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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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Dear readers,

Here is the No. 22 of the International Journal Spatium, which contains eight articles within three thematic groups: General strategic issues; Regional and rural development; and Urban construction and architectural design.

This is the last issue with predominantly miscellaneous content. Following the earlier announced editorial policy, as from the next issue Spatium will be predominantly thematic, however, also containing other articles/topics of professional and scientific interest. The two imminent themes comprise:

- Territorial cohesion in Central and South-Eastern Europe – Challenges ahead for strategic planning and urban-regional governance; and
- Sustainable spatial (territorial) development.

Editor-in-Chief

STRATEGIC PLANNING AND REPUBLICANISM

Luigi Mazza¹, Politecnico di Milano, Department of Architecture and Planning, Milano, Italy

The paper develops two main linked themes: (i) strategic planning reveals in practice limits that are hard to overcome; (ii) a complete planning system is efficacy only in the framework of a republican political, social and government culture. It is argued that the growing disappointment associated to strategic planning practices, may be due to excessive expectations, and the difficulties encountered by strategic planning are traced to three main issues: (a) the relationship between politics and planning; (b) the relationship between government and governance; and (c) the relationship between space and socio-economic development. Some authors recently supported an idea of development as consisting in the qualitative evolution of forms of social rationality and argued that a reflection about the relationships between physical transformations and visions of development could be a way of testing innovations. But such strong demands might be satisfied only if we manage to make a «new social and territorial pact for development», recreating a social fabric imbued with shared values. The re-creation of a social fabric imbued with shared values requires a rich conception of the political community and the possibility that the moral purposes of the community may be incorporated by the state. All this is missing today. Outside a republican scheme planning activities are principally instruments for legitimising vested interests and facilitating their investments, and the resolution of the conflicts that arise between the planning decisions of the various levels of government becomes at least impracticable. A complete planning system can be practised if can be referred to the authority and syntheses expressed in and by statehood, which suggests that in a democratic system planning is republican by necessity rather than by choice.

INTRODUCTION

I should begin by telling you about at least two limitations of my lecture, one linked to my academic and professional background, the other to the peculiarities of the country in which I have always worked.

Since I am a planner, and not a regional scientist, my approach is first and foremost normative. Also, as will emerge from what I am about to say, my approach is not comprehensive, if by this we mean an attempt to consider the economic, social and spatial aspects of an urban or territorial issue simultaneously. On the contrary, mine is a selective approach which considers space as the key topic of study, and not as a resource for vicariously exploring other topics and resources. And, in terms of the possible technical practices, space as particularly

lending itself to 'regionalisation' through the drawing of boundaries – a practice sure to produce political, cultural, social and economic effects and. In short, to produce different forms of political and social control through control of space.

Secondly, despite some consultancy work in other countries, my practical experience has been gained in Italy and especially the north of Italy. Spatial planning is an activity too dependent on the political, cultural and administrative tradition of the context, in which it takes place, to think that one country's planning procedures and methods can be transposed to another or even be the subject of easy comparison. Thoughts about a planning case in Milan cannot be compared directly with those about one in Belgrade, Paris or Berlin. One of the reasons why I am grateful for the invitation to speak at this conference is to understand how far a dialogue between planners operating in different national contexts is possible and useful.

I have mentioned the main limitations of my lecture to justify its particularly theoretical approach and also to stress that despite the theoretical nature of my arguments, they do not claim to be universally valid.

In summary, there are two main ideas that I am putting to you: (i) in its practical applications strategic planning reveals limits that are hard to overcome; (ii) a complete system of planning – i.e. the development of national, regional and local planning – is possible only in the framework of a political, social and government culture that is republican.

To develop these ideas I examine three questions that highlight the reasons for the current difficulties encountered by strategic planning: the relationship between politics and planning; the relationship between government and governance; and the relationship between space and socio-economic development. I conclude by asserting that a republican approach, founded on 'constitutional patriotism' can restore authority to the state as well as legitimacy and meaning to planning.

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I am grateful to Fausto Curti, Daniela De Leo, Luca Gaeta and Gabriele Pasqui for their comments on the first draft of this lecture. I should also add that some of the problems they identified are still, at least in part, unresolved.

