, 1993).

Shown on the social needs level of the hierarchical pyramid (Figures 2, 3) are the needs of a sociological orientation, together with the use of light technologies for the transmission of information. It is assumed that there are interactions between different social groups by age, by occupation, and by the forms of organization of individual and social life. In accordance with the objectives of the research, the need for respect and approval of society is related to the social level of need. Cognitive needs for knowledge and information are located at the social level of the hierarchy.

The visual level determines the need for light in order to enhance the aesthetic perception of the environment, filling it with beauty and art (Shchepetkov, 2006). The viewer's perception of lighting in the most beautiful and valuable parts of the city gives the lighting solutions the status of art that meets the aesthetic needs of society.

Finally, the highest step of the pyramid of needs is occupied by the sacred level of light perception. The sacred effects of light are examined in a wider sense. This is all that relates to the divine, religious, celestial, extramundane, irrational, and mystical, as opposed to the ordinary. This also includes the desire of an individual for self-actualization, which meets the spiritual needs of a human being and his desire to know what life is about. The relation of man to the sources of light (sun, moon, fire) always has a sacral element. Therefore, it is precisely the satisfaction of this level of needs through the creative development of light technologies that evokes the greatest emotional response from the perception of light fluxes (Figure 3).

Practical need - the light use needed to solve practical issues

The primary need is for the presence of light to fulfil basic physiological requirements. Vision, orientation in space and a sense of security are impossible in the absence of lighting. The impact of light on the perception, behavior and psychology of the viewer is considered to be essential. The amount of solar energy received in the process of life directly affects one's emotional state and sense of joy. An important physiological factor that should be considered is the functioning of the circadian rhythms of the body (IWBI, 2017). They are responsible for our sleep and wake cycles, also affecting the blood pressure, metabolism, reproduction and immune response, and they require a certain amount of illumination. In large cities, people often face a chronic lack of daylight because of, for example, the duration of the daylight hours in different regions or a misunderstanding of the importance of smart illumination design processes. Thanks to lighting specialists, the invention of innovative light sources and their implementation into architectural practice has significantly expanded. Up-to-date approaches make it possible to obtain additional artificial illumination with the physical properties of natural lighting.

Sometimes the high building density in large modern cities creates living conditions in which the presence of natural sunlight is becoming less possible. In cities which, due to their natural surroundings, have a limited number of insolation hours, devices for additional illumination with reflected sunlight are being used. The city authorities of Rjukan (Norway) have begun to install large heliostats – mirrors (Figure 4).

The main aim is to redirect the sun's rays to unilluminated places of urban development, where illumination is weak and does not penetrate because of high mountains. Such devices have also been applied in Northern Italy, in the town of Viganella. Reflected sunlight compensates the lack of daylight, creating a more joyful and cheerful mood for people living there. This approach has made it possible to simultaneously solve psychological problems, together with issues of energy saving and the rational use of natural resources. There is an economic benefit in the form of reduced consumption of artificial lighting due to the use of reflected lighting.

Another original approach to the application of lighting devices was invented in Beijing (China). The city administration faced the problem of a sharp decrease in the natural illumination in large urban areas due to the constant presence of smog, which blocked the sunlight. Unable to get rid of the smog, they decided to reduce the psychological consequences of weak illumination by installing a huge multimedia screen of an artificial sunrise (Figure 5). The installation of high-resolution wide screens with a bright image of the sun created the effect of a natural light source and increased the amount of street lighting. Thus, besides being used for advertising and informational purposes, the use of huge media screens in this case contributed not only to their social and communicative impact on society, but also to a relative decrease in psychological stress from the impact of a man-made urban environment.

PRACTICAL NEED The light use needed to solve practical issues							
Light comfort	<u>Health and light</u> ergonomic issues	Improving safety features	Energy saving				
Sufficient illumination Sunlight imitation Stable mental health	Increasing the amount o daylight in cities Avoid glare	f Fight against night crime Illuminated space to feel sat	Use of solar energy fe				
SOCIAL NEED The need for light during various types of interaction and communication							
Communication an	<u>d mutual exchange</u>	Educat	ion				
Formation of small social groupsIntercourseMotivationLife prospects and plansCognitionInteraction with peopleMeetingDevelopment of intelligenceAmbitionsAwarenessConversationConvivialityCommunionGaining knowledgeSpreading knowledgeAttractive placeHighly attended spaceBroaden the horizonsPurposefulnessAdvertisement							
<u>Cultural</u>	<u>enrichment</u>	Entertainment :	Entertainment and leisure				
Cultural level Sense of beauty Succession Rest and relaxation Festive events Emotions Artistic taste Style formation Aesthetics of action Performance Entertainment Spectacle Transfer and receive artistic vision Distraction from pressing issues Show Feeling of happiness Respect the heritage Concept of beauty Daily leisure Bright event Point of attraction							
Т	VISUA The need for perception	L NEED of new visual information	1				
Beauty and magnificence	<u>The game of visual</u> perception	WOW effect	<u>Alternative to the</u> <u>usual</u>				
Aesthetics and tasteLight drawings on surfaceCorrecting visual appearance Alternative imageSense of magnificenceThe play of light and shadowCatching attentionNighttime light showPerceiving of light paintingsVisual optical illusionsDelight from light effectDistortion of perception							
SACRAL NEED The need to search for hidden meaning, to feel the presence of higher forces							
<u>Spiritual development</u>	Presence of higher <u>forces</u>	<u>Search for the hidden</u> <u>meaning of life</u>	<u>Awareness of the</u> <u>place in the universe</u>				
Figurative meaning in religious doctrine Impact on religious feeling and consciousness	Sensation of contact with the supernatural s Sacred atmosphere "Magical glow" Divine environment	Perception of mystical, spiritual and symbolic Mystical context Semantic meaning in religious doctrine	Man as part of the universe				
		Tengious doeume					

Figure 3. Viewer's need for light. Expanded hierarchy of needs with regard to the presence of light (Source: authors)

An important aspect of the practical nature of our need for light is the need for the feeling of safety (Figure 3). The lack of sufficient illumination is identified with a low level of security. According to studies carried out in 2008-2013, the renovation of the Los Angeles city lighting system made it possible to achieve a reduction in night crimes, in particular, vehicle theft, burglary (robbery, theft) and vandalism (Smalley, 2013).



Figure 4. Heliostats – mirrors, Rjukan, Norway (Source: Askinasi, 2018)

The functionality of lighting in relation to human need is represented primarily by light ergonomics, that is, its ability to influence mental and physical health in general. In urban development, when creating the spatial environment of a city, physical volumes and their position relative to the light fluxes are taken into account. It is also taken into account that the quality of visual ergonomics is influenced by the light intensity, depending on the position of the viewer in relation to the lighting device, as well as the comfort and visual perception (IESNA, 2008) (without excessive glare in the observer's field of view, avoiding the effect of overillumination at night, eliminating light and color pollution, etc.) (Powell, 2002).



Figure 5. Artificial Sunrise screen, Beijing, China (Source: Khaw, 2015)

However, it is important to emphasize the other side of this issue. The brightness of modern light sources has a serious impact on the urban environment. This has led to the need for revising the regulatory standards of insolation and permissible values of illumination. The issue of additional control over light sources, their video-ecological compatibility (Filin, 1998, Filin, 2007), ergonomics and energy efficiency has become very topical (Tomassoni *et al.*, 2015). It is essential to avoid flickering light, rapidly flashing light, and a highly-contrasted environment in urban space, as they can have an adverse effect on human health (Yoshimoto *et al.*, 2017).

Social need - the need for light during various types of communication

The examples of satisfying the need for light considered here have shown that not all lighting requirements in urban spaces can be solved by the functional and practical recommendations in normative documents. The technical issues related to the formation of illumination are closely connected with the social and psychological aspects of its perception (Figures 2, 3). A person does not care about the quality of light fluxes until they become unacceptable or uncomfortable for him, or he ceases to notice them.

Any event or light technology scenario in the urban environment is addressed to the user – the viewer, who is the main character assessing the potentials, advantages and disadvantages of the proposed solutions (Rüdiger Ganslandt, 1992). Modern society is at a new social and communicative developmental stage in which visual information has become insufficient. The best results can be obtained by combining the technological aspects of lighting with a person's philosophical attitude to light, both natural and artificial. It is a huge research scope including the implementation of various activities in which light acts as a unifying element, the connection between the units and participants in the processes (Bille, 2019).

The social role of lighting solutions is designed to achieve an emotional effect and maximize the response from as many viewers as possible. It consists of forming a culture of human behavior in an urban environment. The objectives of this study include the theoretical justification of social and psychological factors in the modernization of programs in urban light space. Herewith, the concepts of media and light complement each other, representing an instrument of influence on the viewer, a means of communication.

Computational design frameworks, which are digital light devices placed on a building's facade are an example of a unique socially oriented modern technology. These light panels are a system of sensitive light sensors that scan a person's movement and reflect his actions in the form of a pixel image on a building's shell, creating a dynamic atmosphere of interaction (Krietemeyer *et al.*, 2015). Together with important energy-efficient characteristics, they make it possible to create a time-varying atmosphere on a building envelope. Individuals become participants in a socio-spatial game between the internal space of a building, the facade glazing and the environmental lighting.

Numerous authors confirm the social binding role of lighting, which allows citizens to feel involvement, acceptance, and belonging in a particular social group. At the moment of interaction, a special emotional climate is created within the radius of the light installation, encouraging the surrounding people to gather into small social groups (Hare, 2003). A small group can be characterized by the following properties: the period of time during which it exists, the presence of certain common goals and tasks, the ephemeral structure forming the group, the correlation of the individuals with the whole group and the alliance of the constituents (Taylor, 1970). In terms of a sociological description, the intercommunion between individuals supposes the following types of activities - practical (joint labor activity), gnostic (joint research activity), aesthetic (joint satisfaction of aesthetic needs), or hedonic (leisure, entertaining), directly communicative, ideological and socio-political practice (Enikeev, 2005). Most of these aspects have the potential to establish interaction between social groups and light technologies.

It is within the framework of the socio-psychological level of satisfying the needs of society for light that promising, innovative and creative lighting technology concepts and lighting techniques can be discovered.

Visual need - the need for perception of new visual information

Light acts as an element of visual expressiveness, strengthening the urban spatial context. The role of light in the perception of the beauty of works of art, architecture and urban planning, visual types of design and technology that saturate the urban environment is so great that it becomes possible to talk about meeting the aesthetic needs of man (Figures 2, 3). Planning and considering the viewer's perception is important for places supposing a long stay and aiming to attract more visitors (Barnaby, 2016).

At present, the rapidly expanding spectrum of opportunities for digital light technologies allows architects to use new concepts of ephemeral light space solutions in their creative work. For example, nowadays it is possible to create shining visual effects and change the perception of architecture. Scott McQuire treats light as the main determining factor that "effectively transforms the modern industrial city into a perceptual laboratory, the site for the construction of new and often unexpected "special effects" (McQuire, 2008). The main designation of light is to strengthen the communicative interactions between the viewer and the surrounding space. Thanks to digital design technologies, architectural solutions for buildings create previously unimaginable ephemeral forms of space, setting new tasks for those developing lighting solutions and creating new illumination concepts in the architectural spaces of a city.

The purpose of light design is to attract attention to the forms and spaces of a city's architecture using aesthetically designed illuminating techniques, in order to generate an emotional response from the viewer. An important tool in this process is the construction of an attractive atmosphere, previously mentioned in the text of the article. For example, according to T. Edensor, the atmosphere is formed by a combination of events and sensations, which in their turn "provoke immersion, engagement, distraction and attraction" (Edensor, 2015). Different lighting solutions can completely change the view of familiar places or even improve the perception of unattractive zones. At night, the sight of a highlighted building may be significantly different from its daytime version, thereby creating other aesthetic feelings of familiar places for the city dweller. Light is a new tool for the formation of aesthetics in the urban environment.

A thoughtful approach to light design makes it possible to highlight the architectural features of a building and the composition of its architectural forms, emphasizing the important and evading the illumination of passive zones (Rode *et al.*, 2014). With the help of light solutions, the plastic on an architectural facade can be visually corrected. Even with a simple design solution on the building's facade, a new unusual lighting solution can be created, increasing the aesthetic value of the building. For example, by organizing the flow of light into a graphic composition on the facade, the aesthetic perception of it becomes different. Digital control of light fluxes allows the light compositions to be dynamically adjusted and modified.

Sacral need - the need to search for hidden meaning, to feel the presence of Higher Forces

The sacral level of the needs of society for light (Figures 2, 3) is located at the very top of the pyramid based on A. H. Maslow's principles in relation to the need for light. This hierarchy gives the highest value to the search for self-realization, the truth of life and one's universal destiny. The question of an emotional response is of particular importance, with direct or hidden meaning, and with mystical or divine scope (Ozorhon and Uraz, 2014). Due to the fact that light is capable of evoking sensations of "mystery and fear," L. Roth describes it as one of the most effective elements in the creation of a sense of divinity (Roth, 2007).

The state of enlightenment and catharsis effect are often used in the architecture of religious and occult buildings and structures. At the same time, embodying the Divine Principle, light becomes a unifying factor in the interaction between a man and higher forces. The visual and optical properties of light are used in tandem with colored glass effects (Farahani *et al.*, 2018), together with the creation of spatial barriers and achieving the sense of the presence of supernatural powers.

The history of architecture has examples in which the lighting design, resulting from a deep analysis of the spatial location of the object, the landscape and the orientation to the sides of the world, makes it possible to have an original visual solution, together with a sacred context. For these purposes, the architecture uses the properties of both artificial and daylight.

Drawing special attention to the implementation of social approaches and creative concepts, architects have explored different technical and construction capabilities. An example of this is the ancient Mayan tribes and their Pyramid of Kukulkan in the city of Chichen Itza, Mexico (García-Salgado, 2010). The creation of the complex of pyramids where it stands dates back to the 11th century. The building itself is believed to contain information about the structure of the world and important astrological data. The Mayan Indians designed and positioned the pyramid so that the shadow of its faces fell on the stairs, forming a wave-like black-and-white image of the Feathered Serpent sliding down the stairs (Figure 6). Here, a unique approach to the use of light in architecture can be observed. It is included in the process of spectacular occult events dedicated to the days of the spring and autumn equinox. Emphasizing the position of the light's main source – the Sun, was the main concept of its architectural design.



Figure 6. Kukulkan pyramid Chichen Itza, Mexico (Source: Schwartz, 2018)

Human admiration for the luminous beauty of the sun underlies the concept of creating large light art objects – artistic analogues of the heavenly body. Light devices in the form of an artificial sun have appeared in different cities in the world, such as the lighting installation of the Solar Flare in Calgary, Canada, 2014, and the Dawn over Dnepropetrovsk monument in Dnepropetrovsk, Russia, 2012.

The installation of the Tropicana Sun luminous sphere in Trafalgar Square in London, England aroused great interest and an emotional response from London residents, stirring the imagination and reflections on the important role of the sun in the life of humankind. These are examples of the conceptual embodiment of the special significance of sunlight in people's lives, whereby the man-made sun personifies the philosophy of the unifying principle addressed to all the inhabitants of the planet.



Figure 7. World Financial Centre installation, New York, USA (Source: Collman and Christie, 2015)

An example of the social and psychological role of light and its sacralization was embodied in the light concept in memory of the greatest tragedy of September 11, 2001 – the destruction of the World Trade Center, New York, USA (McQuire, 2008). Two powerful light streams repeating the shape of two ruined skyscrapers with strict verticals are directed to the sky (Figure 7). The dust particles that are in the air create the effect of soaring substances, as if they represent the departed souls. A deep psychological effect is produced. Thus, the observer has a multifaceted impression, touching on various sensations of the soul.

The above analysis of the examples of light technology in the urban environment in accordance with the chosen research methodology shows that the light environment of a city is fragmentarily formed. The sacral principles of the influence of the socio-psychological needs of society on the development of light technologies are not sufficiently disclosed. The regional individuality and expressiveness of the light environment are not sufficiently taken into account, which reduces its informative significance and negatively affects the psycho-emotional state of a person.

RESULTS AND DISCUSSION

The study shows that theoretical generalizations with regard to the characteristics of lighting technologies allows us to identify the degree of their influence on the formation of interesting directions for lighting design. We should take into account the influence of knowledge related to the social and psychological role of light on this process, in order to create a methodology for the formation of lighting programs for outdoor lighting in urban spaces.

The scientific data presented in the paper in the fields of philosophy, sociology and psychology make it possible to deduce a logical relationship between the interests of city residents and the producers of light programs and technologies. The viewer, his emotional needs in the process of perception, and the social nature of the atmosphere created by the light effect in urban spaces are key in the methodology for using light technologies in urban spaces (Figure 8).

Further, using the results of the study, a morphological analysis was made using the cross-consistency assessment (CCA) method, initially proposed by scientist Fritz Zwicky (1969), which has since been adapted by others. For example, Álvarez and Ritchey (2015), Ritchey (2015) and Demirkan and Afacan (2018) have developed methodological recommendations for determining the parameters and criteria in this method.

Basically, the CCA method is used for finding new ways to develop a particular sector and for finding more effective combinations of its properties. By applying this method, it becomes possible to obtain an expanded list of needs, taking into account the relationship between all aspects considered. This paper considers the viewer's four basic levels of need with regard to applying light solutions in the urban environment. The morphological method makes it possible to find options for the most successful combination of types to satisfy needs within a specific light solution.

When conducting this analysis, 4 parameters (A, B, C, D) were identified, corresponding to each level of needs. They



Figure 8. Scheme of logical relationships between participants in the perception process (Source: authors)

are expanded in Figure 3 in the Methods section of the paper. Each parameter is defined by 4 basic conditions A1, A2 and so forth (Table 1), based on which the morphological analysis was carried out.

Further, the basic conditions are distributed horizontally and vertically in Table 2 in accordance with the CCA analysis methodology. According to the method, parameters A – C are arranged horizontally, while parameters B – D are distributed vertically.

Three main criteria were introduced in the assessment as markers: "+ - Possible combination, well-matched needs", "K - Possible combination, relatively matched of acceptable combinations are highlighted. The conditions of social needs are well compatible with the practical conditions, and the visual with sacral conditions.

According to Table 2, it is obvious that the most poorly matched condition is the energy saving sector. Being an important aspect developing lighting technology and forming a budget for urban lighting, such a serious topic requires a separate study and approach. These issues are not addressed in this paper.

Tables 1 and 2 explain the main conclusions of the research; they can be used to interpret and systematize scientific and technical proposals for further development of lighting

Table 1. A 4-parameter morphological field

Parameters							
Condition	Parameter A	Parameter B	Parameter C	Parameter D			
	Practical	Social	Visual	Sacral			
	Condition A1: Light comfort	Condition B1: Communication and mutual exchange	Condition C1: Beauty and magnificence	Condition D1: Spiritual development			
	Condition A2: Health and light ergonomics	Condition B2: Cultural enrichment	Condition C2: The game of visual perception	Condition D2: Presence of Higher Forces			
	Condition A3: Improved safety features	Condition B3: Entertainment and leisure	Condition C3: Wow effect	Condition D3: Search for the hidden meaning of life			
	Condition A4: Energy saving	Condition B4: Education	Condition C4: Alternative to the usual	Condition D4: Awareness of one's place in the universe			

needs" and "X - Impossible combination, poorly matched parameters". The layout of the assessment markers allows visual selection of the sector that received the maximum amount of "+" markers. These are the combinations of the most efficiently compatible conditions: social and visual, as well as visual and sacral needs. Further, two more zones technology and the practical implementation of urban lighting programs.

The scientific importance of identifying the principles and classifying the methods of light usage is explained by the need to improve the functioning of the social environment (Ellin, 2012). The use of light technologies is becoming a socially

Human needs with regard to light		Practical				Social			Visual				
		Light comfort	Health and light ergonomics	Improved safety features	Energy saving	Communication and mutual exchange	Cultural enrichment	Entertainment and leisure	Education	Beauty and magnificence	The game of visual perception	Wow effect	Alternative to the usual
Social	Communication and mutual exchange	+	+	+	Х								
	Cultural enrichment	+	+	К	Х]							
	Entertainment and leisure	+	+	+	Х]							
	Education	+	+	Х	Х								
Visual	Beauty and magnificence	+	+	К	Х	+	+	+	+				
	The game of visual perception	+	К	Х	Х	+	+	+	+				
	Wow effect	К	К	К	Х	+	+	+	+				
	Alternative to the usual	Х	К	К	Х	+	+	+	+				
	Spiritual development	+	+	+	Х	+	+	К	+	+	+	+	+
	Presence of Higher Forces	+	+	+	Х	К	+	К	+	+	+	+	+
Sacra	Search for the hidden meaning of life	+	+	+	Х	К	+	К	+	+	+	+	+
	Awareness of one's place in the universe	+	+	+	х	К	+	К	+	+	+	+	+
+ Possible combination, well matched needs K Possible combination, relatively compatible needs						eds							
X Impossible combination, poorly matched needs													

Table 2. Cross consistency	assessment of human i	need in relation to	lighting technologies
	,		0 0 0

significant tool, a unifying factor that influences the existing atmosphere in urban spaces and introduces positive changes to the structure of the urban environment.

CONCLUSIONS

Lighting technologies have become increasingly important, and they have a great impact on the organization of urban life, both day and night. Technical progress in lighting design provides new tools for the visual transformation of space. The variety, sophistication and affordability of the technology require a much wider conceptual approach to the lighting design process. Light technologies themselves, implemented without a coherent and purpose driven concept, can only serve as technical devices. For this reason, the article offers a methodological approach to avoid mistakes during the design process and to achieve the following goal: to achieve a memorable visual impact with maximum regard for important human needs. The scientific contribution of the article lies in the development of theoretical provisions for conceptual formation of the urban lighting atmosphere based on human needs in relation to lighting.

The research describes and illustrates important scientific approaches in creating an urban lighting atmosphere. Using the principles of a A.H. Maslow's pyramid of needs, a social model of four basic levels of human needs in lighting is created. An algorithm identifying effective combinations of needs in lighting (CCA method) is proposed. Using the results of the study, the concept of a light project can be thoroughly elaborated. Applying this method in practical design work is a matter of great importance. It can be further used in the development of lighting programs, thus improving the health, comfort, psychological state, and perceptual abilities of individuals. It offers opportunities for improving the concept and establishing the value of human-oriented design.

This article also analyzes the interaction between the viewer and the light technology, with the subsequent formation of a special atmosphere that creates a more intense emotional response in the viewer. The main factors determining the process of such interaction in the surrounding sociopsychological atmosphere are specified. The research results can be further used for considering the perception, emotional response to and philosophical understanding of lighting. These socio-psychological and sacral needs can be considered as the basis for further areas of research, especially research that integrates current discoveries in the neurology of vision.

Another important point developed was the logical connection between the formed environment, with its components and creators – participant technologists and designers, responsible for the application of lighting concepts. The range of factors influencing the choice of design tools and techniques was expanded. In order to prepare municipal programs to improve lighting in the urban environment, one should understand the algorithm for creating light effects, as well as the relationship between the project participants. It is essential to organize the work processes properly, to invite the right participants and to make long-term strategies for improving urban spaces. Ultimately, further application of the results is able to make positive changes in the design and application of lighting technology and present the opportunities for lighting technologies in the best way.

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REFERENCES

- Álvarez, A., Ritchey, T. (2015). Applications of General Morphological Analysis: From Engineering Design to Policy Analysis, *Acta Morphologica Generalis*, Vol. 4, No. 1, pp. 1-40.
- Askinasi, R. (2018). Photos show what life looks like in one of the darkest places on earth after residents built a system of mirrors to mimic the sun. INSIDER, https://www.insider.com/what-life-is-like-in-rjukan-norway-2018-11, accessed 28th October, 2019.
- Barnaby, A. (2016). *Light Touches: Cultural Practices of Illumination, 1800-1900.* New York: Taylor & Francis.
- Bille, M. (2019). *Homely Atmospheres and Lighting Technologies in Denmark: Living with Light*. London: Bloomsbury Publishing.
- Böhme, G. (1993). Atmosphere as the Fundamental Concept of a New Aesthetics, *Thesis Eleven*, Vol. 36, No. 11, pp. 113-126.
- Collman, A., Christie, J. (2015). Tribute in Light shines bright: Most powerful shafts of light EVER projected from Earth are beamed into the Manhattan sky in spectacular 9/11 commemoration as America pauses to remember, https:// www.dailymail.co.uk/news/article-3230792/America-marks-14th-anniversary-September-11-attacks-moments-silenceremembrance-nation.html, accessed 28th Oct, 2019.
- Demirkan, H., Afacan, Y. (2018). Setting The Key Issues And A Prioritization Strategy For Designing Sustainable Interior Environments, *METU JFA*, Vol. 35, No. 1, pp. 201-219.
- Edensor, T. (2015). Light design and atmosphere, *Visual Communication*, Vol. 14, No. 3, pp. 331-350.
- Edensor, T. (2017). *From light to dark: daylight, illumination, and gloom*. Minneapolis: University of Minnesota Press.
- Efimov, A. V. (1990). *Koloristika goroda* (in Russian). Moscow: Stroĭizdat.
- Ellin, N. (2012). What is good Urbanism?, *Journal of Architecture and Urbanism*, Vol. 36, No. 4, pp. 247-251.
- Enikeev, M. I. (2005). *ÎUridicheskaia psihologiia. S osnovami* obshcheĭ i social'noĭ psihologii (in Russian). Moscow: NORMA publishment.
- Farahani, L. M., Motamed, B., Ghadirinia, M. (2018). Investigating heritage sites through the lens of social media, *Journal of Architecture and Urbanism*, Vol. 42, No. 2, pp. 199-211.
- Filin, V. A. (1998). *Videoecology. Good and bad for eyes*. Moscow: "TASS-Reklama".
- Filin, V.A. (2007). Problem of ecology of urban visual environment. Beijing conference, Moscow centre of "VIDEOECOLOGY".

Fisher, T. (2014). Is there a right to architecture?, *Journal of Architecture and Urbanism*, Vol. 38, No. 3, pp. 176-179.

García-Salgado, T. (2010). The Sunlight Effect of the Kukulcán Pyramid or The History of a Line, *Nexus Network Journal*, Vol. 12, No. 1, pp. 113-130.

- Hare, A. P. (2003). Roles, relationships, and groups in organizations: Some conclusions and recommendations, *Small Group Research*, Vol. 34, No. 2, pp. 123-154.
- IESNA (2008). *Light + Design: A Guide to Designing Quality Lighting for People and Buildings.* New York: Illuminating Engineering Society of North America.
- Ingold, T. (2016). Lighting up the atmosphere. Elements of

Architecture. New York: Routledge.

- IWBI (2017). Light: background. International WELL Building Institute, https://standard.wellcertified.com/ light?_ga=2.157030523.1915386481.1552036952-1105338767.1552036952, accessed 4th Apr, 2019.
- Khaw, K. (2015). No, Chinese are not watching giant fake sunsets. Daily Dot, https://www.dailydot.com/news/chinese-fakesunsets-beijing-tiananmen/, accessed 4th Apr, 2019.
- Krietemeyer, B., Andow, B., Dyson, A. (2015). A Computational Design Framework Supporting Human Interaction with Environmentally-Responsive Building Envelopes, *International Journal of Architectural Computing*, Vol. 13, No. 1, pp. 1-24.
- Maslow, A. H. (1943). A theory of human motivation, *Psychological Review*, Vol. 50, No. 4, pp. 370-396.
- McQuire, S. (2008). *The Media City: Media, Architecture and Urban Space*. London: SAGE Publications.
- Novatorov, V. E. (2016). *Personal'nyĭ marketing* (in Russian). Moscow/ Berlin: Directmedia.
- Ozorhon, I. F., Uraz, T. U. (2014). Natural light as a determinant of the identity of architectural space, *Journal of Architecture and Urbanism*, Vol. 38, No. 2, pp. 107-119.
- Powell, B. J. (2002). The Ergonomics of Light, https://www. buildings.com/article-details/articleid/1070/title/theergonomics-of-light, accessed 4th Apr, 2019.
- Ritchey, T. (2015). Principles of cross-consistency assessment in general morphological modelling. *Acta Morphologica Generalis, Swedish Morphological Society*, Vol. 4, No. 2, pp. 1-20.
- Rode, P., Burdett, R., Robazza, G., Schofield, J. (2014). *Cities and Energy. Urban Morphology and Heat Energy Demand.* London: The London School of Economics and Political Science, LSE Cities.
- Roth, L. M. (2007). Understanding Architecture: Its Elements, History, and Meaning. Boulder, Colo: Westview Press.
- Rüdiger Ganslandt, H. H. (1992). *Handbook of Lighting Design*. Braunschweig/ Wiesbaden: ERCO.
- Schwartz, E. (2018). Os curiosos enigmas projetuais da Pirâmide de Chichén Itzá. ArchDaily, https://www.archdaily.com.br/ br/890675/os-curiosos-enigmas-projetuais-da-piramide-dechichen-itza, accessed 4th Apr, 2019.
- Shchepetkov, N. I. (2006). *Svetovoĭ dizaĭn goroda* (in Russian). Moscow: Architecture-S.
- Smalley, E. (2013). *State of LED Streetlight Adoption in U.S.* City of Seattle: US Departmentof Energy.
- Taylor, H. F. (1970). *Balance in small groups*. New York: Van Nostrand Reinhold.
- Tomassoni, R., Galetta, G., Treglia, E. (2015). Psychology of light: How light influences the health and psyche, *Psychology*, Vol. 6, No. 10, pp. 1216-1222.
- Yoshimoto, S., Garcia, J., Jiang, F., Wilkins, A., Takeuchi, T., Webster, M. A. (2017). Visual discomfort and flicker, *Vision Research*, Vol. 138, pp. 18-28.
- Zielinska-Dabkowska, K. (2019). Urban lighting masterplan origins, definitions, methodologies and collaborations. In N. Davoudian (Ed.), *Urban Lighting for People: Evidence-Based Lighting Design for the Built Environment.* London: RIBA Publishing, pp. 18-41.
- Zwicky, F. (1969). *Discovery, invention, research through the morphological approach*. New York: Macmillan.

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GRASPING THE FRAMEWORK FOR THE URBAN GOVERNANCE OF SMART CITIES IN SERBIA. THE CASE OF INTERREG SMF PROJECT CLEVER

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There is global interest in the smart city, not only as an operational concept, but also as a funding mechanism of the EU Cohesion Policy, joint programs, projects and initiatives. According to the EU Commission, a smart city is a place where traditional networks and services are made more efficient with the use of digital and communication technologies, for the benefit of its inhabitants and business. Urban governance, as an instrument of integrated urban development, has an important role as a decentralization criterion in improving the smart city's performance in more developed countries and regions. At the same time, the countries of Southeast Europe that are not members of the EU (including Serbia) are lagging in this matter. Taken that the application of urban governance in the context of a smart city can be seen as a practical novelty in Serbia, this paper presents and discusses the existing state of the art in this field. The findings presented were derived from collaborative engagement within the INTERREG project CLEVER – Co-designing Smart Local Solutions for Exploiting Values and Enhancing Resilience, during 2018/2019.

Key words: urban governance, smart city, integrated urban development, CLEVER, Serbia.

INTRODUCTION

The attention to smart cities and their governance is rapidly emerging in policy formulation, resource management, practical action and academia. The fragmentation of approaches to the smart city makes for a complex debate. The concept comprises innovative solutions (and processes) based on technologies with various aspects of integrated urban development planning, including urban governance. According to Meijer and Bolivar (2016: 392), governing a smart city is about generating new forms of social collaboration through the use of information and communication technologies. In this case, the technology itself is not directed towards making a city smarter. In order to direct smart city development, there is a need for political understanding and support for enhancing individual and institutional capacities through a collaborative approach, and a focus on the common good, as well as economic improvements. Landry (2006), for example, considers cities as a nucleus of economic development, where city politicians and administrators should not aim to solve all the problems in the city, but rather enable urban systems to engage and govern a variety of problems and produce a range of common goods. Thus, the governance of smart cities should not be observed solely as a technological issue, but a complex endeavour which involves sharing responsibilities between government institutions and all other participants in the city's development process.

Challenges in the area of urban development are numerous and related to the proliferation of international influences on local urban cultures due to the homogenization of global urbanity, pronounced inter-regional competitiveness and entrepreneurship, but also weakening of the support to cities by the state (Tasan-Kok, 2010). In order to tackle the multilayered challenges and potentials of local environments, various joint programs, projects and initiatives in the field of integrated urban development have been generated

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and are ongoing across Europe. These programs are aligned with the priorities of EU Cohesion Policy² directed towards achieving a smart, green, connected and socially responsible Europe (goals of the EU Cohesion Policy 2021-2027). EU Cohesion Policy supports the development of national and local urban development strategies, since it is an instrument of integrated urban development planning directed towards enhancing administrative capacities and regional and cross-border cooperation (goal no. 5 - Europe close to its citizens). Although a number of programs for strengthening the capacities for urban governance are initiated and ongoing for EU member states, the countries of Southeast Europe that are non-EU members have had little or no experience in this field, and little or no access to funding for testing and innovation in urban development practice.

In the context of Southeast European cities, the global interest in the smart city, as both an operational concept and a funding mechanism of the EU Cohesion Policy, is often coupled with complexities of path-dependency. Although the subject of urban governance has developed into a mature academic field, Serbia can still be considered at the starting position in this matter. This is not surprising if taking into account the long-lasting role of state institutions in planning and development practice, and thus the difficulty of detaching the activities from their traditional "hosts", and transferring both capacities and competencies to other stakeholders (thus changing existing regimes). Furthermore, the local context of Serbia is characterised by conditions of economic transition and the process of European integration, adjustments to planning in an unregulated market environment, and institutional capacities and regulations which do not follow these challenges at the same speed (Čolić, 2015). In addition, the local planning context is influenced by different internal stimuli and the embedded societal values of development actors, including policymakers and practitioners.

A number of activities to raise awareness of urban governance as an instrument of integrated urban development have been carried out in Serbia since the adoption of the New Urban Agenda - Habitat III. In line with goal no. 5 of the EU Cohesion Policy, Serbia participated in several international scientific and professional programs in the field of integrated urban development. Local integrated urban development policies were adopted in the City of Niš (2007), City of Kraljevo (2013), City of Kragujevac (2013) and City of Užice (2014). In 2019, the first national sustainable and integrated urban development policy was prepared - Sustainable Urban Development Strategy of the Republic of Serbia until 2030, hereafter SUDSRS. Besides integrating relevant thematic areas and a number of sectoral policies at different levels (supranational, national, regional, and local) through priority spatial areas of intervention, the national policy provides options for the integration of different financial resources and for establishing urban

governance regimes to facilitate the development process.

The project discussed in this paper, CLEVER (INTERREG SMF project – Co-designing Smart Local Solutions for Exploiting Values and Enhancing Resilience), is here considered as part of the effort to increase capacities in urban governance for the integrated urban development of smart cities. The project was carried out with partners from Romania, Croatia, Serbia and Italy (technical support) during 2018-2019. The project's process allowed for the collaborative identification of dilemmas, problems and potentials in the field of urban governance and smart cities, some of which are explored in this paper.

THE ROLE OF URBAN GOVERNANCE IN THE SMART CITY APPROACH

The challenges of contemporary cities lead to fragmentation of their political, economic and social structures and the emergence of new conditions and new problems that cannot be solved solely by traditional planning and government instruments, or market instruments in and on their own (Jessop, 1998). The lack of public funds has urged cities to seek partners to achieve their goals, giving urban governance an important role in the allocation of material resources (Cars et al., 2002; Hyden, 2011). Urban governance is described as a process of coordinating the decision making of different actors, social groups and institutions within a particular institutional context, whereby the goals are reached through discussion and agreement (Le Galès, 1998; DiGaetano and Strom 2003). It builds on the capacity of the local community to "unite and articulate different entities, both internally and in relation to the external environment" (Le Galès, 1998:496). Socially innovative practices in urban governance and territorial development are associated with the emergence of new institutional forms that draw on the greater involvement of actors and institutions from both the economy and civil society (Moulaert et al., 2007). To enable governance to be effective, the focus is a shift to the formation of institutional and urban networks. This form of planning involves building collaborative relationships between actors to implement specific programs and establish a governance culture (Healey, 2004). Governance practices are thus enhanced by the framework of "participatory, inclusive and networked relations between socio-cultural, political and business actors" (Swyngedouw, 2005: 1995).

Besides the potentials, some of the most pertinent critiques of introducing new governance models relate to linking governance with the new public management (Sager, 2005), the dominance of certain social groups that formulate urban policies (for example economic, socio-cultural or political elites), as well as a lack of process transparency (Swyngedouw, 2005; Borraz and Le Galès, 2010; Innes *et al.*, 2010; Blanco *et al.*, 2011). In addition, the research of networks and partnerships in urban regeneration practices raises questions about the feasibility of multi-partner cooperation goals, the implications for inclusion and innovation, and whether networks can replace or operate in parallel with government arrangements (Blanco, 2013).

Together with the emergence of governance approaches

² One of the EU Cohesion Policy 2021-2027 priority areas for directing investments (65% to 85% of ERDF and Cohesion Fund) is smart Europe, through innovation, digitization, economic transformation and support for SMEs.

seeking the decentralization of decision-making processes, the smart city concept evolved as a blueprint of technological evolution in the field of planning in the early 2000s. At first, the concept was used to reflect the role of information and communication technologies to enhance planning in the area of energy use, competing land-uses and resources. According to Castelnovo et al. (2016: 724) most definitions of the smart city "make a direct or indirect reference to improving performance as one of the main objectives of initiatives to make cities smarter". The performance improvement is most often directed towards the field of ICT or intelligence, infrastructure and services, the economy, mobility or the environment. Additionally, smart city definitions point out the need to tackle the performance/functioning of governance and administration, enhance the quality of life and lifestyle, and take care of society. Thus, it can be argued that in a complex metabolism of a city, the adjective "smart" often refers to the implementation of "hard", visible infrastructure and ICT in urban development processes (and outcomes) in order to enhance the performances of a city as a whole. Besides the hard, visible and usually measurable domains of the smart city, there are soft, not always visible areas that affect the functioning of city hardware: knowledge, capacities, networks, policy innovations, cultural heritage, public participation and more (Hollands, 2008; Angelidou, 2014). Urban governance can thus be seen as a binding component between the aforementioned "hardware" and "software" of urban development.

A comparative literature review of studies suggests that operational domains of urban governance in the smart city context have developed over recent years (Castelnovo et al., 2016; Meijer and Bolivar, 2016). Available research papers in the field of the smart city can be mapped through variation points according to the methodologies applied. Some of the work focuses on smart technology, people and smart collaboration, with an emphasis on process; others examine the transformative potential of urban governance, which may produce new knowledge, understandings and capacities to trigger the more efficient implementation of smart projects. Additionally, there are studies that examine smart city practices in light of power relations. In some cases, projects may obtain the label of "smart" to enhance legitimacy claims for achieving desired outcomes set by powerful decision-makers.

The above noted approaches suggest different ways of observing the concept of urban governance in relation to the smart city. In some cases, the urban governance of smart cities is considered a smart urban collaboration in a lasting transformation process. Other more conservative definitions of urban governance in the context of smart cities suggest no need for the transformation of governmental structures and processes, because smart governance is about "making right policy choices and implementing these in an effective and efficient manner" (Meijer and Bolivar, 2016:399). Although this approach to urban governance does not emphasise the need for the transformation of government structure, it suggests that the restructuring of the decision-making process in line with the principle of subsidiarity in a bottomup fashion is necessary (Bătăgan, 2011).

METHODOLOGY

In recent years, the influence of the EU accession process holds a prominent role in introducing innovation into the planning system at all levels of decision making in Serbia. Following EU development policy, the areas of smart cities and integrated planning have aspired to become a complementary asset to existing practices. The research and testing of novel concepts in Serbian development practice are thus supported through different IPA funded projects, and among them the INTERREG SMF CLEVER project (2018-2019). This part of the paper provides an overview of the research methods employed within the project in order to distinguish the role of urban governance as an instrument of smart city development in Serbia. The results of the analysis are presented and discussed in this paper.

The CLEVER project was carried out in a consortium of Baia Mare Municipality (Romania), Development Agency North (Croatia), TRILOGIS (Italy) and the Institute of Architecture and Urban & Spatial Planning of Serbia (Serbia) during 2018-2019. The main aim of the project was to assist the implementation of smart urban regeneration strategies in partner cities, through a transnational framework that combines innovative participatory governance, PPP and funding tools, based on the exploitation of ICT instruments.

As a Seed Money Facility (SMF) project, the mandate of CLEVER included developing the main project for implementing sustainable urban strategies and action plans for revitalizing public space that would: 1) foster an integrated approach by developing instruments to deliver tangible investments through the horizontal, vertical and area-based integration of key actions and measures with regard to societal, economic, funding and technical aspects; 2) involve key local stakeholders by providing real-time communication and feedback through the use of technology, thus improving transparency, and vertical and horizontal communication; 3) provide citizens with the ability to contribute to the shaping of local policies for public urban spaces and their neighbourhoods or inner-city areas; 4) measure impact through SMART Key Performance Indicators by leveraging on existing frameworks and indicator databases pertaining to Smart Cities (i.e. UNECE-ITU SSSC), as well as projects (i.e. Horizon 2020 ESPRESSO project); and 5) speed up the implementation of innovative solutions in the local administrations, through the development of a smart urban solutions marketplace, a toolkit for organizational innovation in Local Government, and a compendium of best practices.

The main visible results of the CLEVER project are a joint report on the state of the art for smart cities in partner countries, a scan of potential partners for future cooperation in the field of integrated urban development (local self-government, research organizations, non-governmental sector) and optional sources of funding for the implementation of future projects in the field of the smart city, and an application submitted for the main project (iCLEVER). The CLEVER project aimed to support project partners in identifying new candidate stakeholders for implementing the main project through discussions with the local government, research, citizen initiatives and NGO representatives.

The project enabled partners to untangle some of the existing problems, potentials and dilemmas related to the concept of the smart city, including its applicability in different local contexts. The research methodology is predominantly based on a qualitative approach and includes:

- Desk-based analysis of supranational, EU and national policies in partner counties in order to portray externalities and influences in relation to the absorption potential of partner countries in the field of smart cities; analysis of urban governance levels and stakeholders (vertically) and across different local contexts (horizontally);
- SWOT analysis to assess the conditions and dilemmas in the field of integrated urban development for smart cities through technical, financial, governance, leadership, innovation and behavioural domains at the national (contextual) level; and
- Cross-checking findings through Discussion groups with partners from Romania, Croatia and Serbia during meetings in Baia Mare, Romania (21.01.2019; 29.07.2019) and Belgrade, Serbia (09.04.2019) (Figure 1).

POLICY FRAMEWORK FOR THE GOVERNANCE OF SMART CITIES

Supranational level

The operationalisation of the smart city concept at the supranational level is carried out through a set of framework conditions, policies and regulations. A cross-cutting dimension of the supranational policies analysed in this paper is that of decentralisation and governance in the context of the smart city. These instruments of integrated planning serve to coordinate and integrate smart city stakeholders – cities, businesses, and research organisations. The supranational documents related to smart cities that were analysed are outlined in this section, in order to provide understanding about external stimuli in the field in the case of Serbia.

Following the launch of the 2030 Agenda for Sustainable Development by the UN General Assembly in 2015, countries have struggled to find a way to implement the Sustainable Development Goals (hereafter SDGs) at the national level. Therein, the smart city concept is often seen as a linking normative dimension that embraces SDGs at the local level. Urban governance and regeneration in the



Figure 1: First row – Discussion group with partners in Baia Mare, Romania (January 2019); Second row – Discussion group with partners in Belgrade (April 2019) (Source: authors)
context of smart cities are directed towards implementing SDGs, and especially Goal 3, Goal 4, Goal 8 and Goal 11. It should be noted that Goal 11 is directly related to the topic of urban governance for smart cities, and seeks to ensure: access to safe and affordable housing and transport; enhanced urbanization and the capacity for participatory, integrated and sustainable human settlement planning and governance; protected cultural and natural heritage; reduction in the adverse environmental impact of cities; the provision of universal access to safe, green and public spaces; and an increased number of settlements adopting and implementing integrated urban policies (Table 1).

The New Urban Agenda – Habitat III (2017) is another document which is relevant for Serbia in terms of support for adopting feasible and participatory urban policies at the national and sub-national level to enhance effective urban governance for smart and sustainable cities. The new UN Urban Agenda promotes capacity development as a multifaceted approach that addresses the ability of multiple stakeholders and institutions at all levels of governance and combines the individual, societal and institutional capacity to formulate, implement, enhance, manage, monitor and evaluate public policies for sustainable urban development. National urban policies are considered the main pillars for developing governance structures, improving urban legislation and regulations, urban planning and design, the local economy and municipal finance, and local implementation plans. Paragraph 15 of the New Urban Agenda determines that national governments play a leading role in the definition and implementation of policies and legislation in the field of sustainable urban development and emphasises the equally important contribution of subnational and local governments, as well as civil society and other relevant stakeholders, transparently and responsibly. By recognising the importance of the abovementioned groups of stakeholders in managing the urban

Table 1. Comparative overview of priorities for well-governed cities in supranational policy frameworks (Source: authors' elaboration)

Policies / domains	2030 Agenda for Sustainable Development (2015)	New Urban Agenda of the UN (2017)	Geneva Ministerial Declaration on Sustainable Housing and Urban Development (2017)	OECD National Urban Policy Programme (2019)
Urban governance	- good governance at all levels and on transparent, effective and accountable institutions (goal 11 and 17)	 ensure national, subnational and local institutional and regulatory frameworks adequately linked to transparent and accountable finance mechanisms (principle 86); compliance to legal requirements through a strong, inclusive management framework that deals with land registration and governance 	 enhance principles of governance by promoting integrated national policies for smart and sustainable cities with a focus on capacity building and institutional support to promote policy implementation (principle 4) promoting dialogue between governments and local stakeholders; creating professional platforms for dissemination of results (principle 5) 	 - enhance knowledge creation, exchange and management on NUP at all levels of government, civil society, private sector and other relevant stakeholders (goal 1) - help increase the capacity of (human, financial and institutional) policy makers at national and subnational levels (goal 2)
Social development and participation	 well-being for all at all ages (goal 3) inclusive and equitable quality education for all (goal 4) information dissemination for integrated decision-making and participation (goal 16) 	- enhance inclusive, implementable and participatory urban policies to mainstream sustainable urban and territorial development as a part of integrated development strategies and plans (principle 86)	- developing and implementing capacity- building programs for participatory, integrated, sustainable, resilient and affordable urban areas, while enabling the involvement of all relevant stakeholders (principle 2)	- provide direct country support for the preparation of national urban policy and participatory process to ensure the involvement of relevant ministries, subnational governments and civil society; monitor the progress and implementation of national urban strategies (goals 3 and 4)
Innovation and economic development	- inclusive and sustainable economic growth; productive and full employment (goal 1)	- sustainable management and use of land (principle 104)	- focusing on innovation, inclusiveness, improvement of youth perspectives, and job creation (principle 1); - circular economy for sustainable urban mobility solutions, enhanced green infrastructure and nature- based solutions (principle 3)	- provide a networking platform for all levels of government, civil society, the private sector and other relevant stakeholders to enhance collaboration for economic development (goal 5)

challenges, this document states the need for a *smarter approach at the decisional level.*

The Geneva Ministerial Declaration on Sustainable Housing and Urban Development (UNECE, 2017) addresses the challenges that settlements in the UNECE region face. This document emphasises the importance of a smart city approach in relation to education, training and employment in the face of contemporary challenges in urban development. Additionally, it provides a set of strategic goals for national, regional and local governments in the field of economic, social and environmental components of development, focusing on innovation, inclusiveness, the improvement of youth perspectives, job creation and capacity building through programmes for participatory, integrated, sustainable, resilient and affordable urban areas, while enabling the involvement of all relevant stakeholders. It recognises urban governance as an instrument for promoting integrated national policies for smart and sustainable cities, with a focus on capacity-building and institutional support to promote policy implementation. Finally, it outlines the need for regional cooperation and participation in the relevant global and regional processes to harmonize methodologies, definitions and approaches to data collection in the areas of housing, urban development and land management, promoting dialogue between governments and local stakeholders, and creating professional platforms for the dissemination of results (and processes).