First version of this paper was prepared for the International scientific conference *Regional development, spatial planning and strategic governance*, held in Belgrade 7-8 December 2009

UNCLEAR STRATEGIES: THREE REASONS FOR DIFFICULTIES

The need for overall visions and plans capable of steering local and town planning already exists at the beginning of the twentieth century on both sides of the Atlantic,¹ but practices everywhere see relatively similar forms of zoning plans. We must wait until the end of the '60s to have the formal distinction between structure plan and action plan² introduced in the British system, and to begin the journey towards strategic planning. Strategic planning accelerates in the next twenty years when, especially in the United States, it seems to provide the answer to the problems created for planning practices by neoliberal culture.³ Such was the enthusiasm for strategic planning that many were led to believe that this alone was real planning, and the only form worth addressing in the academic and professional world.⁴

Enthusiasm is on the wane: the numerous instruments falling under the broad label of strategic planning have produced results that in too many instances have fallen short of expectations. After an explosion of ideological hostility twenty or thirty years ago, planning now has to consider widespread scepticism about its efficacy, and a low level of agreement between planners themselves about the purposes and use of strategic planning. This lack of agreement is manifest, for example, in the multitude of

definitions offered in the literature. The range of interpretations is really far too wide: it sweeps from traditional and institutional formulas, linked to experiences of subregional and structure planning in the sixties, to dubious transpositions of business culture to the public sector, not only in America. It embraces governance and the design of institutions, or communicative approaches, without forgetting an emphasis on creativity and strategic imagination.⁵

To get over this difficulty Albrechts has written that «There is no 'one way' or 'better way' of strategic planning» and «strategic planning can be defined as a process guided by the public sector, through which a vision, actions, and their means of implementation are formulated, giving a form and framework to that which a place is and can become».⁶ In a more recent essay Albrechts proposes a normative view of strategic spatial planning and indicates its «five main characteristics (selective, relational annex inclusive, integrative, visioning, and action orientated)».⁷ But his conclusions are quite general and open-ended: «The normative view includes a plea for a shift towards a more hybrid democracy, for a type of planning that expands practical democratic deliberations rather than restricts them, and that encourages diverse citizens' voices rather than stifles them; that directs resources to basic needs rather than to narrow private gain; that uses public involvement to present real political opportunities, learning from action not only what works but also what matters».⁸

Patsy Healey, who in the past has used the expressions 'strategic planning' and 'strategic spatial planning', now prefers 'strategy-making', which she defines as a key activity that «focused on urban areas involves creating some conception of an 'urban region' and forming institutional arenas in which to develop and maintain the strategic focus».⁹

Recently, Gabriele Pasqui has traced three different interpretations of strategic planning: «as an institutionalised instrument of territorial government; as a governance device capable of integrating networks of players and building consent around important development strategies; and as a practice of 'societal conversation' capable of selectively activating players and resources around new or reinterpreted projects».¹⁰

A more selective approach is taken by Friedmann who, after acknowledging how strategic planning has been imported from the business world, argues that it is normally used to refer to the key issues of spatial planning over a timescale of 20–30 years.¹¹ But he emphasises the controversial nature of this form of planning and adds: «Some see strategic planning as a way to set out an ideal vision of the future; others see it as a vehicle for generating technical studies that would otherwise not be undertaken; still others see it as a way for substituting technical for political rationality or, alternatively, for undergirding and strengthening political reasons with technical studies; a fourth group may see it as a way to create a broad conceptual framework for wider public discussion and/or collaborative planning. And undoubtedly there are other purposes that may be claimed».¹² Considering, among other things, the difficulties in drawing up long-term policies and plans, Friedmann believes that an approach which concentrates on high-priority projects – 'strategic focus' – is more convincing than comprehensiveness, and suggests how to develop these through studies that go into greater detail. Strategic focus seems better suited to cope with the static nature of traditional planning and to provide a sufficiently rapid response to problems that cannot always be predicted.¹³

¹ Geddes's vision is regional and involves continuity between large-scale spatial ordering and the design detail of public space: note, continuity and not large scale determining small-scale. Olmsted's idea of a general plan focuses particularly on the design of large urban areas and anticipates the pairing of the comprehensive plan and zoning, where in theory zoning should be the detailed and operational translation of the general lines proposed by the general plan.

² In actual fact the pairing of general plans and detailed plans is already witnessed with the Greater London Plan 1944 and the City of Manchester Plan 1945; in the following years it will be the turn of the first subregional plans such as the Preliminary Plan for Lancashire 1951. The reform introduced by the Town and Country Planning Act 1968 is preceded by lengthy debate: see, for example, the Royal Town Planning Institute 1976, Ministry of Housing et al. 1965. For a theoretical framework, see Taylor 1988. In Milan, some of the schemes drawn up by De Finetti and by the AR plan in the 1940s can be defined as structural schemes, and it is singular how the amendment made to the Milan General Town Plan by Hazon in 1967 appears in substance and also in its graphic expression to be a structure plan.