The objectives of the OECD National Urban Policy Programme (joint initiative of UN-Habitat, OECD and Cities Alliance, 2019) in relation to smart city are: to increase the capacities (human, financial, and institutional) of policymakers at national and subnational levels to develop and implement urban policies, particularly in the form of national urban policy (NUP) by providing a platform for capacity-building activities; to enhance knowledge creation, exchange and management in NUP at all levels of government, civil society, the private sector and other relevant stakeholders; to provide direct country support for NUP preparation and participatory processes to ensure involvement of relevant ministries, subnational governments, and civil society; to monitor the progress of NUP in its role as a part of the monitoring process of the New Urban Agenda/SDGs, through a global review, as well as country-specific reviews on NUP; and, to provide a networking platform where all levels of government, civil society, the private sector and other relevant stakeholders can engage in the process of developing and implementing NUP.

EU level

In line with the New Urban Agenda (Habitat III) of the UN and 2030 Agenda on Sustainable Development of the UN, a policy framework for smart cities at the EU level was developed in the Urban Agenda of the EU/Pact of Amsterdam (2016). This document calls for a more effective integrated and coordinated approach to EU policies and legislation with a potential impact on urban areas, thus contributing to territorial cohesion and reducing the socioeconomic gaps observed in urban areas and regions. Priority themes and cross-cutting issues of the Urban Agenda of the EU related to smart cities are outlined in the following principles:

- (12.1) Effective urban governance, including citizen participation and new models of governance;
- (12.2) Governance across administrative boundaries and inter-municipal cooperation: urban-rural, urbanurban and cross-border cooperation; link with territorial development and the Territorial Agenda 2020 (well-balanced territorial development);
- (12.3) Sound and strategic urban planning (link with regional planning, including "research and innovation smart specialisation strategies" (RIS3), and balanced territorial development), with a place-based and people-based approach;
- (12.4) Integrated and participatory approach; and
- (12.5) Innovative approaches, including Smart Cities.

National level

In line with international urban development guidelines, some activities were carried out to implement principles of urban governance for smart cities in Serbia. As a contribution to the New Urban Agenda, the Ministry of Construction, Transport and Infrastructure of the Republic of Serbia and the Standing Conference of Towns and Municipalities, the national association of local authorities in Serbia, jointly developed the national report for the Habitat III conference in Kioto (2016). Some other nationallevel documents which enhance the governance component of the smart city are listed in Table 2 below.

Table 2. An overview of national policy documents in Serbia related to the field of smart cities

(Source: Strategija održivog urbanog razvoja Republike Srbije do 2030. godine (2018), Damjanović et al. (2017))

2008	National Sustainable Development Strategy
2010	Law on the Spatial Plan of the Republic of Serbia Information Society Development Strategy in the Republic of Serbia until 2020 Strategy for Electronic Communications Development in the Republic of Serbia for the period 2010-2020
2011	Strategy and Policy for the Industrial Development of the Republic of Serbia for the period 2011-2020
2012	National Social Housing Strategy
2014	Public Administration Reform Strategy in the Republic of Serbia
2015	Public Financial Management Reform Program 2016- 2020 Strategy for Supporting the Development of Small and Medium Enterprises, Entrepreneurship and Competitiveness for the period 2015-2020 Strategy for e-Government of the Republic of Serbia by 2018
2016	Strategy for Development of IT Industries 2017-2020 Strategy on the Regulatory Reform and Strengthening of the public policy management system for the period 2016-2020 in the Republic of Serbia Strategy on Science and Technological Development of the Republic of Serbia in the period 2016-2020
2017	Draft Strategy for Cultural Development in the Republic of Serbia for the period 2017-2027
2018	National programme for adopting the acquis

From the previous section, it should be noted that SDGs (2015), New Urban Agenda (2017), the Geneva Ministerial Declaration on Sustainable Housing and Urban Development (2017) and the OECD National Urban Policy Programme (2019) strive to enhance the adoption of national urban policy as an instrument of integrated urban development that embraces the principles of governance for smart cities. Thus, this section devotes some more attention to the role of the (integrated) national urban policy which Serbia adopted in 2019^3 – "Sustainable Urban Development Strategy of the Republic of Serbia until 2030" (hereafter SUDSRS). It is the first national urban policy which distinguishes urban governance as not only an instrument for integrated urban development, but as a strategic principle for policy implementation.

The main task of the Serbian national urban policy is to establish coordination over different sectors and define priorities by coordinating the needs and interests of different actors and enable the absorption of different funding options. The policy document was developed through a wide participatory approach as support to urban governance. Participatory events were organised throughout the policy drafting process, involving local planning experts, city government representatives, ministry representatives, university and research institutes and NGOs. Participants were engaged in discussions about the possibilities of integrating different aspects of development in coherent strategic goals and packages of measures. In addition, the policy formation process allowed the participants to identify priority areas of intervention at the local level, intended for integrated application of strategic goals and specific measures. These areas of intervention are a spatial dimension of the national policy, and aim to direct available EU funds towards the development priorities at the local level through bottom-up decision-making processes.

BUILDING ON THE CLEVER PROJECT EXPERIENCE

The previous sections provide an overview of the policy framework for the implementation of urban governance principles in the context of a smart city approach at different levels. This section presents some of the main findings in this field which were derived as a result of the CLEVER project through visible (tangible), but also less visible (intangible) results.

The participatory approach to the identification of the main problems and potentials of integrated urban development throughouttheCLEVERprojectprocessenhanced understanding of context-specific dilemmas in the field of urban governance for smart cities. The partners from Baia Mare (Romania) described their city as one of the pioneers among the members of the Romanian Municipalities Association in developing and improving the Urban Network in Romania. The city administration has wide experience in preparing and managing over 20 projects under EU funding (ICT PSP, URBACT II, URBACT III), and a portfolio of smart city projects. Smart city projects are in line with the city's Integrated Development Strategy, and they are directed towards resolving environmental issues and societal challenges. Some of the main challenges of the city were recognised as: poor use of governance mechanisms by officials; a lack of collaboration between different planning departments; insufficient bottom-up engagement; and the lack of an integrated approach in urban development. The partners from Varaždin also spoke about their activities in the implementation of smart city projects. The main policy framework for units of local and regional government in Croatia in the field of smart cities was outlined for 2018-2019. A number of activities in line with this framework have been implemented via EU projects (INTERREG, URBACT III), including GRIC (City Complaints and Information Centre) as a citizen participation system, and GIS (Geographic Information System). Some of the main challenges in urban development were recognised as digital non-compliance of all local administration units with the needs of citizens, a low level of public participation in planning, low individual capacities, a lack of content and possibilities to engage young people in development activities. Finally, some contextual aspects of Serbia related to the urban governance of smart cities are outlined in Table 3.

The CLEVER project process allowed for the identification of priority areas of intervention in partner cities through horizontal, vertical and spatial integration of key measures and activities. The priority areas of intervention include public spaces in partner cities (Baia Mare, Romania; Varaždin, Croatia; and Smederevo, Serbia) that proactively, in a bottom-up fashion, seek both physical renewal and improvements in citizens' quality of life. Throughout the project, partners identified available sources of funding for integrated activities within regeneration projects focused on public spaces in the partner cities. Additionally, the CLEVER project process enabled the development of trust between the main project partners and other sectors (public, commercial and NGO) to establish a governance system for more efficient identification and application for EU funds to support local innovative financial and methodological tools for urban regeneration.

Besides the opportunity to discuss and disseminate the above-mentioned findings with project partners and involved stakeholders, another significant visible result of the CLEVER project was the proposal submitted for the main project iCLEVER under the Interreg Danube Transnational Program call 2020, specific objective 4.1 Improvement of institutional capacities to tackle societal problems. The collaborative preparation of the main project iCLEVER allowed partners to mutually learn about the possibilities for implementing urban regeneration strategies for public spaces in partner cities through a transnational framework based on participation, governance, publicprivate partnerships, and urban development financing instruments. Thus, less visible, intangible results of the CLEVER project relate to capacities acquired for the urban governance of smart cities among the project partners. Another less visible result of the overall process is the strengthening of individual and institutional capacities of local authorities in the aforementioned partner cities through discussions in the formation of the main project.

³ The initiative for the elaboration of the national integrated urban policy was derived from the Memorandum of Understanding between the Ministry of Construction, Transport and Infrastructure of the Republic of Serbia and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the Government of the Federal Republic of Germany.

Governance	Societal and Innovation	Technical	Financial
 Adopted national integrated urban policy Existence of local integrated urban development policies Enhanced level of Serbia's representation in international programs and projects in the field of sustainable urban development Incentives in practising public participation beyond minimal legal requirements Dissemination of data on "good practice" introducing additional levels and methods of public involvement through different legal framework incentives Poor institutional and individual capacities for implementation of urban governance 	 Rich cultural heritage and cultural biodiversity, developed mechanism for protection of cultural goods, but also deterioration of some urban settlements Inherited public services infrastructure facilities and limited experience in the implementation of social housing programs Low level of citizen participation in the process of urban development High poverty and social exclusion risk rate (around 41.3%), growing disparities in the quality of life among urban and rural areas The ban on employment in the public sector means that no units can be formed to deal with the acquisition of new knowledge and 	 Significant natural capital (ecosystems and resources) and ecosystem services for rural areas Different levels of development of primary traffic infrastructure in central urban zones and new parts of urban settlements Variety of urban settlement typologies Number of objects which need urban regeneration 	 High unemployment Insufficient financial capacities for public services Growing awareness of support to program/project-based budgeting and strategic planning at the national and local level Lags in the transformation of financing tools for planning and development Informal construction Poor quality of housing stock Lack of economic development policy, poor access to sources of financing, limited financial means Undeveloped PPP models Insufficient financing from national and European funds for inclusion and poverty reduction schemes/insufficient capacities (human/intellectual/institutional) to absorb the EU funds
	competences		

Table 3. Governance practices for smart cities – contextual aspects of Serbia (Source: authors' elaboration)

CONCLUDING REMARKS

The role of urban governance in a smart city is to generate new forms of social collaboration through the use of information and communication technologies. In the face of change and the promotion of smart cities through EU Cohesion policy 2021-2027, urban governance mechanisms are mostly applied in practice as flexible systems to respond to new information, changes and new conditions by approaching the available funding mechanisms. Some aspects of urban governance have also been enhanced in Serbia through recent amendments to the legal planning framework. More extensive forms of participation and collaboration in planning have been introduced in Serbia since 2014 in the Planning and Construction Act, Planning System Act and the Local Self-Administration Act (Službeni glasnik RS, br. 72/2009, 81/2009 - ispr., 64/2010 - odluka US, 24/2011, 121/2012, 42/2013 - odluka US, 50/2013 - odluka US, 98/2013 - odluka US, 132/2014, 145/2014, 83/2018, 31/2019, 37/2019 - dr. zakon i 9/2020; Službeni glasnik RS, br. 30/2018; Službeni glasnik RS, br. 129/2007, 83/2014 - dr. zakon, 101/2016 - dr. zakon i 47/2018), while the term smart city has only recently been used in national policy papers (SIURDS 2030, Smart Specialization Strategy of RS - ongoing preparation). Still, the findings presented point out at a statecentred preference in governance practices. A pertinent critique of this approach relates to the implementation of a "citizen-centric manoeuvre", in which collaboration between different government departments spreads out to communities and other stakeholders, who then share responsibilities for the development processes, as well.

Taking into account the findings derived from the CLEVER project, which relate to the supranational, EU, national and local framework for governance in a smart city context, this paper offers the following recommendations for governance regimes in the local context of Serbia. There is a need for strengthening effective public services, partnerships and dialogue, support to subsidiarity, and strengthening of the role of the local community. Harmonization and coordination in decision making and urban governance are needed, and can be achieved through the management of programs and projects on multiple levels, thus increasing the capacities of future project partners. In this sense, the CLEVER project can be seen as a contribution to enhancing governance capacities in the field of smart cities, which requires further development.

One of the benefits of urban governance is that it has the capacity for experimentation, innovation and learning. In the transitional planning context of Serbia, with the strong path-dependency of a dominantly top-down approach to decision-making, participatory governance processes may increase awareness among citizens and stakeholders of their right to be included in decision-making. Traditional methods of informing and consulting should be directed towards strengthening social responsibility and balancing public and private interests, where innovative practices should be specifically encouraged as a part of economic and cultural activity. In some cases, governance practices may also enhance the redistribution of top-down power structures, and enhance cooperation between actors around their common interests - local community actors, investment vehicles and organised civil society around the creation and implementation of jointly-defined priority projects. Within such a framework, processes can be carried out through informal networking, coalition building and mutual agreements, as instruments for setting collective rules.

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References

- Angelidou, M. (2014). Smart city policies: A spatial approach, *Cities*, Vol. 41, No. 1, pp. 3-11.
- Bătăgan, L. (2011). Smart Cities and Sustainability Models, *Infomatica Economic*, Vol. 15, No. 3, pp. 80-87.
- Blanco, I. (2013). Analysing Urban Governance Networks: Bringing Regime Theory Back in, *Environment and Planning C: Politics and Space*, Vol. 31, No. 2, pp. 276-291.
- Blanco, I., Lowndes, V., Pratchett, L. (2011). Policy Networks and Governance Networks: Towards Greater Conceptual Clarity, *Political Studies Review*, Vol. 9, pp. 297-308.
- Borraz, O., Le Galès, P. (2010). Urban governance in Europe: the government of what?, *Pôle Sud*, Vol. 1, No. 32, pp. 137-151.
- Cars, G., Healey, P., Madanipour, A., De Magalhaes, C. (Eds.) (2002) *Urban Governance, Institutional Capacity and Social Milieux.* Ashgate: Aldershot, Hants.
- Castelnovo, W., Misuraca, G., Savoldelli, A. (2016). Smart Cities Governance: The Need for a Holistic Approach to Assessing Urban Participatory Policy Making, *Social Science Computer Review*, Vol. 34, No. 6, pp. 724-739.
- Čolić, R. (2015). Integrated Urban Development Strategy as an Instrument for Supporting Urban Governance, *Serbian Architectural Journal SAJ*, Vol. 7, No. 3, pp. 317-342.
- Damjanović, D., Pantić, M., Čolić Damjanović, V. M. (2017). Smart city concept in the strategic urban planning process. Case study of the city of Belgrade, Serbia. In Bijedić, Dž., Krstić-Furundžić, A., Zečević, M. (Eds.), *Places and technologies 2017* - *keeping up with technologies in the context of urban and rural synergy*, Book of conference proceedings. Sarajevo: Faculty of Architecture, University of Sarajevo, pp. 341-348.
- DiGaetano, A., Strom, E. (2003). Comparative Urban Governance: An Integrated Approach, *Urban Affairs Review*, No. 38, pp. 356-395.
- Healey, P. (2004). Creativity and urban governance. *Policy Studies*, Vol. 25, No. 2, pp. 87-102.
- Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial?, *City*, Vol. 12, No. 3, pp. 303-320.
- Hyden, G. (2011). Making the state responsive: rethinking governance theory and practice. In G. Hyden, J. Samuel (Eds.), *Making the state responsive: Experience with democratic governance assessments.* New York: UNDP, pp. 5-28.
- Innes, J.E., Booher, D.E., Di Vittorio, S. (2010). Strategies for megaregion governance: Collaborative dialogue, networks and self-organization. Working Paper, No. 2010-03, University of California, Institute of Urban and Regional Development (IURD), Berkeley, CA.
- Jessop, B. (1998). The rise of governance and the risks of failure: the case of economic development, *International*

Social Science Journal, Vol. 155, pp. 29-45.

Landry, C. (2006). The Art of City Making. London: Routledge.

- Le Galès, P. (1998). Regulations and Governance in European Cities, *International Journal of Urban and Regional Research*, Vol. 22, No. 39, pp. 482-506.
- Meijer, A., Bolivar, M. P. R. (2016). Governing the smart city: a review of the literature on smart urban governance, *International Review of Administrative Sciences*, Vol. 82, No. 2, pp. 392-408.
- Moulaert, F., Martinelli, F., González, S., Swyngedouw, E. (2007). Introduction: Social innovation and Governance in European cities: Urban Development Between Path Dependency and Radical Innovation, *European Urban and Regional Studies*, Vol. 14, No. 3, pp. 195-209.
- New Urban Agenda, Habitat III (2017), http://habitat3.org/wpcontent/uploads/NUA-English.pdf, accessed 29th May 2020.
- Sager, T. (2005). Communicative Planners as Naïve Mandarins of the Neo-liberal State?, *European Journal of Spatial Development*, pp. 1-9.
- Službeni glasnik RS (br. 129/2007, 83/2014 dr. zakon, 101/2016 dr. zakon i 47/2018). *Zakon o lokalnoj samoupravi* (in Serbian). Belgrade: JP "Službeni glasnik".
- Službeni glasnik RS (br. 72/2009, 81/2009 ispr., 64/2010 odluka US, 24/2011, 121/2012, 42/2013 - odluka US, 50/2013 - odluka US, 98/2013 - odluka US, 132/2014, 145/2014, 83/2018, 31/2019, 37/2019 - dr. zakon i 9/2020). *Zakon o planiranju i izgradnji* (in Serbian). Belgrade: JP "Službeni glasnik".
- Službeni glasnik RS (br. 30/2018). Zakon o planskom sistemu RS (in Serbian). Belgrade: JP "Službeni glasnik".
- Strategija održivog urbanog razvoja Republike Srbije do 2030. godine (2018). Beograd: Ministarstvo građevinarstva, saobraćaja i infrastrukture (in Serbian).
- Swyngedouw, E. (2005). Governance Innovation and the Citizen: The Janus Face of Governance-beyond-state, *Urban Studies*, Vol. 42, No. 11, pp. 1991-2006.
- Tasan-Kok, T. (2010). Entrepreneurial Governance: Challenges of Large-Scale Property-Led Urban Regeneration Projects, *Tijdschrift voor Economische en Sociale Geografie*, Vol. 101, No. 2, pp. 126-149.
- UNECE (2017). Geneva Ministerial Declaration on Sustainable Housing and Urban Development, https://www.unece.org/ fileadmin/DAM/hlm/sessions/docs2017/ECE_HBP_2017_1_ ENG_cover.pdf, accessed 29th May 2020.
- UN General Assembly (2015). 2030 Agenda for Sustainable Development, https://sustainabledevelopment.un.org/content/ documents/21252030%20Agenda%20for%20Sustainable%20 Development%20web.pdf, accessed 29th May 2020.
- UN-Habitat, OECD, Cities Alliance (2019). The National Urban Policy Programme.
- https://www.oecd.org/cfe/cities/NUPP-overview.pdf, accessed $29^{\rm th}$ of May 2020.
- Urban Agenda for the EU 'Pact of Amsterdam' (2016), https:// ec.europa.eu/regional_policy/sources/policy/themes/urbandevelopment/agenda/pact-of-amsterdam.pdf, accessed 29th May 2020.

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FLUID SPACES IN A CONTEMPORARY URBAN CONTEXT: QUESTIONING THE BOUNDARY BETWEEN ARCHITECTURE AND INFRASTRUCTURE

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The aim of this paper is to research the relations between the contemporary networked context and transformations in the understanding of architectural and infrastructural spaces, and to research the main models of fluidity within this relation. The contemporary urban context is characterized by globalization, transculturalism and increased technological development, which simultaneously change the everydayness, usage and perception of urban spaces and architecture. New networking phenomena occurring on informational, communicational and spatial levels transform the city and its architecture into constant processes of flows. Fluidity is positioned as the main problem of this research, simultaneously causing, and manifesting in, transformations of contemporary spatial conditions where the notion of *flow* becomes the new spatial quality. This research is focused on one of the main spatial manifestations of the fluidity phenomenon in contemporary cities – the dispersion of the boundary between architectural and infrastructural space. The aim of the paper is to present the idea that fluid spaces are characterized by: 1) increased loss of disciplinary boundaries; 2) loss of physical boundaries – inner-outer space overlapping; 3) dispersion of perceptual boundaries in space. The research is significant because it defines new meanings of spaces of flows and movement in a contemporary urban context.

Key words: fluidity, flow, architecture, infrastructure, boundary.

INTRODUCTION

The main idea presented here is based on the hypothesis that fluid spaces are expressed in diverse aspects of the dematerialization and loss of the architecture-infrastructure boundary. Globalization and the information revolution, which are the biggest contemporary phenomena, have shifted the values and appropriations of space on many levels. The new context of social and spatial networks has constantly changed and accelerated in terms of perception, communication, mobility needs, transfers etc. The dynamized network, based on continuous processes of flows – flows of information, traffic, money, energy – dematerializes its qualities into fluid, variable character. Therefore, fluidity is positioned as the main conceptual phenomenon in a contemporary urban context, where the notion of flow becomes the new main determination of spatial use and design. Such dynamized conditions transform the relation between architecture and infrastructure and the position of their boundary in terms of the fading of typological boundaries and their hybridization. Functions of movement and mobility become the main and the essential ones in modern cities. Accordingly, such *spaces of flows* are the subject of this research.

This research starts with the hypothesis that fluidity in a contemporary urban context is notable through the position of the boundary between architecture and infrastructure, observed through transdisciplinary, physical and perceptual aspects of its dematerialization. The infrastructural character of contemporary architecture is mainly associated with networked infrastructural systems, which present new spatial and functional potential for the

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notion of place. Accordingly, new architectural patterns are made in the contemporary urban context. Contemporary architecture transforms into an infrastructure of flows, and infrastructure becomes the subject of the design as well. This relation between contemporary architecture and infrastructure becomes the expression of transformations and changes every-day urban experience. Additionally, the question of contemporary architectural form is replaced with new adaptable spatial patterns in which the notion of *flow* becomes the main design principle.