³ Kaufman, Jacobs, 1987; Bryson, Roering, 1987.

⁴ Faludi, van der Valk, 1994.

⁵ Even a few years ago strategic planning was defined by John Bryson as «a disciplined effort to produce fundamental decisions and actions that shape and guide what an (entity) is, what it does and why it does it». (Bryson, 2003, cited by Healey, 2007, p. 30; but likewise Bryson, 1995, pp. 4–5). A definition so closely connected with corporate planning as to be of little use in the public sector where profit is not the be all and end all and where there are a variety of missions often competing with each other. In the public sector strategic planning can produce satisfactory results only if applied to a specific sector with a well defined and relatively straightforward mission. For the rest, if we exclude forms of economic planning, such as that seen in France in the 1950s and 1960s, it has not yet been possible to bring the activities of all sectors of public administration under the umbrella of overall strategic frameworks, capable of increasing the efficiency and effectiveness of government and administration.

⁶ Albrechts, 2005, p. 268.

⁷ Albrechts, 2006, p. 1149. Albrechts uses "building blocks from literature (planning and business) and [his] experience in practice to construct a workable normative definition of the 'what' and 'how' of strategic spatial planning".

⁸ Albrechts, 2006, p. 1165.

⁹ Healey, 2007, p. 13.

¹⁰ Pasqui, 2008, p. 53.

¹¹ And in support he cites Salet and Faludi, 2000; Albrechts et al., 2003.

¹² Friedmann, 2005, p. 224.

¹³ We ought to ask what the static nature of planning consists in and why it has to be overcome. In the case of urban planning, its 'static' nature, if interpreted and used properly, is its strength, but a footnote can only touch on this theme and certainly not address it properly.

Uncertainty about the meaning of strategic planning is accompanied by an explicit lack of confidence about the possibility of applying it in practice. For example, in his introduction to a research into experience of strategic projects in seven European cities, Willem Salet writes that: «The evolution of cities is the largely unplanned and unintended outcome of more or less deliberate actions by many individuals and dispersed agencies searching to find a way out of the problems and circumstances they experience. As such, urban evolution is consciously man-made and even policy-made in many respects, but it does not unfold harmoniously according to the lines of a strategic plan. There is no complete control, not even in countries where powers are shaped to enable hierarchical planning».¹⁴ Salet believes, however, that there is a strategic dimension of planning practices which lies in «the transcendence of individual horizons in scope and time»; therefore, he thinks it useful to focus attention on framing, by which he simply means «the different ways in which individual agents can be held together».¹⁵ Salet does not seem to stop and consider on what terms and how in the current situation a perceptible 'transcendence of individual horizons' could be achieved, with the effort that this would require, or, especially, what the not inconsiderable political implications of that transcendence might be, or the necessary repercussions that it would have on the design of planning practices and the justification behind them.

Even from these few citations, a situation emerges as ramified as it is uncertain; a situation certainly explained by a host of reasons, partly inherent to technical culture, and partly supplied by the political and cultural contexts in which planning practices are developed. But it is a situation rather too ramified to be convincing, bringing to mind an old essay by Wildavsky, 'If Planning is Everything, Maybe it's Nothing', one which is much cited but which unfortunately has produced no great results.¹⁶

¹⁴ Salet and Gualini, 2007, p. 3.

¹⁵ The subject of framing is also the focus of a comment offered by Fausto Curti who suggests «creating light frames (whether they are called structural or strategic plans) capable of having some diagnostic efficacy. These frames should especially regard the infrastructural and environmental matrices (which also involve commitments and constraints for the administration)». He then suggests «trying to pilot the portfolio of possible options, by exploiting incentives, partnerships and competition» (personal communication).

¹⁶ Wildavsky, 1973.

Without claiming in any way to exhaust the subject, I believe that a critical exploration of this situation must begin with careful thought about three issues within technical culture: the relationship between planning and politics; the relationship between government and governance; and the relationship between the physical and socio-economic aspects, i.e. between territory and development. Three issues that seem useful in casting light on the current predicaments of strategic planning.