Recent research on the relationship between architecture and infrastructure includes changes in the meanings of architectural and infrastructural, and it opens up the ideas of the architectural qualities of urban infrastructure, but there have been no studies that link architecture and infrastructure to the phenomenon of fluidity by researching the position of the boundary in their interrelations. Stan Allen analyzed the theme of infrastructure as an object of architectural design, whereby we may recognize the indications of disciplinary boundary loss between architecture and infrastructure (Allen, 1999). Gilles Delalex continues Allen's ideas and directly links the urban and architectural scale of infrastructure, which is important for the development of the idea that infrastructure at all levels can be the subject of architectural creation, thus recognizing the transdisciplinary nature of the architectureinfrastructure relation (Delalex, 2006). The idea of contemporary architecture as a continuation of urban infrastructure and urban landscapes has been developed by a number of different authors (Delalex, 2006; Koolhaas et. al., 1998; Easterling, 1999; Angelil and Klingmann, 1999; and others). The change in the understanding of physical architectural elements as a continuation of the infrastructure and environment can be recognized in the theoretical positions of these authors, although each position focuses on a different aspect of understanding the notion of infrastructure in the context of architecture and the city. Delalex researches the theme of *infrastructural ground*, Easterling researches infrastructural space, while Koolhaas, Angelil and Klingman talk about architecture as an element of a dynamic system, formed with the urban environment and the new design principles by which such architecture can be created. Fluidity, as a phenomenon in architecture, has not been defined so far in the field of architecture and urbanism. Contemporary theoretical positions on the city and architecture introduce the notion of flows, systems of flows and networks from other fields, such as culture, sociology and technology. Stephen Cairns introduces the connection between the notion of *flow* and architectural typologies in architectural theory (Cairns, 2012), and Sanford Kwinter uses the term *fluidly* in the understanding and theories of "new urbanism" (Kwinter, 1998). David Goldblatt uses the term fluidity in architecture as a new aesthetic quality representing lightness and elegance (Goldblatt, 2007). Accordingly, the originality of this work is in the study of fluid spaces through the relationship between architecture and infrastructure, which questions the position of their boundary.

A comparative analysis of theoretical approaches to the problem of fluid spaces in contemporary cities was carried

out. Its main hypothesis is that fluid spaces are characterized by: 1) increased loss of disciplinary boundaries; 2) loss of physical boundaries – inner-outer space overlapping; and 3) dispersion of perceptual boundaries in space. The actualization of the fluidity phenomenon from these three aspects is its main scientific contribution. The aim is to present the potential of fluid spaces in the contemporary context of globalization, since it influences the development and diverse directions of cities and urban spaces transformations. In addition, the concept of the networked city, as one of the possible approaches in the understanding of contemporary patterns of urbanization and globalization, is also explored. The main conditions for contemporary conceptualizations in architecture and urbanism are identified.

The first section analyzes diverse theoretical approaches on the topic, while the second part focuses on an analysis of how architectural models of fluidity concepts are applied, by means of selected case studies. The main question asked is: how can the conceptualization of fluidity give adequate direction in the field of sustainable architecture and urbanism?

THE CONTEMPORARY URBAN CONTEXT AND GLOBALIZATION: FLUIDITY AS A NEW DESIGNATION OF THE NETWORKED CITY

In the contemporary context of the information age and global interconnectedness, the city becomes a complex system of flows within the networks, comprising architectural, infrastructural and social spaces, where the permanence of change leads to changes in the physical foundations of our everyday experience, perception and apprehension. Accordingly, form in the contemporary urban context could be understood as the following:

"Contrary to stances saying that form is a visual and aesthetic phenomenon, in the theory of urban morphology form is seen as a complex phenomenon and physical result influenced by different factors of development: socioeconomic, functional, sociological, psychological, visual and perceptual" (Niković and Manić, 2018: 18).

This research is based on recognizing the phenomenon of fluidity as a contemporary phenomenon founded on these factors, as well as information overload, and elements of the urban structure losing their identity within the fluid, dynamic totality. The phenomenon of fluidity manifests itself as a consequence of globalization and ubiquitous interconnectivity, whereby flow, circulation, changeability, speed, etc. become the new determination of the city and its structure.

Talking about the context of contemporary changes in the urban environment, Stephen Graham and Simon Marvin introduce the term "sociotechnical process" while considering the influence of globalization, technological advancement and infrastructural networking on changes in city structure, architecture and culture. The development of technology infrastructure, its use and growth, transform the contemporary city into "a complex and dynamic sociotechnical process" in which cities and urban regions become places of perpetual flux of infrastructurally mediated flow, movement and exchange (Graham and Marvin, 2001: 8). Thus, the architectural form becomes reduced in order to support the constant stream of information and communication effects, accentuating the message coproduced with the subject of the contemporary city.

This immediate relationship between the space and the subject, emphasizing transience and the fast accumulation of images and information in our mind, so fast as to turn our attention only to information that is useful and momentarily required, results in spaces called non-places by Marc Augé. Augé defines non-places as a total of all the air, rail and motorway routes, all the mobile cabins, means of transport, the airports, terminals and stations, and all the cable and wireless networks of installations and communication (Augé, 1995). Station signposts, airport markings, advertisements, screens and boards have become an essential and dominant part of our habitat, and "infrastructure takes over the contemporary urban landscapes" (Augé, 1995: 93). Nonplaces are embodied by constant high-intensity dynamics, where the phenomenon of flow is conjoined by the aspect of speed, which describes the quality of perception, usage and inhabitation of Augé's non-place, thus the manifestation of architecture is primarily defined by the information effect it produces and the functional circulation it supports.

The concept of *space of flows* was introduced to the theories on the contemporary urban context by Manuel Castells in The Rise of the Network Society, where he said that in the contemporary network society, "interaction between places breaks spatial patterns of behavior in the city into a fluid network of exchange, which points to the need for a new space - space of flows" and that "the global city is not a place but a process" (Castells, 1996: 429). In Castells' theory of urbanism, the technological and cultural changes in the information age are closely followed by problems of increased mass transit under the influence of the rising number of everyday activities and "time compression", as a consequence of new spatial networks which intensify the flow and physical mobility of people in the city (Castells, 1996: 426). The phenomena within the domain of functional interconnectedness lead to a specific social and cultural fragmentation within the frame of fluid networks of global and local exchange.

In this context, Castells says: "the technological infrastructure defines new spaces" (ibid., 1996: 426). The space of flows refers to a socio-spatial context in the contemporary paradigm of networking and, as he says, "space does not reflect society, it expresses it" (ibid., 433), thus we can establish a relation between social transformations and the transformation of the value system in architecture. In this way, the contemporary urban experience is based on the functional and symbolic meaning of the space of architectural flows within the context of mass migrations of the population and tourism. "Network Fever" by Marc Wigley describes the preoccupation of the modern and postmodern context with networking and new ways of thinking about the architecture and city structure, expressed by the form of fluid, interconnected central functions and communication lines that transform the constructed environment into complex systems of functions and flows (Wigley, 2001). Architectural design becomes a process of managing the

relation between nodes and exchanges within the network, and the management of flows in architecture becomes the fundamental organizational and formal principle (Pawley, 1998). In this respect we underline the emergence of the new value system in architecture in which "technologies and infrastructures simply and deterministically shape both the forms and worlds of the city and wider constructions of society and history" (Graham and Marvin, 2001: 9). Infrastructural landscapes followed by socio-technological processes form the contemporary experience of culture, city and "structures of feeling' of modern urban life" (*ibid.*, 2001: 12). As a result, by increasingly participating in the urban structure, infrastructural landscapes shape our experience and perception, and carry the meaning of society and culture development.

Diverse directions of urban transformations are influenced by globalization processes. An ecological approach to contemporary urban development is recognizable in theories that deal with the infrastructural landscapes in contemporary cities. James Corner (2006) notes that contemporary urban dynamics are increased with the effects of mass tourism and massive urban growth, resulting in transdisciplinary interactions between architects, urbanists, designers, landscape designers, engineers etc. Referring to Victor Gruen's "cityscape" concept of an urban environment consisting of buildings, paved surfaces and infrastructures - "technoscapes", "transportation-scapes", "subcityscapes" etc., Corner (2006) introduces infrastructural landscapes as a significant infrastructural element in the city. The potential of such an approach is, as he says: "the ability to shift scales, to locate urban fabrics in their regional and biotic context and to design relationships between dynamic environmental processes and urban form" (Corner, 2006: 24). The same study also states that such "fluid urbanism" is based on dynamic relations, implying the complexity of interaction between the elements, rather than forms. Therefore, Corner's Terra fluxus evokes the meaning of the urban context as a dynamic field of constant shifting processes occurring within it. In this context, the relation between architecture and infrastructure loses its boundaries because the separation between the environment and buildings becomes blurred. A similar theoretical approach can be noticed in Elizabeth Mossop's "landscape urbanism", which also conceptualizes contemporary cities as dynamic systems where the disciplinary position of architecture is transgressing urban discourse and practice, and infrastructure is the most important generator of public landscapes (Mossop, 2006: 166). In the chapter "Blurring boundaries and hybrid landscapes" Mossop presents the importance of intellectual shifts in contemporary landscape urbanism, influenced by architects Kenneth Frampton, Peter Rowe and Rem Koolhaas, who transformed the disciplinary divisions in the complexity of contemporary urban patterns (ibid., 2006: 170-171). On the other hand, the economic aspect of urban transformations influenced by globalization processes is discussed by John Forrester in Urban dynamics. Forrester provides the understanding of complex urban systems in which urban problems are examined in terms of the interactions between the elements of the urban structure (ibid., 1969). The urban context is presented as a dynamic system where the *flows* are the main determiners

of interactions between urban elements (*ibid*). In this approach, architecture becomes a tool of the economic infrastructure in cities.

UNDERSTANDING THE BOUNDARY BETWEEN ARCHITECTURE AND INFRASTRUCTURE IN CONTEMPORARY FLUID SPACES

Contemporary interpretation of the urban environment erases the conventional boundaries between the meaning of *infrastructure* and *architecture*. The ambiguous relationship between architecture and infrastructure in the contemporary city environment is evident not only globally, but also in the new design concepts and the new formal strategies of architecture and urbanism. A wider interpretation of infrastructure opens up the space for emphasizing its generative role in terms of its direct impact on the built environment, and thus on creating the contemporary notion of place. Accordingly, beyond the systems and networks of communications and resources, the infrastructure includes all constructed facilities and constituent environments, as well as public spaces for cultural and social programs.

In architectural discourse, the phenomenon of the boundary has been defined by both the physical elements of space and social parameters shaping the value system. The significance of the boundary in a contemporary urban context, and its role in creating a new value system of architecture, is determined by the users of the space and their comprehension of its meaning.

Bearing in mind that architectural form becomes a support to the constant circulation of information and communication effects, the manifestation of architecture is defined by contemporary urban experience. The fluidity of the boundary is examined through the concept of flow in architecture. The perceptual evaluation of space is formed by users' impressions of the fluidity of the spatial boundaries during their movements; it describes the unity of static and dynamic architectural elements. The qualities of diffusion and dispersion give the boundary the dialectic relation of enclosing and interlacing through integrating the characteristics of content and form by the fusion of constructions, activities and events. Therefore, with regard to function, hybrid integration of transportation, mobility, public and cultural spaces become a unified system.

In the following sections, the problem of the boundary between architecture and infrastructure will be critically analyzed through the criteria: **1) loss of disciplinary boundaries, 2) loss of physical boundaries, 3) dispersion of perceptual boundaries in space** with the idea of presenting their merging to form uninterrupted urban landscapes that increasingly characterize the contemporary city environment. The main research methodology in this paper relates to the examination of theoretical approaches and their application in selected examples of architectural practice through the analysis of the opuses of representative authors.

Loss of disciplinary boundaries

The loss of disciplinary, physical and perceptual boundaries between architecture and infrastructure stems from

modernist utopian projects such as Walking City and Plug-in *City* by *Archigram*, and *Fun Palace* by *Cedric Price* in which architecture behaves like infrastructure and vice versa. Cited examples of the architectural avant-garde elaborate the concept of redefining the status of architecture as an object, symbol or monument, into the convergence of places and ever-changing programs and events. Furthermore, Japanese Metabolists, with their megastructures, likewise erasing disciplinary boundaries between architecture and infrastructure, presented the concept of architecture as an interconnected system. These utopian concepts, although never effected, are important for understanding the roots of the ideas brought to life and executed by contemporary architecture. The question of the boundaries between architecture and infrastructure can be put into perspective with technological changes which alter the contemporary urban context in a physical sense.

The question of the disciplinary boundary between architecture and infrastructure in this context is not only the question of parallel and correlated changes between technology and the tectonic qualities of architectural form, but also the new meanings taking shape at their intersection. Innovations and new meanings create new design principles and values which occur in between the complexity of managing the flows and designing the form, which is not merely infrastructural. Therefore, new meanings and spatial manifestations are developed through mutual intention through both technology and architecture to shape our perception within culture and the city. Rem Koolhaas, Stan Allen and Keller Easterling explore the needs and possibilities of fusing infrastructure, architecture and landscape into a unique dynamic system (Koolhaas et al., 1998; Allen, 1999; Pawley, 1998; Easterling, 1999). By exploring formal transformations and hybrid structures, both in the sense of form and meaning, contemporary architectural practice often transcends architecture's conventional field of study. The transdisciplinary transformation of architecture links the architecture and infrastructure with the landscape, resulting in the natural and urban space lacking clear edges. Therefore, the loss of disciplinary boundaries in terms of understanding the fluidity in a contemporary urban context is a matter of coordinating complex functional and design principles, whereby flows in space stay functionally separated according to protocols and infrastructural principles, but the structure they belong to overcomes the infrastructural utility and becomes a matter of architectural design. Accordingly, disciplines such as design, architecture and urbanism transgress into traffic, structural engineering and technology, and vice versa, providing new models of built achievements and transforming the contemporary cities.

Loss of physical boundaries

The loss of physical boundaries in terms of fluidity researched in this paper refers to the complex structures in which functions based on the articulation of flows in space remain separated while the whole form of space becomes unified, fluid and liquid with no sharp edges, and it almost becomes hard to recognize their zonal and spatial beginning and end. Stephen Cairns (2012) in his text "Flows", referring to Manuel Castells' theory, links the spaces of flows to airports, railway stations, terminals, intermodal transfer areas, telecommunication infrastructure, harbors, ports and computerized trading centers. Castells describes "communication exchangers" (Castells, 1996: 453) as "the significant building types of the space of flows". Castells says that, when it comes to architecture, the spaces of flows are: corridors and halls which connect places around the world and we have to understand them as places of exchange, shelters, homes and offices of the contemporary society (ibid., 1996: 448). Castells notes that how we relate to airports, to train and bus stations, to freeways, to customs buildings, etc. is how the new urban experience is formed (ibid., 1996: 407-459). In the relation between technological discourse and architectural productiveness, Sanford Kwinter's new "soft urbanism" defines the city as: "the medium of the flow of population, information, goods and communication, i.e. the formation of functions and the changeable field of perception" (Kwinter, 1998: 586). Corresponding to Manuel Gausa's understanding of the contemporary urban environment: "which can be understood as an endless interior of blurred boundaries. where the citizens are located in the form of flow" (Gausa, 2003: 230), Kwinter talks about negating the limits of threedimensional space and boundaries between the interior and exterior, where the architecture consists of social, economic, biological and spatial elements.

Such a contemporary context transforms the physical boundaries in architectural space. Architectural form increasingly becomes a continuation of the infrastructure or an extension of a landscape. In relation to the phenomenon of flows and the dynamics of a contemporary context, the architectural form becomes open to their influence, and its physical elements become dynamic fragments integrated into a unique assemblage. By blurring the boundaries between the interior, exterior, object and context, and by overlapping architectural layers of events, form and function, the architectural structure becomes a new determination of contemporary architecture in the urban environment.

Dispersion of perceptual boundaries in space

Fluid spaces are characterized by the loss of perceptual boundaries, in which the infrastructural flows become part of the architectural spatial experience in the contemporary urban environment. The perceptual experience of fluid spaces comes down to functional, momentarily useful information, namely the accumulation of visual images at high speeds, at which the sequences of space cannot be separated from the sequences of movement in the space itself. Based on everyday observations, experiencing the social and spatial context as a network of flows composed of dynamic forces and mutual relations of elements shapes the experience of the contemporary urban context as a dispersed field of effects. In this field, the perception of constant changes creates the spatial experience of architecture as an integral element of a dynamic urban system. Accordingly, the spatial perception characterized by increasingly dynamic and fluid effects overlapping in space changes the structure of our living space from a system of solid boundaries to a system of connections, networking and flows.

By perceiving flows of movement, we are equally informed about the material and immaterial properties of space and we may equally conceptualize space by form, dynamism, speed and flows as the main aspects of fluidity. Flows of movement are determined by constant variability - a change of position over time, by which we equally observe differences, repetitions and changes that form a fluid continuity. The perception of variability and mobility, and the differences in their intensities, blurs boundaries in space and between spatial zones. In addition, the perception of flows in space, as well as the perception of space by movement, are equally important aspects of experiencing contemporary fluid spaces, in which by moving through space, the continuity and mutual integration of the architecture and our experience is achieved. The perception of the whole is built on the basis of the cognitive process of assembling sequences of space, i.e., visual images that we perceive with movement. Therefore, fluid spaces in a contemporary urban context are considered through dispersion of the perceptual boundaries. These boundaries are fluid and softened so the zones and programs overlap and dissolve into each other. The form of such spaces frames programs and action occurring within, while allowing the perception of the users to flow freely and change constantly.

MODELS OF FLUIDITY IN A CONTEMPORARY URBAN CONTEXT

Based on the previously defined criteria that identify the characteristics of fluid spaces in terms of disciplinary, physical and perceptual boundary redefinitions, reference examples will presented of some selected projects that manifest one dominant aspect, while others equally fulfil all aspects of fluidity within relevant typological groups. The loss of physical, perceptual or disciplinary boundaries in fluid spaces is mutually conditioned and interconnected. Accordingly, examples of contemporary architectural practice are selected to present how the notion of fluidity, manifested through disciplinary, physical and perceptual boundary dispersions, creates new meanings, knowledge and potential in a contemporary urban context (Figure 1). The research covers the works of Santiago Calatrava, FOA Architects, Zaha Hadid, SANAA, Rem Koolhaas's OMA and UN studio, and the selected projects respond to all three set aspects of the manifestation of fluidity in the context of the loss of the architecture-infrastructure boundary.

Architecture, interpreted and designed as an extension of infrastructure (as shown in the works of Santiago Calatrava, OMA, Zaha Hadid, FOA architects, UN studio *et al.*), is recognized also as an extension of the landscape, urban as well as natural. That being so, the architectural form arises based on flows from the contexts it absorbs and remodels in the interior space. Through superimposition of architectonic and infrastructural layers and blurring of boundaries between them, the architectural form becomes an open tectonic field, countering traditional notions of architecture as a finite entity. This form is not necessarily mobile, but shaped so it can assimilate the architectural and environmental trends in a kinesthetic and empirical way. Architectural form is defined by Angelil and Klingmann (1999: 24) as "accumulations, connections, densities and fluctuations", and this use of the term determines the city and its architecture to be a dynamic system where the flows and the shaping of space they occupy erase the boundaries between architecture, infrastructure and landscape. Both spatial, and consequently formal, constellations develop as uninterrupted fluctuating processes and new interpretations of architectural design and methodologies. Therefore, the fluid spaces analyzed in this paper are characterized by the transformation of the architecture-infrastructure boundaries as presented below.

One of the most distinguishable examples of traditional disciplinary boundary loss due to the artistic and complex tectonic treatment of structures, which are simultaneously infrastructure and architecture, is Santiago Calatrava. Large infrastructural units, primarily bridges and terminals, in a unique way embody and affirm the aesthetics of form by the tectonics of their construction and shaping of the structural elements, mainly linear, whose repetition and translation fashion surfaces. Selected Calatrava projects, such as the Orient Station in Lisbon, Liege-Guillemin station in Liege, the World Trade Centre Hub Terminal in New York, Lyon Airport Station etc., are typologically and functionally in the domain of city infrastructure and engineering, but according to their aesthetic and tectonic quality they without doubt go beyond their infrastructural meaning. The architectural design principles involved in creating these spaces are the principles of fluidity, where the coordination of flows of movement and traffic also become a matter of experience, perception and architectural form. Calatrava's works are structurally complex achievements in which the disciplines of architecture and urbanism are intersected with engineering and technology in the most specific way. A similar example of disciplinary boundary loss is Yokohama Terminal by FOA Architects, which is one of the most representative examples of where function, complex tectonics and shaping surpass the infrastructural meaning and transform the architectural disciplinary framework. Yokohama Port Terminal is a masterpiece of formal design, as well as a functional articulation of protocol. This project is also an example of how new technical and technological possibilities, which transform formal and tectonic possibilities in architecture and infrastructure, contribute to socio-technological transformations in contemporary society. Buildings by Zaha Hadid are the most obvious examples of the formal expression of dynamic spatial fluidity. The hybrid nature of her methodology and absence of standard architectonic classification are both the cause and result of specific fluid shaping of form, characteristic of the greater part of Zaha Hadid's opus. Selected projects, such as the Bridge Pavilion in Zaragoza, Galaxy Soho in Beijing and BMW Centre in Leipzig, are representations of specific overlapping and transgression of architecture and engineering, i.e., the loss of their disciplinary boundaries. Complex structures and forms, characteristic of Zaha Hadid's opus, require constant technological and technical innovations which go beyond the common architectural domains. Ryue Nishizawa from SANAA created Kumamoto Station in Tokyo as an extension of its infrastructural functions, attempting to generate a calming, park-like square area in a complex environment for mass transit. Composed of multiple roofs, all meandering and organic in shape, this recent example of SANAA's work represents the well-known architectural philosophy and

principles of this group, this time applied in defining the architecture-infrastructure boundary in the contemporary city of Tokyo. UN studio's Arnhem Central Transfer Terminal also demonstrates design principles based on the integral flow of movement within an object and in its environment. The design process of this facility involved exploring human flows and different modes of transport in order to make the terminal a "transfer machine" that incorporates the full spectrum of public urban transport and individual passenger needs of the user. The methodological process of UN studio in many projects is *flow-based*. Therefore, the flow is a methodological tool of architectural form shaping that is functionally organized. Accordingly, such design methodology follows the unique nature of flows and the spontaneity of events in the context in which they exist, while articulating them into a dynamic system of architecture, infrastructure and urban landscape with no defined and sharp boundaries in between. In addition, Rem Koolhaas (OMA) integrates urban infrastructure into an architectural object in the Tate Modern project, as well as in Jussieu library and Cardiff Opera, thus directly transgressing the interrelationship between the disciplines of architecture, urbanism, engineering and technology.

Calatrava's works, mentioned above, are mainly terminals and bridges that are masterpieces of both architecture and infrastructure, representing spaces where areas are overlapped to make the whole space flow and manifest the physical boundary loss between inside and outside. The structures are transparent and the combinations of materials and shapes transform the meaning of the physical boundary. Functionally divided flows of traffic and pedestrian movements, as well as the integration of other diverse programs, are organized and shaped to create one unique, dynamic, fluid spatial whole. Another space without sharp physical boundaries between functionally distinct zones is Yokohama Terminal by FOA Architects. The terminal is designed through a diagrammatic take on the research of flows and movements of all sorts (physical flows of people, vehicles and ships as well as motions of fluids - air and water within the premises). The terminal represents the fluid shaping of volume, with no boundaries between the interior and exterior spaces, where the spaces entirely dissolve into each other and flow unceasingly. Zaha Hadid's unique formal expression conveys the blurring of boundaries between the elements for a larger urban scope, as well as in the interior. On a city scale, the architectural form is developed by assimilating the flows from the environment in constructing a unique system with no boundaries between landscapes, infrastructure and architecture. On the other hand, by shaping the volume of the interior space, by curving the membrane of space and by fluid forms of walls, ceilings and floors, she creates specific kinesthetic impressions in which the flows and motions are the base of formal and methodological principles. The boundaries between spaces and areas within one formal whole are blurred, elastic and sometimes completely absent in a unique free-flowing and fluid space. The absence of boundaries between inside and outside, internal and external flows, and those between the interior and exterior, landscape and architecture, is characteristic of the work of SANAA Architects. The distinct features of oriental culture

are reflected in the contemporary architectural tendency to enable the unobstructed circulation of air, light and movement of people within the architectural space. SANAA's architecture is defined by bright, weightless surfaces that are as transparent and open as possible. As a result of assimilating the flows from the environment and inner space, the form is revealed by shaping the surfaces that partly enclose the space. The Dutch Embassy in Berlin by OMA is another example of architecture where the flow of movement through an object is main the design principle that determines the form. The free flow of the ramp, which zigzags through eight levels, determines the organization of space and programs and dematerializes the boundaries between the spaces and programmatic zones. This design approach, on the other hand, enables the coexistence of architecture with the environment through a form that tracks the external and internal movements of people, and the circulation of air, vapor and humidity. The volume of flows that diagonally permeates the cubic form is also projected onto the object's membrane, which visually dematerializes the facade itself into the form of flow, and dematerializes the boundaries between inside and outside. In relation to Koolhaas's view of the city as a form of landscape evolving in the form of a dynamic process, the architectural form loses its autonomy and isolation and opens itself to the processes that make up its environment. The architectural object is not a closed entity, but integrates into the context through fluid and dynamic processes, achieving the connection of interior and exterior space and becoming a continuation of the infrastructure and landscape with no sharp physical boundaries in between. UN studio's Arnhem Central Terminal was also intended to blur the physical boundaries between exterior and interior in a form that represents the extension of the urban landscape to the interior of the building, where ceilings, walls and floors overlap and the common understanding of physical spatial boundaries is lost.

The works of Calatrava mentioned so far are examples of architecture-infrastructure boundary loss on many levels. One of these levels is most certainly the dispersion of perceptual boundaries, with no boundaries between the interior and exterior spaces creating a very dynamic, unique ambient. The spatial limits of perception are softened and dispersed, the spaces entirely dissolve into each other and flow unceasingly. The opus of Zaha Hadid is characterized by the design methodology and principles by which specific perceptual qualities in space are created. The Bridge Pavilion in Zaragoza provides the experience of innerouter space overlapping while moving through the space, which is accomplished by the effects of a semipermeable membrane of the space in the design of the façade. Projects such as Galaxy Soho in Beijing, the BMW Centre in Leipzig, Heydar Aliyev Center in Baku, and many other designs by Hadid were designed so that during movement through the space, dynamic forms, materials and programs overlap with no boundaries in between them. Programs take their own functional spaces and develop within a fluid whole, while the perceptual experience is in constant change - dynamic, fluid and continuous. SANAA's projects such as Toledo Museum of Art, the Glass pavilion in Toledo, University café in Okayama, the meandering river building at Grace

Farms in Connecticut, Rolex Learning Center in Lausanne, Serpentine Gallery Pavilion etc. are examples of the form of surfaces which enable the kinesthetic experience of the interior and sensory unity of the context and architectural space. Voids and the absence of solid walls provide views in every direction, allowing the external environment to be seen and become part of the interior. This loss of perceptual boundaries in space is emphasized by the city or nature as a background. Therefore, the fluid space appears to frame the activity and action which is taking place within, while allowing the perception of the users to flow freely between inside and outside. In the Terminal 3 project by UN studio, the shaping of the horizontal surfaces creates a soft form that follows the spatial fluidity, flows of movement and events in it. A similar design principle, by which form develops as a support for flows and events, is noticeable in the Center for Virtual Engineering in Stuttgart. Through the adaptability of architecture to the processes of communication, subjectivity and experimentation, the architectural program becomes hybridized and the form flexible, with visible loss of both physical and perceptual boundaries.

CONCLUSION

The main idea of this paper was to position the phenomenon of the fluidity of a contemporary socio-spatial context into the spatial perspective, with the aim of questioning the boundary between architecture and infrastructure. These boundaries were researched in terms of meaning, perception and the function of architectural and infrastructural space in a contemporary urban context. The relations between architecture and infrastructure have been transformed according to new dynamized conditions where mobility, speed, movement and *flows* become the necessities of contemporary urban life. Accordingly, the phenomenon of fluidity is the main conceptual phenomenon in a contemporary urban context, in which the notion of flow has become the new main determination of spatial use and design.

The theoretical framework in this paper is based on a transdisciplinary synthesis of recent approaches to the problem of fluidity and the contemporary concepts of the theory of architecture and urbanism, in order to explain the relations that have been made, their origins, and the possible forms of their interpretation. This research examined the relevant theoretical approaches through their application in the opuses of representatives of contemporary architectural practice, such as Santiago Calatrava, FOA Architects, Zaha Hadid, group SANAA, Rem Koolhaas's OMA and UN studio, with the aim of analyzing how selected projects by these authors fulfil all of the aspects of fluid spaces: the loss of disciplinary, physical and perceptual boundaries in the relation between architecture and infrastructure.

Although the ideas of overlapping architecture, infrastructure and landscape in an urban context, which becomes a space with no defined boundaries, started with modernist utopian concepts, contemporary technological innovations have allowed the rethinking and implementation of these ideas. Therefore, both architectural and infrastructural form become an expression of the position in a process of constant dynamics.



Figure 1. . Classification of contemporary architectural examples in terms of boundary loss (Source: authors)

Identifying several key models of fluidity in accordance with the basic hypothesis of the paper has created the basis for further interpretations of this complex problem and its impact on the global transformation of cities and urban spaces. The hypothesis and the aim of the research were confirmed.

Flow has become the new relational, kinesthetic, aesthetic and formal determination of contemporary architectural space in the urban context. Accordingly, contemporary architecture tends toward an infrastructure of flows, and infrastructure becomes a matter of architectural rethinking and design. New forms become more fluid, dispersed and reinterpreted, thus opening new potential for spatial design.

The results extend the findings of previous studies linking architecture and infrastructure to the phenomenon of fluidity by researching the position of the boundary in their interrelations. Although the research has shown that fluid spaces are expressed in diverse aspects of the dematerialization and loss of the architectureinfrastructure boundary, the number of examples analyzed is a limitation of this study. The original and significant scientific contribution of this paper is its identification and analysis of the concept of fluidity within clearly defined typological frameworks, which, with contemporary theoretical approaches to this issue, builds a platform for new design approaches and spatial interpretations. Future trends regarding this type of research and opportunities for future research can be found in the development of new principles and methodologies in architectural design.

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REFERENCES

- Allen, S. (1999). *Points + Lines*. New York: Princeton Architectural Press.
- Angelil, M., Klingmann, A. (1999). Hybrid morphologies: infrastructure, architecture, landscape, *Daidalos*, No. 73, pp. 16-25.
- Augé, M. (1995). Non-Places. London: Verso.
- Cairns, S. (2012). Flows. In G. Crysler, S. Cairns, H. Heynen (Eds.), *The SAGE Handbook of Architectural Theory*. Los Angeles: SAGE, pp. 451-464.
- Castells, M. (1996). The Rise of the Network Society. 2nd ed. Oxford: Blackwell Publishers.
- Corner J. (2006). Terra Fluxus. In Ch. Waldheim, (Ed.), *The Landscape Urbanism Reader*. NY: Princeton.
- Delalex, G. (2006). *Go with the Flow*. Helsinki: University of Art and Design Helsinki.
- Easterling, K. (1999). *Organization Space*. Cambridge. Mass.: MIT Press.

Forrester, J. (1969). Urban Dynamics. Cambridge: MIT Press.

- Gausa, M. (2003). *The Metapolis Dictionary of Advanced Architecture: City, Technology and Society in the Information Age*. Barcelona: Actar.
- Goldblatt, D. (2007). Lightness and Fluidity: Remarks Concerning the Aesthetics of Elegance, *Architectural Design*, Vol. 77, No. 1, pp. 10-17.
- Graham, S., Marvin, S. (2001). *Splintering Urbanism*. London: Routledge.
- Koolhaas, R., Mau, B., Sigler, J., Werlemann, H. (1998). *Small, Medium, Large, Extra-Large*. New York: Monacelli Press.
- Kwinter, S. (1998). "LaCitta` Nuova: Modernityand Continuity," Zone1–2. In M.Hays (Ed.), *Architectural Theory Since 1969.* London: MIT Press, pp. 586-612.
- Mossop, E. (2006). Landscape urbanism. In Ch. Waldheim (Ed.), *The Landscape Urbanism Reader*. NY: Princeton.
- Niković, A., Manić, B. (2018). A Possibility of Introducing the Concept of Form into Urban Planning in Serbia, *SPATIUM*, No. 40, pp. 18-24.
- Pawley, M. (1998). *Terminal Architecture*. London: Reaktion Books.
- Wigley, M. (2001). Network Fever, Grey Room, No. 4, pp. 82-122.

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CONTEMPORARY VARIANT OF A TRADITIONAL MACEDONIAN BONDRUCK HOUSE

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The traditional bondruck system for constructing single-family homes, which is one of the most important segments of Macedonian material culture and heritage, can create a path for developing and improving contemporary design and construction solutions for sustainable architecture in Macedonia. The classic variant of traditional bondruck has not been of a high enough standard over a long period of use, which was also the case even at the time when it was a popular building method. Some disadvantages of its classic variants such as: the lack of quality materials for external and internal processing, inconsistent stability due to technological defects in the wood, a low standard and level of physical performance, functional deficiencies etc., can be overcome with modern technological solutions, the use of new building materials, and the possibility of systematic planning in a market economy, combined with the realization that a higher standard of housing is needed today. Based on an analysis of traditional Macedonian bondruck, it is possible to make a contemporary version of this system with improved quality of performance, both of individual elements and of the whole system. This is demonstrated by the proposed solution of a reference house in the village of Bitushe, built with the traditional bondruck system.

Key words: contemporary, variant, traditional, Macedonian, bondruck house.

INTRODUCTION

The task of this research is to explore the possibilities for enhancing bondruck systems that would introduce traditional construction concepts into modern building practice, with the aim of improving technical and energy performance and achieving adequate living comfort, as well as preserving the environment. This indicates that the topic is a contemporary one, and that scientific research can be put into practice.

Several scientific research methods have been used to design this study according to the nature of the problem and the field of research:

- Content analysis: research of reference literature, visiting and recording selected locations and measurements in the field, a case study;
- The historical method, which was used to obtain accurate knowledge of the course of particular social processes, taking into account the chronology of development, and the causal and consequential dependencies of the problems in question. The main instruments used in

this method are published works and texts, projects and technical documentation;

- The comparative method, in order to establish a connection between the appearance of a general phenomenon in close or related fields, by constructing a positive or negative analogy; and
- Synthesis of the results.

After the synthesis and comparative analysis of the data collected and the results of the analyses, the basic principles and conclusions were established in the form of a reference model with satisfactory technical, energy and design performance.

TRADITIONAL ARCHITECTURAL CONSTRUCTIONS IN MACEDONIA

The architecture of houses built in the 18th and 19th centuries, scattered in the cities and villages of Macedonia, with its high-quality achievements in terms of function, construction and aesthetic design, reflected the socioeconomic and political circumstances in the Ottoman period (Namičev and Namičeva, 2014).

The traditional house in Macedonia inherits its forms from the medieval house, the remains of which, due to the poor building materials used, have not been preserved to this day.

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In the so-called national architecture of Macedonia, we encounter extremely correct functional solutions, which can be said to be based entirely on modern principles. If we start with the construction of the house in relation to the insulation and the view of the landscape, and then consider the organization of the interior space and the ventilation of the rooms, with its windows placed in a row, we will see that the Macedonian master deeply penetrated and mastered the positive principles of spatial solutions with regard to the exterior, and even more the interior.

The shape of the buildings themselves, which have a ground floor and one or two floors, has a high aesthetic value in the architectural dismantling of the mass, with various architectural motifs. The relationship between the full wall surfaces and the openings, as well as their proportions, creates certain harmonious effects important for shaping the facades (Nikoloska, 2003).

Of particular interest is the actual construction of the Macedonian house. It is essentially functional, economical, standard, bold and often spiritually formed. Thus, the achievements of Macedonian national architecture can be said to represent, in most cases, a unity between function, construction and aesthetics, achieving a single harmony in the architectural expression.

The building traditions on the Macedonian territory were historically quite developed, from the late antique and early Byzantine achievements, and later throughout the Middle Ages. The numerous preserved monuments of sacral architecture are the best proof of the skill of the Macedonian masters in performing quite bold constructions. The building materials were primitive: stone, wood, lime and sand, and the technical means of construction were quite simple.

Having these conditions in mind, the ability and inventiveness of the Macedonian master is expressed in every house, and especially in the construction of larger houses and monastic complexes.

The completed works of the Macedonian masters abound with extraordinary construction solutions, both in the application of the material and its processing, as well as in the shaping of the forms. Without static calculations and based on experience, with great knowledge of the craft that was passed from generation to generation, the Macedonian master created a rational and at the same time unobtrusive construction, always with the function of individual units. Therefore, we can conclude that the function of the construction itself is clearly understood and consistently implemented, with cost effectiveness as a result of knowing the above principles.

The most common construction in traditional Macedonian houses is the bondruck system. It is a skeletal wooden structure consisting of horizontal and vertical wooden beams 14/14 or 16/16cm, fastened with brackets (Figure 1). Carved planks up to 1cm thick are nailed on the inside and outside of the wooden skeleton, onto which mortar is applied on both sides. The total thickness of such a wall is 18-20cm, and it is a combination of two canvases with a layer of air – the construction is quite light, with good insulating properties. This construction can be found on the upper floors of houses in Ohrid, Struga and other places (Figure 2). "In village houses, the space between the planks was filled with gravel, sand and mud" (Tomovski, 1959-61: 3).



Figure 1. Skeleton of a wooden bondruck system at a house in Ohrid (Source: Tomovski, 1959-61: 3)



Figure 2. The bondruck construction was applied on the 1st and 2nd floor. The ground floor is masonry. The axonometric display of the constructive assembly shows the solution of the bondruck walls built in the Ohrid houses (Source: Tomovski, 1959-61: 4)

There is a strong south wind in Ohrid that tears the plaster from the facades. Therefore, often the walls are not plastered at all, but lined with a metal sheet as protection against the wind, so we can study these walls at all stages of their construction. The bondruck is almost American in style, filled with straw, then coated with a "shepher's" plank (Macedonian term) and plastered, or lined with an anti-wind sheet on the high ground floor made from a row of stone. On top of all of that is the roof, which is covered with shingles – to protect against the wind.

This type of construction was described by Grabrijan (1986: 145):

"Isn't that a semi-dry construction? Only the clay between the stone and the plaster on the wooden planks of the "shepher" is wet, everything else was built dry. At the fishermen's houses in Ohrid, even the ground floor was built on wooden poles everything else was built dry and plastered. And when the metal sheet replaced the plaster, then it became a completely dry installation, built on completely modern principles and different from the brick construction".

In some places the bondruck construction is filled with "kerpich" (unbaked bricks). Of course, in these cases the construction is heavier in weight and the insulation is weaker. "Chopped straw, wood shavings, wood chips, dried corn leaves and other natural materials can be used for filling. This treatment of the wall contributes to its light weight" (Tomic *et al.*, 1983: 67). In mountain villages, such as Galichnik and Tresonche, the console parts of the floor are usually lined on both sides with wooden planks that remain visible. In all of the above examples, the bondruck structure itself is not visible. There are also rare cases (in Galichnik), where the bondruck construction is visible from the outside, while the inside is covered with wooden planks.

Certain parts of the bondruck, such as the vertical and horizontal beams around the corners, around the windows and the visible wooden beams of the floor structures, parts where the plaster is poorly retained, are covered with wooden planks. The covers, therefore, have a purely functional role in which the Macedonian master shows his sincere attitude towards solving these seemingly small details. On the other hand, the covers and the aesthetic enrich the facade. With their dark patina, they contrast white and light-colored wall surfaces.

The bondruck construction allows the release of part of the floor or the whole floor, as well as the upper floors from the ground floor line. The cantilever overhang from the upper floors is due to a lack of building space and has a functional justification – it corrects the shape of the ground floor, which often follows the street line and has irregular shapes; it expands the rooms on the first floor, giving them more correct shapes, and it allows the installation of windows on both sides, which serve to look at one or the other side of the street. These cantilever overhangs are supported by consoles or brakes if they are larger or not in the direction of the floor beams.

The brakes are often visible, but can be also covered with wooden planks in various profiles, onto which mortar

is applied. In addition to supporting the cantilevers, the brakes are also used to support other ejected parts, such as chimneys, stairs, eaves, etc.

Free-standing wooden pillars are load-bearing structural elements. If the wooden pillar is located on the ground floor, it is situated on a stone dug into the ground. At the top of the pillar is a wooden, usually profiled, capitula, through which there is a horizontal floor beam.

The foundations and ground floors of houses are usually masonry with stone between 50-80cm thick. Often the stone is also present in the upper floors, completely or partially, which is especially evident in houses in mountainous areas (Galichnik, Lazaropole, Tresonche, Krushevo, etc.). The stone walls are leveled and connected with wooden "santrach", a type of wooden cerclages at a distance of 80cm. Usually, stone walls are not plastered due to their resistance to weathering. Stone that is crushed or carved remains visible. Thus, a rustically treated ground floor looks heavier than the other floors, which is logical because those walls carry the structures above the ground floor. "For the construction of the ground-floor walls in village houses, unbaked bricks were often used, especially in houses with only one floor. Those walls are plastered and painted" (Tomovski, 1959-61: 85).

In general, the composition of bondruck walls and wooden profiles is very adaptable, improvised in situ, depending on the need and the size of the wood available, and then the size of the openings in the wall; there is no pre-determined method used to connect the wood – it is just cut and joined with nails, but never absolutely processed and flat. The trees are usually only cut into smaller profiles and are short in length. Even the wooden profiles (8/10cm) in the Ohrid houses are made according to the American bondruck system, at a distance of 40-60cm (Grabrijan, 1986).

Traditional Macedonian city and village houses both have a sloping roof. Since there is not too much snow, the roofs have only a slight slope, except in mountainous places, where they are steeper. They are covered with tiles, stone slabs or straw, depending on the construction site and the material available. In mountainous areas, houses are usually covered with stone slabs, and in settlements in the plains - with tiles. The Macedonian master was not always economical in the construction of the roof. On the contrary, the roof constructions abound with a lot of timber, due to the heavy roofing materials (such as in houses covered with stone slabs). The "chair" system is most commonly used, and the "pendant" is less common, usually in churches - basilicas. The roof structure itself is released from the plane of the walls, often up to 150cm or more, in the form of gutter-free eaves with visible wooden beams. Often, the eaves are covered with planks. Thus, the released eaves protect the facades, diverting rainwater away from the wall surfaces, which is a logical conclusion in the shape of the houses. Often, especially in city houses, the building ends with a rather protruding richly profiled wreath. The wreath is formed with a substructure. In some houses, the wreath also has a baroque shape. In city houses such as in Krushevo, Skopje and Bitola, the tympanum front is usually situated very centrally.

The floor constructions are made of wooden beams. In country houses, especially in the ground floor rooms, the ceiling beams are visible. Otherwise, the ceilings are usually covered with wooden planks with wooden moldings. The floors are also made of wooden planks or compacted clay (in country houses). In richer houses, there are carvings on the ceilings, which are examples of outstanding Macedonian woodcarving.

Stairs are always wooden, usually in patterns. In houses with a loggia (chardak), the stairs are situated in the porch (trem) and they lead to the loggia on the upper floor, from where the living rooms are accessed. In some monastery lodgings, the stairs are outside, on consoles, from the plane of the loggia. In this way, the vertical movement takes place freely, without taking up space from the porch or the loggia (Figure 3).

The structures and structural elements described are the most important ones, which are usually standard and appear in almost every Macedonian house.



Figure 3. The lodging in the monastery of St. Jovan Bigorski. The stairs are built out of the plane of the loggia (Source: Photo by the author)

"The richness of the construction, the materials used and their processing, as well as the static regularities and the aesthetic created all demonstrate the inventiveness and capability of the Macedonian craftsman, who created with primitive materials and technical means using state-of-theart building principles. Some structures of old houses serve as examples that can be applied in newly designed modern constructions" (Tomovski, 1959-61: 41).

PROPOSED SOLUTION FOR A CONTEMPORARY VARIANT OF A TRADITIONAL MACEDONIAN BONDRUCK HOUSE

An analysis of the construction of a traditional Macedonian bondruck house can be a starting point for forming a contemporary reference type variant as a proposal for modifying the traditional bondruck system and eliminating some of its shortcomings by applying contemporary technical solutions, which was one of the main tasks of this research. A contemporary reference-type variant was obtained by optimizing the energy performance of the basic structural elements, using contemporary materials that meet the requirements for thermal and sound insulation, design characteristics, safety of the structural system and construction technology, flexibility and energy savings.

For example, the exterior walls can be of much better quality, both in terms of the facade finishes and in relation to the intermediate layer and interior finish.

A. The final **exterior cladding** of the building can be achieved with a variety of contemporary materials that will allow the authentic appearance of traditional bondruck to be achieved: two-layer extension mortar made over a corrosion-resistant steel rabic mesh substrate or plastic mortar, waterproof plywood, ribs or corrugated sheets, etc.

B. The **Intermediate layer** with thermo-acoustic protection can be achieved with: an air gap of 3-5cm, positioned immediately after the coating material, which can be ventilated (in summer) or trapped as additional free thermal insulation (in winter). Then, better thermal-sound insulation can be achieved with: expanded polystyrene, lightweight special construction boards (heraclit), mineral, glass or stone wool 10-15cm thick as needed, reinforced with additional thermal insulation from the inside and outside side panels, hard-pressed 2cm thick polystyrene, hard-pressed mineral wool or polyurethane.

C. The interior finishing of the walls can be made of different building materials depending on the purpose of the partitioned rooms (gypsum board or wooden boards, panel boards, OSB boards, etc.), mounted on a wooden or metal substructure, between which the internal thermal isolation is positioned. This space between the metal subframe also allows the position for conducting electrical wiring cables, which in classic bondruck house are made on the outside of the partition wall, which are visible and therefore unprotected (one of the disadvantages of the traditional bondruck system).

All other architectural and design elements of the facade (vertical and horizontal cladding, window decorations, etc.) can be executed equally authentically with the classic variant, enhanced by new styling and design (Figures 4, 5 and 6).

Of course, this contemporary variant, over time, in accordance with experience and new needs, can continue to be a perfect solution for most of the key shortcomings of the traditional bondruck system. Certainly, one of the most serious shortcomings of traditional bondruck was the inability to provide sanitary facilities that were well protected from the effects of water and moisture. The waterproofing materials that we have today and the technical capabilities for their application mean that this problem is becoming banal, and even new, innovative solutions are possible.

The contemporary variant of the traditional bondruck system (Figure 7), designed using an adequate modular system or a completely free-developed architectural basis, makes the achievement of a new quality of architectural expression possible, both through the authentic application of traditional architectural forms and a completely new

















A. Exterior cladding

 two-layer extension mortar made over a corrosion-resistant steel rabic mesh substrate or plastic mortar, waterproof plywood, corrugated sheet etc.

B. Intermediate layer - air gap of 3-5cm

 thermal-sound insulation with: expanded polystyrene, lightweight special construction boards (heraclit), mineral, glass or stone wool 10-15cm, reinforced with additional thermal insulation from the inside and outside side panels, hard-pressed 2cm thick polystyrene, hard-pressed mineral wool or polyurethane C. Interior finishing

- gypsum board, wooden boards, panel boards, OSB boards, etc.

Figure 5. Contemporary variant (right) of a traditional bondruck system (left); Detail of cantilever formed by a slight ejection of the profiled heads of the beams from the floor construction (Source: Drawings by the author)



A. Exterior cladding

 two-layer extension mortar made over a corrosion-resistant steel rabic mesh substrate or plastic mortar, waterproof plywood, corrugated sheet, etc.

B. Intermediate layer - air gap of 3-5cm

- thermal-sound insulation with: expanded polystyrene, lightweight special construction boards (heraclit), mineral, glass or stone wool 10-15cm, reinforced with additional thermal insulation from the inside and outside side panels, hard-pressed 2cm thick polystyrene, hard-pressed mineral wool or polyurethane C. Interior finishing

- gypsum board, wooden boards, panel boards, OSB boards, etc.

Figure 6. Contemporary variant of a traditional bondruck system; Detail of a console released bondruck wall for a building with a basement or ground floor (Source: Drawings by the author)

stylization and inventiveness in the design of the facade, to the extent that it may well follow the most recent tendencies in architecture.

This is demonstrated by the floor plans (and adequate details) of the reference example of a traditional bondruck system for an existing old house in the village of Bitushe (Figure 8). The building has three floors: the basement (with porch called "trem"), the ground floor (with hallway



Figure 7. An axonometric display of the contemporary variant of the traditional bondruck system (Source: Drawings by the author)

called "gjizentija" and cellar called "kled") and the upper floor (with the main living space called the "house" and two rooms called "odaja"). The stone wall of the basement and ground floor also extends upstairs in the area of contact with the neighboring building and the facade closure of the "house". Bondruck walls appear only in part of the facade closure of both rooms. One bondruck wall is in the line of the stone wall of the ground floor and the other is cantilevered (details in Figure 8).

The following is the proposed solution for the same spatial concept in the contemporary version of the traditional bondruck system, shown in the floor plans (Figures 9a and 9b) and in the characteristic details of the floor plans (Figures 10a, 10b and 10c).

In order to preserve the authenticity of the traditional facade design, the stone walls of the ground floor, and the upper floor, it is proposed that the "sandwich" consists of: a facade cladding with stone 18-48cm thick, a 3.5cm concrete layer, thermal EPS insulation 5cm thick, a 12cm brick layer and lime-cement mortar of 1.5cm as the interior finish. Thus, the total thickness of the wall can vary from 40 to 70cm (as with the original, exclusively stone wall).

Figure 7 shows a variant solution with stone walls covered only on the inside with thermal EPS insulation 5cm thick and gypsum board 1.25cm on a frame of wooden slats 5/5cm.

Due to the reduction of the initial thickness of the stone wall (70cm) and to enable its load-bearing function, the new proposed solution requires the establishment of a skeletal system with reinforced concrete columns and beams in the position described in the floor plans (Figures 10a and 10b).

Variability in the dimensions and composition of the sandwich facade walls, traditionally built only in stone, as well as those built in the bondruck system, depends on the orientation of the wall, the climate zone in which the building is located, and the new purpose of its premises. In this way, better thermal protection can be achieved with the coefficient U= $0.25-0.30 \, [W/(m^2K)]$.



Ground floor

1. entrance 2. "gjizentija" 3. "kled" 4. "house" 5. "odaja"

100

Figure 8. . Old house in Bitushe (Source: Brezoski, 1993; 82)





Figures 10a, 10b and 10c. Details of the joints of the facade walls ("sandwich" with finishing facade cladding of stone and the bondruck system) (Source: Drawings by the author)

CONCLUSION

The analysis proves the values and advantages of bondruck systems, which can open the door to the true reaffirmation of this traditional architectural form through its further contemporary development, both in terms of using higher quality materials and applying modern processes to create a new architectural expression.

By applying quality processing methods and materials to the so-called "dry" installation process, as well as the use of sophisticated heating systems and infrastructure systems (installations), this architecture can greatly exceed the performance of current construction systems, especially in terms of construction time, cost-effectiveness during operation, energy savings, more comfortable conditions, bio-climate subordination and environmental balance. This is in addition to their environmental friendliness, opportunities for easy recycling, replacement of most of the materials used, and flexibility if interventions are needed, even in the construction system. In addition to this, through the research and refinement of this construction system and on the basis of experiential knowledge during construction, this system can greatly exceed the performance of even contemporary bondruck systems that are applied today in the developed countries of the world.

The results of the analysis and proposed solutions confirm the basic task of this research: to formulate a proposal for a modified traditional bondruck system and a solution with contemporary materials that meet the requirements for thermal and sound insulation, as well as the safety of the construction system and construction technology, flexibility and energy savings. This opens the door for the reaffirmation of this traditional architectural form by developing and applying a contemporary better quality variant.

REFERENCES

- Brezoski, S. (1993). *Rekanska kuka* (in Macedonian). Skopje: Bigoss.
- Grabrian, D. (1986). Makedonska kuka ili preod od stara orientalska vo sovremena evropska kuka (in Macedonian). Skopje: Misla.
- Namičev, P., Namičeva, E. (2014). *Traditional city house in Northeastern Macedonia*. Skopje: Petar Namičev.
- Nikoloska, M. (2003). *Gradskite kuki od 19 vek vo Makedonija* (*prostorna organizacija*) (in Macedonian). Skopje: Republički zavod za zaštita na spomenicite na kulturata
- Stojkov, T. (2006). Practicum III bondručni i lesno-montažni (BOLMO) sistemi, zbirka na rabotni crteži, detali i proekti, pp. 53 (in Macedonian).
- Tomic, Lj., Pljakoski, D., Filipovski, Lj., Boskovski, V., Stoilova, M. (1983). *Erker i ograda vo arhitekturata* (in Macedonian). Skopje: Naša kniga.
- Tomovski, K. (1959-61). Za konstrukciite vo narodnata arhitektura vo Makedonija (in Macedonian), Zbornik na Tehničkiot fakultet oddelen otpečatok. Skopje: Univerzitet vo Skopje, pp. 14.

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MULTI-FUNCTIONAL LAND-USE PLANNING AS A REGULATOR OF URBAN METABOLISM: A CONCEPTUAL PERSPECTIVE

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This paper is an attempt to reveal the possibilities for using land-use planning to improve the urban metabolism (UM) circularity and sustainability, and thus its usefulness for urban planning and development. The available literature about UM is overviewed and analysed from this conceptual perspective, and a comprehensive and consistent definition of the UM concept is proposed. The Circular UM is also presented as an efficient and sustainable extension of UM. It has been found that distinct urban forms strongly influence UM, and that this influence to a great extent transfers through, and connects, the layers of the urban form, from the urban morphology, through the spatial distribution of urban functions, to the level of the building stock. These relations imply that proper intertwining of city functions in compact urban areas could have favourable impacts on many aspects of UM, reducing the consumption of land, material and energy, as well as pollution, and improving the overall quality of life. Quantification of these impacts requires a more precise determination of the effects of intertwining of urban functions, and the side-effects of doing so, and is a precondition for the effective use of MLU for UM optimisation.

Key words: urban metabolism, circularity, sustainability, multi-functional land use, intertwining of urban functions.

INTRODUCTION

Despite numerous activities undertaken with regard to environmental protection, our planet is at a critical crossroads, and the choices that humanity makes will have a significant and lasting effect on all life on earth. For a long time, environmental protection and sustainability were focused on areas outside cities and the protection of natural rarities, isolated landscapes, and wilderness (Vasiljević, 2012). However, due to high concentrations of people, goods and activities, it has turned out that cities have a crucial impact on global sustainability (Kennedy et al., 2007; UN General Assembly, 2016; Pistoni and Bonin, 2017), forming some kind of critical points, which are particularly vulnerable to natural and man-induced catastrophes (Antrop, 2006). The United Nations Department of Economic and Social Affairs (2014) reported that in 2014 there were about 7.3 billion people on the planet, with 54% of them (about 3.9 billion) in cities. The estimate for the total population in 2050 is 9.8 billion, of which 66% i.e. 6.5 billion will live in

cities, which is almost double the 2014 figure and close to the total human population on the planet in 2014.

According to Global Footprint Network estimations, current consumption of resources exceeds the planet's capacity by 56%, and with this trend the consumption in 2050 will be double what is sustainable (Ávila, 2018). Cities are large consumers of various resources and they generate huge amounts of waste, thus making a vast impact on the environment. Urban areas are responsible for 60-80% of global energy consumption, 75% of global carbon dioxide emissions and 75% of global resource consumption (Swilling *et al.*, 2013). The result is the loss of agricultural land, forests and other natural habitats, the reduction of biodiversity, and air, water and soil pollution. In that way, the environmental footprint of cities deepens over time and worsens not only the quality of life in them, but also global environmental conditions (Kennedy et al., 2010). Therefore, big cities appear to be the greatest obstacle to sustainable development, especially in less developed countries with an intense urbanisation process (United Nations Environment Programme, 2017). Consequently, it is difficult to achieve a balance between often conflicting demands and expectations imposed by the quality of life in cities and environmental

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protection (Conke and Ferreira, 2015).

The aforementioned indicates that current urban development trends are alarming and indicate the need for change through adequate planning. Spatial and urban planners have developed numerous concepts and models to explain the functioning of cities and to solve complex problems that accompany life in them. One of them, the concept of urban metabolism (UM), which considers cities as "living organisms" (Wolman, 1965; Pinho et al., 2011), will be presented in this paper in more detail. The urban functions of housing, business, recreation, etc. are recognised as drivers of UM, determining energy and matter flows within a city, and between the city and its surroundings, and so a better understanding of these functions and of their relations can enable more efficient planning and development of cities. As a natural extension of the concept of sustainable development, the UM concept is particularly suitable for improving the urban development in that sense, too (Kennedy et al., 2010).

The rapid increase of urban population has led to a chronic lack of space in cities, and the role of space has become increasingly important, "both as an instrument and as a goal" (Lefebvre, 1992: 411), raising the issue of spatial planning and management. Land-use necessarily affects the urban metabolism in many aspects and at various levels, so insight into its influence is of great importance for the optimisation of city functioning. Therefore, it is surprising that very few among the increasing number of papers dealing with UM are devoted to its relationship with land-use planning, which has left many significant questions unanswered. In this paper, ways in which multi-functional land use (MLU) affects UM and the quality of life in cities are addressed, and possibilities for improving some important issues of city functioning are proposed.

The objectives of this paper are twofold. The first objective is to provide an insight into the UM concept through an overview and analysis of available literature, and on that basis formulate a comprehensive and consistent definition, and determine directions and areas for its optimal use. The second objective is to investigate the possibilities for land-use planning, especially MLU, for the optimisation of UM. This is done through the analysis of impacts that different urban forms have on UM; the conclusion drawn is that proper optimisation of intertwining city functions in compact urban areas can improve many aspects of UM.

THE CONCEPT AND DEFINITION OF URBAN METABOLISM

Motivated by rapid and intense urban development in the United States during the mid-20th century, Abel Wolman published a paper (Wolman, 1965) which is considered to be the beginning of the modern concept of UM, the roots of which can be dated back to the mid-19th century and the work of Karl Marx (Zhang, 2019). In his paper, Wolman tried to identify reasons and to offer solutions for the deterioration of the air quality and water supplies in American cities. For that purpose, he analysed the "metabolism" of a hypothetical American city region with one million inhabitants, which included the inputs and outputs of energy, water, materials and waste, establishing the framework and basic features of UM (Wolman, 1965). Patrick Geddes also contemplates cities as living organisms which consume resources from, and excrete waste into, their surroundings (Pistoni and Bonin, 2017), or according to Decker *et al.* (2000: 715): "cities transform raw materials, fuel, and water into the built environment, human biomass and waste".

Now, after more than 50 years, the UM concept is neither completely elaborated, nor adequately defined (Latin definitus - determined, distinct). This makes it difficult to clearly and precisely designate meaning, features and scope to the concept, which must be overcome in order to improve the concept from descriptive to being applicable. To do that, it is advisable to start from the meaning of the words in the name of the concept. The word urban originates from the Latin *urbs*, which is used for a city, or something that has the characteristics of a city. The word metabolism originates from the Greek $\mu \epsilon \tau \alpha \beta o \lambda \eta \sigma \mu \delta \varsigma$, which means change. In biology, metabolism is defined as a set of interdependent processes, including nutrition, growth and reproduction, and the maintenance of structures and responses to stimuli coming from the surroundings, all of which make the life of cells and the organism possible (Voet and Voet, 2004). Although it came out of this "natural" definition, in many details UM cannot be equivalent to the metabolism of a living being. In an attempt to expand and improve Wolman's analysis that focuses on energy and matter flows, Kennedy et al. (2007: 44) define UM as: "the sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy, and elimination of waste". Most authors (Wolman, 1965; Minx et al., 2011; Kennedy et al., 2014; Conke and Ferreira, 2015) agree that UM includes numerous processes which use and affect the flows and transformation of energy and matter in the city, human activity, and the interaction of the city with its surroundings. All of the previously mentioned can be embraced by the definition that: "UM is a complex process that involves numerous, diverse and mutually conditioned relations and interactions which determine the flows, transformation, and exchange of energy, matter and people within the city, and between the city and its environment". In order to make this (or any other) general definition of UM practically applicable, one must have in mind that every healthy metabolism *per se* entails the functioning by which all elements of the "organism" work to optimally support it, leading to the fulfilment of the purpose of its existence, in the sense of Aristotle's τέλος (purpose, reason i.e. cause of existence). This significantly limits the large number of possible solutions that the complex concept of UM offers, and directs them towards the desired goal: an organised and functional city which exists for the benefit of its inhabitants.

The components of Urban Metabolism

Although a holistic approach in spatial and urban planning is not new, and can be traced back as far as the end of the 19th century and Ebenezer Howard's Garden City (Xu and Madden, 1989), it is still poorly integrated into the UM concept. As a matter of fact, one of the major shortcomings of current UM applications is that they neglect the *raison d'être* of urban settlements: their social component. Better and safer living, achieved through the processes and functions of city, was the essential reason for forming the first urban settlements, or in the words of Aristotle: "men come together in the city to live; they remain there in order to live the good life" (Mumford, 1961: 111).

The social component of UM is manifested through the quality of the urban environment, its services, comfort, safety and similar parameters (Southworth, 2003), some of which are easy, and some more difficult to quantify. The difficulty of quantifying social components is probably the main reason why it is only occasionally analysed in UM studies; it is much easier to quantify and study the flows of energy and matter, and their economic and environmental consequences. A purely quantitative approach to UM has also been criticised by urban ecologists and urban sociologists, insisting that they should also be engaged in an integrated approach to planning urban areas (Lin et al., 2012). Such a comprehensive approach should enable the balanced and harmonised development of urban systems, i.e. development that is not selectively adjusted to specific interests, because this increases differences between the city residents (Davis et al., 2016). In particular, the selective control of urban space and infrastructure is known to lead to the uneven distribution of urban functions and related facilities, as well as the uneven density and quality of communal utility and traffic networks, making social inequalities more prominent (Janin Rivolin, 2017). This significantly affects the quality of life in cities and can lead to the formation of slums and the "death" of certain zones – sometimes even of entire urban settlements (Jacobs, 1961), indicating that sustainable urban development is impossible if some citizens are prevented from meeting their basic needs. If the goal is a sustainable UM, its economic, social and environmental components must be equally taken into account.

Circular Urban Metabolism

Cities are very complex "organisms", and at the same time they are habitats for a multitude of beings - humans, animals and plants, which makes them specific ecosystems (Kennedy et al., 2010; Castan Broto et al., 2012). Natural ecosystems are sustainable if they have sustainable inputs of energy and matter, while food chain, decomposition and similar processes ensure that there is no real waste in their metabolism, as each output is the input for another process or organism. Thus, a significant amount of energy and matter is recycled within the circular metabolism of a natural ecosystem (Kennedy et al., 2010). If cities could obey similar principles, their sustainability and that of the area (region) they directly affect would be much better (Van Broekhoven and Vernay, 2018), which is especially important for cities that are large and significant on the global scale. However, cities are artificial (anthropogenic) systems with a predominately linear metabolism, and they require large flows of energy and matter. Resources enter a city as inputs into specific processes, and the waste produced leaves the city or accumulates in designated parts of the city, or its surroundings (Kennedy et al., 2010).

The purpose of the Circular Urban Metabolism (CUM) concept is to propose mechanisms compatible with those of the circular economy and industrial ecology, which would, as much as possible, transform linear flows of

energy and matter that occur in a city into circular ones, thus reducing their negative impact on the environment and contributing to more efficient and sustainable use of the available material and human resources (Saavedra et al., 2018). By connecting different processes into loops, the waste from one becomes input for other processes, making the entire system more sustainable (Van Broekhoven and Vernay, 2018). It has already been anticipated that what we now treat as "waste" tomorrow could be a more suitable and cheaper resource than if it were obtained by primary exploitation, especially in terms of the concentration and purity of the desired material (Brunner, 2007). Although they share a common intention to connect different processes in the connected loops, CUM differs from the circular economy and industrial ecology by its tendency to treat economic, social and environmental issues on an equal footing. The city of Lille, France provides a good example of CUM: using anaerobic digestion, organic waste is processed into biogas and compost, thereby connecting waste management, energy, transport and agriculture and improving the environmental conditions (Van Broekhoven and Vernay, 2018).

However, one city is too small, and in many respects an incomplete system to ensure that the outputs from all processes taking place in it can be used as inputs for other processes, thus enabling a metabolism that would be completely circular and self-sufficient. It is easier and more efficient to establish circularity within a larger network inside a region, country, continent, or even globally, synchronising the city's metabolism with its environment and with other cities from the network. In that way, the products of one city's metabolism could be more efficiently used in neighbouring cities or settlements, rather than insisting on their use in their city of origin. Therefore, CUM needs to be extended to areas wider than a city that are sufficient to manage optimal networking and circularity. Such an optimised network is capable of providing extremely efficient circulation of energy and matter in the area in question. This has been in practice for decades between municipalities and cities in the area around Helsingborg and Malmö, in Skåne County, Southwest Sweden, making them a perfect illustration. The "symbiosis" of public and private companies inside a unique system of waste collection, sorting and treatment has made it possible to extensively (more than 80%) and efficiently process, recycle and reuse various types of waste, including the production of biogas and its usage in public transport and heating. Better quality biogas is used as a fuel for transport vehicles, and lower quality biogas is used for heating, especially in greenhouses, thus promoting sustainable gardening that would otherwise be difficult in that particular climate (Nordvästra Skånes Renhållnings AB, 2020).

LAND-USE PLANNING AND URBAN METABOLISM

The activities that occur in a city and its surroundings are initiated by the needs of its inhabitants, from existential needs, such as food, water and shelter, to more complex needs of an economic, political, social, or cultural nature. They are the drivers of UM, determining the flows of energy and matter, and the way of life in a city; there is no UM without them. These activities and processes, and the matter, energy and people flows they produce are connected into feedback loops, so it is necessary to study and understand their relationships in more detail (Dijst et al., 2018). The spatial organisation of these functions significantly influences their performance (ibid.), and so the optimisation of land-use is crucial to attaining an efficient and highly sustainable UM, thus improving the quality of life and protecting the environment affected by urban areas. The systematic classification and assessment of land-use options are necessary for deciding between various, often competitive, demands, and coordinating them with the existing natural conditions, application possibilities, and human needs. In that way, land-use planning procedures could ensure the efficient and sustainable use of land, and thus preserve the land resources for the future (Food and Agriculture Organization UN, 1993).

Multi-functional Land Use

Multi-functional Land Use (MLU) is as old as cities themselves, and implies "the implementation of more functions in a determined place in a determined period of time" (Priemus et al., 2000: 270). In order to have sustainable land-use, it is essential that MLU is conducted in a way that enables synergy of the effects of city functions, i.e. that the joint effect of their actions exceeds the sum of the effects of individual functions, thereby giving a new quality (Rodenburg et al., 2003; Van Broekhoven and Vernay, 2018). The selection of functions that intertwine in a particular city zone has a major influence on the quality of the MLU performance results. That choice should be natural and guided by experience; only the functions that are known to be compatible (the effects they produce support one another) or complementary (the effects they produce complement each other) should be intertwined. There are various methods for evaluating the complementarity and compatibility of city functions, but it should be kept in mind that besides the characteristics and features of locations, land-use should also consider the interests and desires of the local community. Low compatibility of intertwining functions can lead to significant side effects (externalities), which typically affect the economic, social and health aspects of life, and effective land-use planning should minimize them (Taleai et al., 2007). This could be achieved by land-use classification and development control (Willis et al., 1998), and analysis of the complementarity and compatibility of intertwining basic city functions, which was done by Taleai *et al.*, 2007) using a combination of several techniques. As a measure of compatibility, the authors took the degree to which two or more functions can interweave in the same space and time with insignificant negative effects. They confirmed that an increase in the number of functions combined in one city area increases the overall negative effects, pointing out that in such cases, very careful planning is necessary. Rodenburg and Nijkamp (2004) made an attempt to quantify the MLU concept by introducing the degree of multifunctionality, which increases with an increase in the space heterogeneity and the number and degree of intertwining city functions.

Regulation of urban metabolism using MLU

Motivated by health and economic concerns during the final stage of industrialisation, and later formalised by spatial planning based on functionalism and zoning (Van Broekhoven and Vernay, 2018), the major city functions (housing, business, recreation, etc.) are usually spatially and temporally separated, limiting the ability to properly organise a city, and significantly degrading the quality of life of most of its residents. To remove the consequences of this approach, which are to various extents still present in many cities of the world, a consistent and up-to-date approach based on CUM and MLU concepts, which are complementary and well-adjusted to each other, can be used (*ibid*.). Since CUM implies a connected network of various processes and activities, MLU should be implemented in a way that supports this connectivity and circularity, and overcomes the separation of urban functions and formation of monofunctional city zones. Although a completely circular metabolism is not feasible within a single city, MLU can facilitate and support the local connection of some processes into loops, including the re-use of some types of waste, thus promoting circularity (ibid.). Jane Jacobs (1961), an ardent advocate of a multi-functional approach, has pointed out that multi-functional urban areas are more economically viable, safer and more culturally and aesthetically interesting than mono-functional ones. Also, Van Schaick and Van Der Spek (2008) suggest that intertwining different urban functions within the same city area results in conditions that, in multiple ways and at different levels, make living more comfortable. Over the past few decades, the idea of multifunctional city zones has become increasingly auspicious and gained numerous followers (Van Broekhoven and Vernay, 2018).

Research conducted by Pinho *et al.* (2011) shows that intertwining different functions in a particular space is more efficient if the density of the population and buildings, i.e. the space compactness, is higher, and that this intertwining reduces the need for additional building, thus reducing the pressure on free space in a city (parks and other green areas) and its surroundings (agricultural and forest land). Table 1 was constructed from the results presented by Pinho *et al.* (2011) to analyse the impact on UM of four basic types of urban form, each containing three layers: 1) *larger urban configuration*, which deals with the morphology of urban areas and population density; 2) *urban diversity patterns*, which deals with the spatial distribution of functions in an urban area; and 3) *urban building stock*, which deals with primarily residential buildings in an urban area.

Table 1 aims to classify various types of each of the three layers into their appropriate urban form, and to establish how, and to what extent, the principal impact of the urban form on UM is transferred from layer to layer. Although cities are complex systems in which the transfer of any feature between layers cannot be complete and exact, the data presented in Table 1 clearly indicate strong correlations and a pronounced transfer of the influence of each urban form on UM through all three layers. It becomes evident that urban areas with a compact structure and higher residential densities have lower consumption of the main UM factors, energy and matter than those with a fragmented structure and low densities. An increase in compactness leads to lower consumption of material and energy per unit of built-up space and in the construction of supporting infrastructure, as well as to lower energy consumption for heating and cooling (Pinho *et al.*, 2011). Since the construction and maintenance costs in such zones and their infrastructure are lower, the basic infrastructure is accessible to a larger population. More compact city zones also make the intertwining of urban functions and services easier, and thus significantly reduce the distances that people have to travel to meet their needs. This intensifies the use of non-motorized modes of transport and urban public transport systems, which together with the extensive use of communal heating systems, drastically reduces pollution from fossil fuel combustion (Ghafouri, 2016; Hsu, 2019). school, in the street, etc.), leading to better cooperation and stronger support between inhabitants, a reduction in the crime rate, and safer, more pleasant and homely urban areas (Vreeker, 2004; Hsu, 2019).

It follows from the above mentioned that adequately optimised MLU is able to have a positive effect on important UM components, such as:

- Land consumption;
- Consumption of materials and energy for construction, and associated infrastructure;
- Energy consumption for heating/cooling;
- Energy consumption in transport; and
- Environmental pollution;

Tanle 1. Cross consistency assessment of human need in relation to lighting technologies	
(Source: Pinho et al., 2011)	

/er	Turne of unboundary		Supposed impact			
			land consumption	energy consumption	material consumption	
Ι	high density, compact structure		low	low	low	
Ш	monocentric model		-	low	-	
Ш	high-density housing		low	low	low	
Ι	high density, fragmented structure		medium	medium	medium	
П	composite model	$\langle \!\!\!\!\!\!\!\!\!\!\rangle$	-	medium	-	
III	high-density and medium-density housing		low	low to medium	low	
Ι	low density, compact structure		high	medium	high	
П	polycentric model		-	high to medium	-	
III	medium-density housing		high to medium	medium	high to medium	
Ι	low density, fragmented structure		high	high	high	
П	urban village model		-	high	-	
III	low-density housing		high	high	high	

Besides the positive economic and environmental effects that MLU can provide, it can also improve the social indicators of the quality of life in a city, such as the share of households connected to the electricity and water supply, sewage, and waste collection systems, (Conke and Ferreira, 2015). In addition, the harmonization of city functions (residential, work, recreation and leisure, culture etc.) enriches social interactions and promotes cohesion and association within the community. In compact and multifunctional city zones, social interactions are more frequent and diverse (in neighbourhood, in transport, at work, at and in that way, it improves related aspects of the quality of life in a city.

However, together with the mentioned positive effects of MLU, an increase in density and compactness can lead to significant negative effects (externalities), especially if different city functions intertwined in space and time do not match well. The application of MLU in the past has often suffered negative effects because the economic aspect prevailed over social and environmental ones. A development that insists on higher densities and compactness, without considering other aspects of urban life, often leads to congestions problems, especially in transport, services and supply, including the electricity and water supply, and may increase the already existing deficiency in open spaces and green areas (Neuman, 2005). A higher concentration of activities and congestion problems can increase pollution in dense cities (Van der Waals, 2000), and the constant presence of large numbers of people in a small urban area can lead to overcrowding and loss of privacy (Vreeker, 2004). Therefore, an increase in compactness is desirable only in suitable city areas, under conditions that ensure that such an increase will not reach a level which produces significant negative side effects and a deterioration of the quality of life in the city.

CONCLUSION

In this paper, a comprehensive and consistent definition of the complex concept of urban metabolism (UM) has been proposed, with its utilisation directed by the notion that UM is "healthy", i.e. that it contributes to the efficient and sustainable functioning of a city, only, and only if all elements of the city contribute to its successful functioning as a whole, which implies much more than energy and matter flows into and through the city. It also implies that UM and other urban planning concepts should be based on an integral and circular (holistic) approach, rather than being sectoral and linear, including not only economic and environmental, but also social aspect of urban development. Such an approach requires the extension of urban planning to areas wider than cities in order to achieve optimal networking and circularity, and in return it could bring a balance between public and private interest.

Land-use planning has been recognised as a powerful tool for regulating UM, and some interdependencies and relationships between the concepts of UM and multifunctional land use (MLU) have been presented and analysed. It was observed that urban forms significantly affect the UM, and that this influence is to a large extent transmitted through the layers of urban form, from the level of the city morphology, across the spatial distribution of urban functions, to the level of the building stock. In that way, it has been shown that adequate spatial organisation of city functions and their proper intertwining can help to optimise UM and make it more sustainable.

Some important issues are still waiting for adequate development, such as more precise determination and quantification of intertwining urban functions, and a reliable methodology for estimating the upper limit of urban area compactness, below which the negative effects are acceptable (problem of externalities). These are topics for further study.

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REFERENCES

- Antrop, M. (2006). Sustainable landscapes: contradiction, fiction or utopia?, *Landscape and Urban Planning*, Vol. 75, No. 3-4, pp. 187–197.
- Ávila C. (2018). New Urban Landscapes. In C. Díez Medina, J. Monclús (Eds.) *Urban Visions*. Cham, Switzerland: Springer, pp. 289-298.
- Brunner, P.H. (2007). Reshaping Urban Metabolism, *Journal of Industrial Ecology*, Vol. 11, No. 2, pp. 11-13.
- Castan Broto, V., Allen, A., Rapoport, E. (2012). Interdisciplinary Perspectives on Urban Metabolism, *Journal of Industrial Ecology*, Vol. 16, No. 6, pp. 851-861.
- Conke, L.S., Ferreira, T.L. (2015). Urban metabolism: Measuring the city's contribution to sustainable development, *Environmental Pollution*, Vol. 202, pp. 146-152.
- Davis, M.J.M., Jácome Polit, D., Lamour, M. (2016). Improving Sustainability Concept in Developing Countries: Social Urban Metabolism Strategies (SUMS) for Cities, *Procedia Environmental Sciences*, Vol. 34, pp. 309-327.
- Decker, H., Elliott, S., Smith, F.A., Blake, D.R., Rowland, F. (2000). Energy and material flow through the urban ecosystem, *Annual Review of Energy and the Environment*, Vol. 25, pp. 685-740.
- Dijst, M., Geertman, S., Helbich, M., Kwan, M., Worrell, E., Harmsen, R., Ribeiro, A., Carreón, J., Böcker, L., Brunner, P., Davoudi, S., Holtslag, A., Lenz, B., Lyons, G., Mokhtarian, P., Newman, P., Thomson, G., Perrels, A., Urge-Vorsatz, D., Zeyringer, M. (2018). Exploring urban metabolism - Towards an interdisciplinary perspective, *Resources, Conservation and Recycling*, Vol. 132, pp. 190-203.
- Ghafouri, A. (2016). Sustainable Urban Form, Multifunctionality and Adaptation: Redefining urban spaces as multifunctional shared areas, doctoral dissertation. Strasbourg: University of Strasbourg.
- *Guidelines for land use planning* (1993). Food and Agriculture Organization of the United Nations, Rome.
- Hsu, K. (2019). Effect of Distinct Land Use Patterns on Quality of Life in Urban Settings, *Journal of Urban Planning and Development*, Vol. 145, No. 4, https://doi.org/10.1061/(ASCE) UP.1943-5444.0000522.
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Random House LLC.
- Janin Rivolin, U. (2017) Global crisis and the systems of spatial governance and planning: a European comparison, *European Planning Studies*, Vol. 25, pp. 994-1012.
- Kennedy, C., Cuddihy, J., Engel-Yan, J. (2007). The Changing Metabolism of Cities, *Journal of Industrial Ecology*, Vol. 11, No. 2, pp. 43-59.
- Kennedy, C., Pincetl, S., Bunje, P. (2010). The study of urban metabolism and its applications to urban planning and design, *Environmental Pollution*, Vol. 159, pp. 1965-1973.
- Kennedy, C., Stewart, I.D., Ibrahim, N., Facchini, A., Mele, R. (2014). Developing a multi-layered indicator set for urban metabolism studies in megacities, *Ecological Indicators*, Vol. 47, No. 1, pp. 7-15.

Lefebvre, H. (1992). The Production of Space. Oxford: Blackwell.

Lin, L., Liu, M., Luo, F., Wang, K., Zhang, Q., Xiang, W. (2012). Comment on "The study of urban metabolism and its applications to urban planning and design" by Kennedy et al. (2011), Letter to the Editor, *Environmental Pollution*, Vol. 167, pp. 184-185.

- Minx, J.C., Creutzig, F., Medinger, V., Ziegler, T., Owen, A., Baiocchi, G. (2011). *Developing a Pragmatic Approach to Assess Urban Metabolism in Europe – A Report to Environment Agency, Climatecon Working Paper*. Berlin: Technische Universität Berlin and Stockholm Environment Institute.
- Mumford, L. (1961). The City in History. New York: Harcourt.
- Neuman, M. (2005). The Compact City Fallacy, *Journal of Planning Education and Research*, Vol. 25, No. 1, pp. 11-26.
- Nordvästra Skånes Renhållnings AB, http://nsr.se/om-nsr/ vart-miljoarbete, accessed 5th Jan, 2020.
- Pinho, P., Santos, S., Oliveira, V., Barbosa, M., Silva, M., Galera Lindblom, P., Weber, R., Reardon, M., Schmitt, P. (2011). *Report on approaches and strategies for a metabolically sustainable city - SUME Working Paper 3.3.* Portugal: Oporto.
- Pistoni, R., Bonin, S. (2017). Urban metabolism planning and designing approaches between quantitative analysis and urban landscape, *City, Territory and Architecture*, Vol. 4, 20.
- Priemus, H., Nijkamp, P., Dieleman, F.M. (2000). *Meervoudig Ruimtegebruik; Stimulansen en Belemmeringen*. Delft: Delft University Press.
- *Resilience and Resource Efficiency in Cities* (2017). United Nations Environment Programme.
- Rodenburg, C.A., R. Vreeker, P. Nijkamp (2003). Multifunctional Land Use: An Economic Perspective. In P. Nijkamp, C.A. Rodenburg, R. Vreeker (Eds.), *The Economics of Multifunctional Land Use*. Maastricht: Shaker Publishing, pp. 3-15.
- Rodenburg, C.A., Nijkamp, P. (2004). Multifunctional land use in the city: A typological overview, *Built Environment*, Vol. 30, No. 4, pp. 274–288.
- Saavedra, Y., Iritani, D., Pavan, A., Ometto, A. (2018). Theoretical contribution of industrial ecology to circular economy, *Journal of Cleaner Production*, Vol. 170, pp. 1514-1522.
- Southworth, M. (2003). Measuring the Liveable City, *Built Environment*, Vol. 29, No. 4, pp. 343-354.
- Swilling, M., Robinson, B., Marvin, S., Hodson, M. (2013). *City-Level Decoupling: Urban Resource Flows and the Governance of Infrastructure Transitions: A Report of the Working Group on Cities of the International Resource Panel.* UNEP.
- Taleai, M., Sharifi, A., Sliuzas, R., Mesgari, M. (2007). Evaluating the compatibility of multi-functional and intensive urban land uses, *International Journal of Applied Earth Observation and Geoinformation*, Vol. 9, pp. 375–391.
- UN General Assembly (2016). *New Urban Agenda*, Quito: UN General Assembly.
- Van Broekhoven, S., Vernay, A.L. (2018). Integrating Functions for a Sustainable Urban System: A Review of Multifunctional Land Use and Circular Urban Metabolism, *Sustainability*, Vol. 10, No. 6, 1875.

Van der Waals, J. (2000). The Compact City and the Environment: A Review, *Tijdschrift voor Economische en Sociale Geografie*, Vol. 91, No. 2, pp. 111-121.

- Van Schaick, J., Van Der Spek, S. C. (2008). Urbanism on Track: Application of Tracking Technologies in Urbanism. IOS Press.
- Vasiljević, N. (2012). Landscape Planning as an Instrument of Spatial Development of Serbia, doctoral dissertation. Belgrade: University of Belgrade – Faculty of Forestry.
- Voet, D., Voet, J.G. (2004). *Biochemistry*, 3rd edition. Hoboken, New Jersey: John Wiley & Sons.
- Vreeker, R. (2004). Urban Multifunctional Land Use and

Externalities. ERSA (European Regional Science Association) conference papers.

- Willis, K.G., Garrod, G.D., Harvey, D.R. (1998). A review of cost-benefit analysis as applied to the evaluation of new road proposals in the U.K., *Transportation Research, Part D: Transport and Environment*, Vol. 3, No. 3, pp. 141-156.
- Wolman, A. (1965). The Metabolism of Cities, *Scientific American*, Vol. 213, pp. 179-190.
- *World Urbanization Prospects: The 2014 Revision, Highlights* (2014). Department of Economic and Social Affairs, and Population Division of the United Nations, New York.
- Xu, S., Madden, M. (1989). Urban ecosystems: a holistic approach to urban analysis and planning, *Environment and Planning B: Planning and Design*, Vol. 16, No. 2, pp. 187-200.
- Zhang, Y. (2019). Urban Metabolism, *Encyclopedia of Ecology*, 2nd Edition, Vol. 4, pp. 441-451.

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MARK BAIN'S WORK AS A TECHNOLOGICAL SYNTHESIS OF ARCHITECTURE, MUSIC AND THE (IN)ANIMATE NATURE

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The subject of research in this paper is Mark Bain's work, perceived as a synthesis of architecture, music, technology and the (in)animate nature. Its basic thesis is that Bain sees his works of art as a set of agents that have the function of mediating social relationships within the surrounding world, and that sound vibration is treated as a means by which architectural constructions become animate beings, enabling the coherence of art and the animate – the living world. The study analyzes the theoretical and interdisciplinary research of Bain's work, viewed through the prism of anthropological theory and both philosophical and theoretical perspectives of art. It investigates an innovative concept which introduces novelties into architecture and music, applying a specific interdisciplinary approach. The contribution of the study is that it determines the special aesthetics of Bain's work, which constitutes a new vision of the world and knowledge of the future. The unity of knowledge belonging to different realms is presented through the creation of an innovative research concept and a specific worldview, characterized by a problem-solving approach to the relationship between the animate and inanimate nature.

Key words: Mark Bain, architecture, infrasonic sound, oscillators, sound vibration.

INTRODUCTION

Mark Bain (1966, Seattle) is a contemporary American experimental artist and a researcher in the field of audiovisual arts and technologies. He studied at Massachusetts Institute of Technology and the Rijksakademie in the Netherlands, and he currently lives and works in both the United States of America and the Netherlands. Together with his brother, John Bain, he is a member of the band *Mutant Data Orchestra* and a co-founder of the company *Simulux*, which deals with audio-visual research (Veen, 1998).

In his work, Bain creates a synthesis of architecture, music, technology, and the (in)animate nature, and hence an innovative concept aimed at presenting a new vision of reality through a problem-solving approach to life and the inanimate environment.

Connections between music, architecture and technology can be established in the following ways: 1) by using mechanical and electrodynamic oscillators to create sound vibrations and cause a change in the kinetic state of architectural objects (which had previously been perceived in their static context); 2) by mapping and recording an inaudible sound already existing in building materials and architectural constructions through the use of geosensors; 3) by applying sound synthesizers to architectural objects to achieve more complex wavelengths; and 4) by interpolating the existing sound of the ambience and the sound vibration through a transducer (*ibid*.). In such ways, architecture is revived, and it vibrates, moves, sounds and expands its boundaries, because the function of architecture is expanded into the domain of musical instruments, for the production of sound. As a result of such transformation in the position of architecture, a sub-sonic sound appears, which further interacts with the animate and inanimate worlds (materials, people and the entire environment). Bain creates sound within the boundary field of music and acoustics, and within the context of Cage's theory, his work belongs to the field of experimental music, because the resulting sound, processed over a certain period of time, cannot be foreseen or planned (Nyman, 1999: 1), since it is performed on different architectural objects and in various places. Cage transposes the sound of ambience into music, in fact, life itself in his theory of silence becomes a field of

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art (Cage, 1961). If we apply Cage's theory, the ambient sound which Bain experiments with, in the context of the sound already existing in different materials, can be seen as a form of experimental art. He also introduces a novelty into a contemporary music by the sound vibrations (trembling) from architectural constructions and the application of inaudible sound. From a behavioural aspect, Bain researches the influence of low-frequency sound on people in a psychological and physiological context, by analyzing subsonic sound within the domain of the interaction between music, acoustics and psychology. Bain investigates the effects that infrasonic sound leaves on the material itself and the structure of buildings, bridges and architectural objects (*ibid*.), by incorporating knowledge from material science and acoustics. Material science plays a very important role here, because specific materials (wood, iron) produce interesting effects from sounds, which resemble those produced by classical instruments.

The presence of sound vibrations and frequency resonance (by the performance of mechanical and electrodynamic oscillators) indicates the interpolation of mechanics and acoustics. The influence of seismology is evident in the application of sound vibrations and tectonic movements of the ground, as well as the study of the effects of trembling, which can occur during the interpretation of a work of art. Mechanics and seismology, through oscillation and resonance, make a fruitful dialogue with architecture (which hence enters into the musical sphere), after which they go beyond their boundaries through mapping the influence sound vibrations have on humans in psychological terms. Bain links these disciplines into a concept of research and understanding of the world surrounding us. His goal is to investigate and problem-solve the relationship between everyday objects, a work of art and the entire environment by means of sound vibration, and Bain's installations become agents (mediators) in establishing these relations.

The aim of this paper is to gain an insight into the signifying theory within Bain's work, through the synthesis of multiple arts and sciences, that is, to examine Bain's work from an interdisciplinary and theoretical point of view, systemized through the theory of anthropology as well as various philosophical and theoretical perspectives of art. The purpose of this paper is to investigate an innovative concept which introduces novelties into architecture and music, as well as to examine a less researched part of Bain's concept and therefore to expand an unexplored sphere of research and contribute to the scientific flows in the theory of art.

The contribution of this paper can be perceived within the constitution of a particular aesthetic of Bain's work which, through the translation of the animate nature towards the inanimate and correlating man with his environment, creates a new vision of the world, the future and a new type of transcendental knowledge. In this context of new knowledge, architecture is viewed here as an interdisciplinary and unlimited field, creatively unified with other sciences and fields of art – music, acoustics, material science, seismology, psychology, physiology and sociology.

The work of art – an object – becomes a work of process, in constant motion toward an animate nature (animate

architecture) connecting in such manner with man, who becomes aware of his body (physical and psychological) and existence as part of the entire world. Within the wider scheme of things, there is an interrelation of all sciences and arts with a human being and his or her existence, aimed at his constant progress and well-being.

The contribution related to Gell's anthropological theory (Gell, 1998) refers to the interdisciplinary approach through which a work of art becomes an animate being. While Gell employs anthropology and sociology, the influence of additional different sciences is found in the elaboration of Bain's work (mechanics, acoustics and seismology), which all make a complex connection to architecture and music. Regarding Cage's paradigm of silence and his theory (Cage, 1961), according to which art is seen as a part of everyday life, the contribution of Bain's aesthetics is the introduction of the inaudible sound which already exists in materials, and sound produced by the oscillations of architectural objects.

AN ANTHROPOLOGICAL APPROACH TO ART: THE INANIMATE NATURE AS ANIMATE NATURE

Bain believes that architectural objects, such as the houses we live in, the schools that we attend, and the buildings of institutions where we spend our working lives, can actually be perceived as living beings (Veen, 1998). The sound vibrations of architectural constructions provide their connection with the living environment/animate nature, because by oscillation, architecture moves and produces sounds, all of which means that Bain constitutes his installations as agents that serve as mediators of social relations within the context of the world of nature itself.

The thought of connecting the notions of the animate and inanimate world through sound can be observed at the micro and macro levels: 1) within architecture itself and 2) in relation to architecture's interaction with humans. By using technology and oscillators, the architecture in Bain's work produces sound and movements, enabling Bain to see it as an animate (living) being. The second level of connecting the animate and inanimate nature implies that architecture, which oscillates acoustically, has an influence on humans and a way of communicating with them. Sound is a condition for putting this concept into practice, together with oscillation and movement, which are common elements of both animate and inanimate materials, by which a dynamic architectural shape is created. Roland Barthes speaks of changes taking place in art when a work of art as an object, in the form of a "material creation", is transposed into a text, which is a "methodological area" which is "a process of demonstration, it speaks according to certain rules (or contrary to some rules)" (Bart, 1986: 182). The work of art is distinguished in the area of the signified, which encapsulates it, whereas the text is marked by the "infinity of the signifier"; it is in constant motion and runs through several works of art, with the appearance of the "infinite signifier" (ibid., 183). If we apply Bain's concept, architecture moves from having a static nature as a work of art, an object, towards being a process, a living entity which is open and in constant motion and communicates with the surrounding environment and with human psychological and physical existence, where sound vibrations are visible.

The infinity of the signifier occurs through an ever-changing implementation of the *Live Room* concept, because Bain performs it using various architectural constructions (buildings, houses, bridges, laboratories, and so on) and in different countries.

Alfred Gell, in his anthropological theory of art, like Bain, says that works of art can be perceived as persons, living beings, and states that anthropological theories are "recognized" as theories of social relations (Gell, 1998). Although he does not analyze art within the context of meaning and symbols, he observes notions such as intelligence, causality, result and transformation within the field of symbolic communication, defining art as a "system of action, designed to change the world, rather than encode symbolic propositions about it" (ibid., 6). Unlike a semantic approach which observes objects as a type of text, perceiving art within the context of "action" is determined by an anthropological prism, because one practical role of a work of art is perceived in the social process, which means that the theory is based on the fact that "the nature of the art object is a function of the social-relational matrix in which it is embedded" (*ibid.*, 7). In the context of anthropology, art is "the theoretical study of social relations in the vicinity of objects mediating social agency ... and in relevant theoretical respects, artistic objects are equivalent to persons, or more precisely, social agents" (ibid.). Pallasmaa, like Gell and Bain, perceives a work of art as a person one can unconsciously talk to, for example, feelings can emerge when faced with a work of art (Pallasmaa, 2005: 66).

Gell nominates objects which are equivalent to persons as social agents, and to analyze them it is necessary to research the biographies and life phases of the agents (Gell, 1998). Buildings in Bain's work are equivalent to living beings, and the life phases of the social agents can be presented as follows: 1) the static phase of a building, that is an object; 2) the action of augmenting the existing invisible sound in material and sound vibration of a sound-inducing material; 3) architecture being enlivened under the influence of sound, when the work of art is perceived as a person. A social agent, that is the work of art, is referred to by Gell as an index which is "seen as the outcome, and/or the instrument of 'social agency'" (ibid., 16). The sound is a social agent, and it is interesting that Bain delineates sound as a form of agent, but only in relation to another sign: "I use sound as a reflecting agent to define the materials and elements of structure and space" (Bain and Pascual, 2017), that is, the *sound* as a *sign* is viewed in relation to another sign (materials, and structure) and used to define them.

Bain, like Gell, looks at buildings (social agents) as animate persons with a specific way of breathing, inhaling and exhaling, with the process becoming particularly noticeable when doors are being closed, especially if they are being slammed (Veen, 1998). During the action of a door opening or closing, the sound is a signifier of the breathing of the building, as well as of the micro-movements and sound vibration of the material. "To get the life out of a building is an art... He (Bain) looks at a building and finds the soul" (*ibid.*). Bain applies a special method which can confirm such a conclusion, by researching sound interacting with architecture, structures, light and materials used in an object's construction (*ibid*). Unlike Bain, Pallasmaa sees the movement of opening/closing a door within a sociological and temporal context as a "handshake of the building", because by means of a tactile sensation, the door connects time and different generations of people who have opened the door in the past (Pallasmaa, 2005: 56). By touching a door, one is shaking hands with all the previous generations who have been in contact with the door (*ibid*.), which means that architecture serves as a bridge connecting inanimate and animate beings through different temporal dimensions. Architecture simultaneously shows the past and present, demonstrating thus the transiency of time: "Buildings and cities are instruments and museums of time" (*ibid.*, 52).

Gell defines art as a system of action designed to change the world, which, applied to Bain's work, can be interpreted as the action of sound vibrations, which changes the view on architecture and music, and on a wider scale - changes the world by a problem-solving approach to the animate and inanimate environment (Gell, 1998). Machines and sounds are the mediums and means by which the invisible and inaccessible become visible and noticeable. Veen explains that Bain "enlarges the things that are already present, and he breathes life into it (the building) by using kind of ninja stars, you can throw them into the wall" (Veen, 1998). The star becomes an integral part of the building as a form of the artist's intervention and continues to change its visual aspect by releasing acid and rust, which leave their marks on the building and achieve the infinity of the signifier of the building, which changes over time under the influence of external factors, such as temperature, humidity, weather and seasonal changes (*ibid*.). Bain claims that by introducing some form of energy into the building, it behaves like a radiator or a loudspeaker in a certain context.

"The surfaces are rattling and vibrating...What you hear is the movement of the building. Most of it (sound) is subsonic though, and it has this heaviness that relates to the heaviness of the architecture. I like this massiveness of the sound" (Bain and Bosma, 1999).

William McDonough and Michael Braungart point out that buildings can be viewed as animate (living) beings, unlike Le Corbusier (who sees buildings as machines), that is, by applying the laws of nature, they believe that buildings are like a "human leaf" or "trees, alive to their surroundings and inhabitants, and cities like forests, in which nature and design create a living, breathing habitat" (McDonough and Braungart, 2002). A "good design", according to McDonough and Braungart, implies the "possibility of developing healthy and creatively interactive relationships between human settlements and the natural world" (ibid.). This concept of architecture is modeled upon nature, using solar energy and wind power, with the "design of materials and building systems that eliminate the concept of waste" and the "diversity of design solutions" (ibid.) that would fit into the environment in a cultural and natural sense. McDonough accomplishes the concept of architecture as an animate being by means of "design principles inspired by nature's laws" (ibid.), while Bain applies the laws of mechanics, acoustics and technology, making architecture oscillate and create sound. Both of them believe that it is very important to study the environment, history, culture and specificities of the climate in which architecture is found, in order to achieve better results.

Within the context of "reviving" architecture and its interconnected-ness with humans, Gell argues that works of art are not "self-sufficient agents, but only 'secondary' agents, in conjunction with certain specific (human) associates" (Gell, 1998: 17). "The primary" agents are beings with intention; they "initiate happenings through the acts of will for which they are morally responsible" (ibid., 21). Gell's anthropological theory of art can be exemplified by Bain's Live Room: Transducing resonant architecture (1998), which was performed at the DEAF98 (Dutch Electronic Art Festival 98), where its installation included eight mechanical oscillators attached to the pillars of the floor across the exhibition space, which in turn acquired the property of being a musical instrument. By highlighting the audio segment of the architectural structures (inanimate nature) in the Live Room and their sound vibrations (due to the movements of the mechanical oscillators), the artist integrated them within an animate nature and created mediators (social agents, according to Gell) to establish a relationship between the animate and inanimate world. Sound vibrations and the movements of constructions connect humans and the building they live in, whereas, under the influence of wave forms, frequencies and vibration energies, people transform into "activated objects" that feel "the liveliness in themselves, others and the space within" (Goodman, 2010: 222). Such an attitude is also confirmed by Pallasmaa's statement that the meaning of architecture transcends the limits of architecture, as "it directs our consciousness back to the world and towards our own sense of self and being" (Pallasmaa, 2005: 11).

The composition Live Room employs four musicians in the lab, while the audience is free to stand, lie on the floor or move unrestrictedly through the exhibition space. According to Gell's theory, the musicians are primary social agents with intention, and they causally influence the audience through sound (Gell, 1998). On the other hand, an architectural object has the property of an agent (secondary), while Mark Bain is the primary agent because he "initiates happenings through the act of (his own) will" (ibid., 21). There is a dual role of sound within the context of the experience in two different senses, as well as the presentation of an audible and inaudible spectrum of sound. The music performed by the musicians is distinguished by the sense of hearing, while the conduction of low-frequencies, inaudible to the human ear, is noticeable only through the intervention of oscillators, the action of sound waves on materials, and the sound vibrations of the entire room that can be felt by the whole body. In his theory of silence Cage says that musicians do not have only ears, but other body parts as well, since music is not exclusively an audible art (Cage, 1961). In Bain's work, the audience has an opportunity to grasp sound not only through the sense of hearing, but also through the oscillating and movement of materials and objects, which can vary depending on where the listener is positioned in the room and his exposure to different materials that vibrate. In this way, architectural structures and materials have the function of secondary social agents, while the audience feels the effect of the room's sound vibration.

By its presence and movements, the audience also has an influence on the room's sound vibrations and its resonance, therefore participating in the creation of the composition. In this context the members of the audience can be seen as primary agents affecting the work of art itself, by their actions.

Bain's idea was to erase the boundaries between the performer and audience, connecting the musicians, audience and architecture by means of a network of influences through socially primary and secondary agents. All of this, at the same time, presents an innovative view of a composition where music, architecture, various materials, seismology, new technologies, mechanics, acoustics and psychology merge into a superior unity. Relationships and correspondences are established between different sciences, arts and technologies, as well as the permeation of the aforementioned disciplines united into a superior whole, as a new worldview of the surrounding reality. The influence of mechanics and acoustics is achieved by testing oscillations, frequencies and resonances, and the use of mechanical oscillators. The knowledge of material science is applied in the consideration of sound propagation through the material, while the sound vibration and trembling of materials, constructions and the environment indicate a seismological context. The relationship between music and architecture in this work of art is achieved through the vibrating object, which emits the sound and thus acquires the function of a musical instrument.

Bain's approach, in the context of a different worldview, is complementary to Gell's definition of art, as a "system of action, intended to change the world" (Gell, 1998: 6). Gell claims that art is "a theoretical study of social relations surrounding objects" and that "artistic objects are equivalent to persons" (ibid., 6). In his work, Bain uses a problemsolving approach to the relation between the animate and inanimate world and presents a somewhat eccentric worldview. By adopting the concept of the synthesis of music, architecture and technology, that is, introducing sound vibrations, architectural objects are treated as living beings which establish a relationship with the entire environment because they themselves begin to vibrate and are subject to the influence of the sound. The ultimate outcome of all the frequencies and sound vibrations (as well as the unity of science and art) is a human body where all the sensations and sonic and vibrating effects are manifested in a psychological and physiological sense. Merleau-Ponty states that a human perceives the structure with all his senses and totality of being: "I perceive in a total way with my whole being: I grasp a unique structure of the thing, a unique way of being, which speaks to all my senses at once" (Merleau-Ponty cited in Pallasmaa, 2014: 231). Bain says that sub-sonic and infrasonic sound is inaudible and can only be experienced as a "sonic wind" (Bain and Bosma, 1999), that is, through the vibrating and physical prism that simultaneously cause changes in the human body. The relationship between Bain's artwork, which is always a specific impersonation, and a human being, can be perceived in both positive and negative contexts. Under the influence of an infrasonic sound, one can have a headache, and feel confused, anxious, tense and nauseous, while some of the sound frequencies can affect

organ functions (such as bowel movements, for example). Other than a negative experience of anxiety, low-frequency sound, that is below 10 Hz, can also contribute to spiritual and soothing experiences, which was particularly practiced in the 1960s, with the aim of entering into a light hypnotic "alpha state" - with neural oscillations in a frequency ranging from 8 to 12Hz (ibid.). Like Bain, Pallasmaa also states the spiritual influence of architecture in relation to humans, claiming that settlements (cities) and buildings enable the understanding of human existence: "Significant architecture makes us experience ourselves as complete embodied and spiritual beings" (Pallasmaa, 2005: 11). Architecture includes mental and physical structures, an "integrated material, embodied and spiritual sense" (ibid., 12). Bain claims that there is a correspondence between architectural constructions and the human body in both the building frequency and body frequency, so that certain sonic amplitudes which can cause a sense of pain or anxiety can also cause the demolition of buildings or cracks in the walls (Bain and Bosma, 1999).

Bain has an investigative and experimental attitude towards art: "All of my sound work is highly experimental, like tests. I take sort of a systematic approach to it, setting up complex systems that have a life of their own" (*ibid*.). Such aesthetics are evident in *Live Room*: where "machines are connected to architecture" and there is an action of "playing the building as an instrument", while "architecture is also a complex system of parts and materials", so that it can be concluded that there is a 'cooperation' within that structure (*ibid*.).

In the sound recording of his compositions, Bain uses special low-frequency sensors that have applications in geology for recording earthquakes and other seismic events (Bain and Bosma, 1999). It is interesting that Bain records sound propagation within the material itself, rather than merely in the air (*ibid.*), which results in a comparative reading of sound and a mapping of the structure of the material, as well as in their mutual reaction, because the propagation of lowfrequency sound waves through material creates vibration in the material that is manifested in the artistic text through three levels: 1) sound signifier/marker, 2) material signifier/marker, 3) interaction of the sound and material causing seismic changes noticeable by, and manifested in, the audience. In this case we can conclude that sound waves are secondary social agents.

ARCHITECTURE, SOUND AND THE BODY

Pallasmaa states that the human body has a central position in both architecture and the world (Pallasmaa, 2005), and similar to this statement, Merleau-Ponty centralizes the human body in the world of existential experience (Merleau-Ponty cited in Pallasmaa, 2005: 40): "Our own body is in the world just as the heart is in the organism: it keeps the visible constantly alive, it breathes life into it and sustains it inwardly, and with it - it forms a system" (*ibid., 40*). In Bain's work, inanimate nature becomes a living nature by means of sound vibrations and the vacillations of structures, which can be read on a physical human body and which enable communication with architectural constructions. If we apply Merleau-Ponty's aforementioned concept onto Bain's work, we can say that, in fact, man makes architecture animate, by being at the "heart" of architecture and the entire work of art, and only in symbiosis with him can an organism can be created (*ibid*.). Pallasmaa presents the interconnectedness of a city and a human body as follows: "The city and my body supplement and define each other. I dwell in the city and the city dwells in me" (*ibid.*, 40). In the context of Bain's work, the body communicates with the city through architecture and sound vibrations, in a way that the sound permeates the body, thus creating a unity with residential constructions and bridges, that Bain asserts, vibrate.

Within the context of the human body, Shaun Gallagher defines a body schema as a "system of motor and postural functions that operate below the level of self-referential intentionality, although such functions can enter into and support intentional activity" (Gallagher and Cole, 1995: 371). Gallagher deals with boundaries between the environment and the human body, within the context of which he argues that: "The body schema functions in an integrated way with its environment, even to the extent that it frequently incorporates into itself certain objects" (Gallagher, 2005: 37). Through their senses (of hearing, sight and touch) the audience feel sound vibrations produced by the architecture in Bain's work, while simultaneously being exposed to the visual and spatial experience of the architecture which surrounds their bodies. In such a way, certain constitutive elements of architecture (the sound of structures and oscillations of materials) are taken as parts of the human body, because these sensations are interpolated in one's body. Pallasmaa sees this concept of interactions through the mutual permeation of man and space: "As we enter a space, the space enters us, and the experience is essentially an exchange and fusion of the object and the subject" (Pallasmaa, 2014: 232).

McLuhan speaks of the term "acoustic space" as a dynamic term that "encapsulates time as a dynamic of constant flux" (MacLuhan cited in Cavell, 2002: 22), as opposed to the static of visual space. He distinguishes visual space and spatiality, which has a dynamic character and is "extended into 'oral' through the concept of acoustic space" (Cavell, 2002: 26). The dynamics of acoustic space are enabled by the concept of resonance, which "conceptualizes the break in the uniformity and continuity of space as visualised" (Cavell, 2002: 23). McLuhan then adds that the resonance is "a sign, in other words, of the discontinuity of acoustic space, of the fact that it produces meaning through gaps (including the gaps between elements of the dialogue)" (McLuhan cited in Cavell, 2002:23). Bain's acoustic space is solid material and his pioneering creativity is reflected through the recording of sound using a different medium (different acoustic space) to traditional art, in which the acoustic space of air is the medium of sound propagation. In contrast, in Bain's work solid materials (such as wood or steel) from buildings or bridges become a sonorous environment reflected on the human body. Resonance, as a "discontinuity of acoustic space" (*ibid.*, 23), according to Bain's research, can cause extreme seismological effects and discontinuity, such as cracks in a building, or even its destruction.

Richard Cavell points out that McLuhan, influenced by Lewis's notion of a *sensuous nature of space*, constitutes a wider picture of acoustic space in the 'audio-tactile' direction (Cavell, 2002: 22). The sound is no longer intended for one sense – hearing, but is experienced by the whole body and through psychic sensations caused by low-frequency sound, through which Bain expands the field of sound reception, as well as the normally accepted term "musical instruments", because traditional instruments are replaced by architectural objects. Bain connects 'good design' with an immaterial prism, the questions of feeling and the "research of space and structures". He explains that "Essentially, what I try to do is design an invisible entity, sculpting form in space using sound as the 'clay' or medium" (Bain and Pasqual, 2017), whereby the sound is constituted within a sculptural context, as a form of artefact.

McLuhan views space in a sociological context, defining it as "the geographical site of action and the social possibilities for engaging in action" (McLuhan cited in Cavell, 2002: 30) and as a "cultural dominant of contemporary society" (*ibid.*, 24). For every performance, Bain adapts to its location, and to its social and historical discourse, which he studies before the performance. We can therefore talk about specific geoaesthetics, because his works of art differ depending on the location and characteristics of the actual buildings, bridges and other facilities.

Similar to McLuhan's observation regarding the audio-tactile determinant of the acoustic space, Pallasmaa also speaks of the importance of the tactile which has somehow been neglected in the past in relation to sight, so he emphasizes that all senses (like vision) are actually "extensions" of the tactile sense (Pallasmaa, 2005: 10). In this regard, Pallasmaa makes a reference to the anthropologist Ashley Montagu, who claims that skin is the most sensitive and the oldest organ of the human body and the "first medium of communication and our most efficient protector", as the "mother of all senses" (ibid., 11). Pallasmaa explains the "sensual nature of architecture and interiors" and "the embedded senses of sight, sound, smell, taste, touch and a sense of movement he describes as skeleton and muscle" (Pallasmaa, 2011: 40), and emphasizes that architecture is perceived by the totality of human senses, not just one sense. In Bain's performances, the audience has the opportunity to get to know the architecture by means of various senses - that is sight, hearing, touch and also at the level of their entire body, because low-frequency sound can also affect the work of one's internal organs.

In his work, Bain applies everyday life aesthetics, because the ambient sound he documents is already present in materials and structures, and recorded by special equipment, while the low frequency sound (below 20Hz) applied in his work as the result of a geo-sensor, is present in everyday life - in an industrial form like the sound of cars, trains, planes, and within nature itself as the sound of storms, wind, waterfalls, earthquakes and volcanoes. The aesthetics of everyday life also denote that objects for daily use (such as buildings, bridges, galleries or laboratories) become part of Bain's work in that he extinguishes the borders between art and life, that is, as Cage quotes in his theory, life is overturned into art and art blooms into life (Cage, 1961). Architecture vibrated by Bain creates an insight regarding its inclusion into everyday life, as it becomes part of humans and their lives, without ceasing to be a form of experimental art.

Before Bain, ambient sound was utilized by John Cage in his poetics and aesthetics of silence, in which silence is actually the sound of the environment, comprising sounds and noise generated by the audience, as well as during the performance of his artwork 4'33" (1952) (ibid.). The silence in Cage's work is not an absence like negation or nothingness, but rather the absence of the traditional "sound" and the infinity of possibilities, that is the presence of an infinite signifier, because his work is always different in each performance, under the influence of different ambient contributors. To Cage, the sound of an ambience is stretching in the air, whereas Bain records sound in materials and structures and deals with silence in a different way, through an inaudible low frequency input. A comparative reading of both the visual and auditory is noticeable with both Bain and Cage: Cage's partiture Tacet Edition shows similarities to Rauschenberg's White paintings (1951), which were the inspiration for 4'33", while Bain connects visual-spatial elements of architecture to sound, with a special focus on the micro-levels and atomic structure of materials. Bain performed his work in the Barcelona Pavilion (the Mies van der Rohe) in Barcelona, and Brendan Joseph, using the example of the same artist (van der Rohe), explains the notion of the "architecture of silence" by linking it to the "architecture of glass" (Joseph, 1997). The silence of architecture is reflected in the transparency of walls made of glass, which draws a boundary line between the exterior and interior, hence the openness of the building in relation to the environment is achieved. The projects in questions are Fansfort House (1945-1951) and Crown Hall ITT (ibid.).

In his philosophy, Heidegger analyzes the "being-in-theworld" phenomenon, explaining that man already exists in the world, and is related to other humans, the environment and shared objects. By the very fact that he uses objects used by other people (such as tools, cutlery, etc.), he is simultaneously interrelated to other people and the world itself in the process defined by Heidegger as "being with" (2010: 111). If we apply Heidegger's theory to Bain's work, we will be able to draw a conclusion that humans, by using mutual objects (galleries, laboratories, buildings or bridges), enter into a dialectical communication and relationship with other people, the environment and the world in totality. Bain's concept of the sound vibration of objects felt by various human senses, provides an awareness of one's own presence in an architectural object, that is an awareness of "being-in-the world". The notion of the body in Heidegger's work does not refer to the object of the body, but a "living body" which is open to the world (Heidegger, 2001: 231). The audience in Bain's work becomes susceptible to all sensations generated by the sound vibrations and movements of the environment and the world itself.

Scientists at the University of Illinois at Urbana-Champaign, within an interdisciplinary group for autonomous material systems, have produced a self-healing polymer modeled upon biological systems. In the case of material damage, the polymer has a self-renewal property thanks to minute capsules containing a healing agent inserted into them (Patrick *et al.*, 2016). In the future, such self-healing materials will promote Bain's concept of a building as an animate being, at the material level. Architectural objects

(such as buildings and bridges), if constructed from such materials, should they be subjected to physical damage, will regenerate and restore just like a living body, and will thus prolong their life.

CONCLUSION

Bain's works are constituted as social agents, equivalent to living beings, that is, mediators in establishing complex social relations. Agents (architectural objects or ambient sounds) are also transformed into musical instruments and components of a work of art, that brings about a different worldview. Bain's creative work is an exploratory and critically innovative concept that implies a synthesis of architecture, music and technology and merging with other sciences: acoustics, material science, seismology and psychology, thus creating a specific aesthetic which connects animate and inanimate nature.

There is a certain paradox in relation to the sound in Bain's work (when inaudible transcends into audible) and it brings about an alternative way of "listening to the sound". Unlike previous sound recordings, Bain notices sound within materials, at the level of the tiniest particles. He involves the audience in his interpretations, particularly with regard to their reaction to the low-frequency sounds in the psychological and physiological contexts.

Through the analysis of Bain's work, one can also see the image of today's society in the form of the great advancement of science and technology which is implemented and visible in all segments of life. The equipment records the movements of particles at a micro level and the inaudible sound, as modern science tends to make the invisible and inaccessible visible and achievable, aiming for new levels of knowledge. As William Blake wrote in his poetry: "To see the world in a grain of sand..." (Blake, 2014: 85), such is to see the world in small patterns and understand and find the energy of the finest particles and make the inaudible heard; that means to understand the sound and the vibration of the entire world. The aesthetic in Bain's work actually strives to foresee future knowledge, the hidden cognition contained within superficial knowledge, that is knowledge beyond knowledge - through the connection, synthesis and unity of various sciences and arts.

REFERENCES

- Bain, M., Bosma, J. (1999). Interview: Mark Bain. *Trembling structures Mark Bain*, http://www.nettime.org/Lists-Archives/nettime-l-9908/msg00023.html, accessed 28th March, 2018.
- Bain, M., Pascual, M. (2017). Interview. Mark Bain. *Listen* to the Wall, http://www.nettime.org/Lists-Archives/nettime-l-9908/msg00023.html, accessed 2nd April, 2018.
- Bart, R. (1986). Od dela do teksta. In M. Beker (Ed.), *Suvremene književne teorije* (in Croatian). Zagreb: SNL, pp. 181-186.
- Blake, W. (2014). *Pesme nevinosti i iskustva* (in Serbian). Beograd: Mali vrt.
- Cage, J. (1961). Silence. Hanover: Wesleyan University Press.
- Cavell, R. (2002.) *McLuhan in Space: A cultural Geography.* Toronto, Buffalo, London: Toronto University Press.
- Gallagher, S. (2005). How the Body shapes the Mind. Oxford, New

York: Oxford University Press.

- Gallagher, S., Cole, J. (1995). Body schema and body image in a deafferented subject, *Journal of Mind and Behavior*, No. 16, pp. 369-390.
- Gell, A. (1998). *Art and Agency. An Anthropological Theory*. Oxford: Clarendon Press.
- Goodman, S. (2010). *Sonic Warfare: Sound, Affect, and the Ecology of Fear*. Cambridge Massachusetts, London, England: The MIT Press.
- Heidegger, M. (2001). *Zollikon seminars: Protocols Conversations Letters*. Evanston: Northwestern UP.
- Heidegger, M. (2010). *Being and Time*. Albany: State University of New York Press.
- Joseph, B. (1997). John Cage and the Architecture of Silence, *October*, Vol. 81, pp. 80-104.
- McDonough,W., Braungart, M. (2002). *Buildings Like Trees, Cities Like Forests*, https://mcdonough.com/writings/buildings-like-trees-cities-like-forests/, accessed 26th September, 2019.
- Nyman, M. (1999). *Experimental music, Cage and Beyond*. Cambridge: University Press.
- Pallasmaa, J. (2005). *The Eyes of the Skin. The Architecture and the Senses*. Chichester, West Sussex: John Wiley & Sons Ltd.
- Pallasmaa, J. (2011). *An Architecture of Seven Senses. Toward a New Interior*. New York: Princeton Architectural Press.
- Pallasmaa, J. (2014). Space, Place and Atmosphere. Emotion and peripheral perception in architectural experience, *Lebenswelt*, Vol. 4, No. 1, pp. 230-245.
- Patrick, J.F., Robb, M.J., Sottos, N.R., Moore, S.R., White, S.R. (2016). Polymers with autonomous life-cycle control, *Nature*, No. 540, pp. 363-370.
- Veen, van L. (1998). Mark Bain: *Architect Plus*, http://v2.nl/ archive/people/mark-bain, accessed 26th March, 2018.

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