Planning and politics

A talk on strategic planning is forced to consider the shifting boundaries between planning activities and political activities as well as the equally shifting boundaries between techniques and ethics. To a large degree the political nature of spatial planning activities is linked to their redistributive character and to the mechanism of exclusion and inclusion that follows from this. The main effects of planning practices are therefore political and social, rather than economic and spatial. Above all, these main effects redesign citizenship,¹⁷ to the extent that the undoubted spatial and economic effects can be correctly defined as resources for pursuing the political and social effects, rather than the actual aims of planning. It is these political and social effects that make the relationship between technical knowledge and ethical principles indissoluble; after all, control of space has always involved ethical assumptions.¹⁸

If we agree that an ethical framework is indispensable to the building and application of technical knowledge, this does not mean that planning must be so mixed up with politics that it becomes 'a form of politics'. The implicit and explicit values and purposes of planning knowledge are unrelated to political practices and, precisely for this reason, can reveal - because they are in agreement or at variance with them - the values and purposes often implicit in decision-making processes as well as the political and ethical implications of the decisions under discussion.

For example, the principle of preserving vestiges of the past is based on the ethical value attached to those vestiges; if there is a conflict between this principle and a decision to redevelop an area, the arguments that technical culture may use for or against conservation serve to highlight the ethical

cost of the decision.¹⁹ In other words, planning knowledge serves to raise ethical as well as technical questions about decision-making processes, but certainly not to replace these processes by taking the decisions itself, on a technocratic basis.

If we believe that it is the task of planning to come up with visions and strategies for designing the future, we are entrusting it with a political role, such as proposing values and objectives, and an ideal society or city. From a technical perspective, this can be an exercise in political philosophy and law: to create visions and devise strategies planning must bring about syntheses that are not technical, but characteristic of societal conversation and political debate.²⁰ Unless the approach is technocratic, it is inappropriate to entrust technical practice with the task of guiding societal conversation about a design for the future without the mediation of those civil institutions - political parties and clubs, cultural associations, pressure groups, etc - to which this role is assigned. Importantly, when they seek the contribution of experts these institutions are not so much interested in the

¹⁹ One example is the story of the car park built near the Church of Sant'Ambrogio in Milan. The Church and its surroundings are one of the sites marking the origins of the city, and the memories that they guard have been very carefully tended over the last few centuries, as expressed by the spatial equilibrium maintained despite the numerous and considerable changes witnessed over the course of time. One could say that until now the piazza of Sant'Ambrogio and its surroundings have been an example of particularly good conservation within a wider development. The addition of an underground car park with entrances in the immediate vicinity of the Church seems an excessive risk that could and should have been avoided, especially after various negative experiences of this kind in the past, such as the ruining of the nearby Piazza dei Borromei. One does not have to be a Catholic to recognise that the area of Sant'Ambrogio is an important monument, to be respected and saved from excessive modernisation. Evidently, the local authorities did not believe that the opening of the car park could result in a 'disfigurement' and, without any particular justification, went ahead with the decision. This case also shows that only widespread recollection of the past can defend a city from risky or 'wrong' developments; the opposition of the neighbourhood itself is rarely sufficient.

²⁰ Luca Gaeta observes that if creating visions and future strategies is a political task, when undertaken by political philosophers and lawyers it cannot become more of a technical one than it is when undertaken by planners. While acknowledging the sharpness of this observation, I believe that a difference lies in the fact that when philosophers and lawyers design models of an ideal city, they propose them within the context of philosophical and legal debate as subjects or examples of argument and not as the elements of plans or laws to be actually implemented.

technical merit of their proposals as in the likely political consequences. To entrust political tasks to technical practice may seem a generous decision, showing commitment. But it is a decision that, on the one hand, is at risk of tumbling into technocratic arrogance and, on the other hand, of seeing the technical content – still to be found in even frail practices such as those of planning – evaporating into the common sense of what that content should be.²¹

Just as unconvincing, though widely held, is the idea that the task of planning might be to identify and involve interested parties. To give a voice to interested parties and involve them in the decision-making process is again a political task. It is part of the game that politicians are ready to let certain interests have a voice and not others.²² If, for example, politicians do not let weak interests have a voice, it is not because they are incapable of doing so, but because they are not interested in doing so. And if politicians do not let weak interests have a voice, this does not mean that planners, merely because they wish to, are politically and technically able and institutionally authorised to do so.²³ A planner may act as a political advisor or directly as a political activist – this is an important commitment assumed by many experts in every disciplinary field. The problem is not to expect a commitment, on the part of an individual or a group, to be transformed into the institutional goal of the technical practices of a professional activity such as planning.²⁴

If designing the future and development of a society was the job of planning practices, it would no longer be possible to trace the boundary

between planning and political activity. As a result planning would be completely absorbed by politics, or a situation would arise in which the independent contribution, that techniques can give to societal conversation and the formation of the decision-making process, would disappear.²⁵ The theoretical approach that considers planning as a ‘form of politics’ is the most explicit expression of the confusion between political decision-making processes and planning practices. And it is also the safest way of denying independence and specificity to planning activities. The confusion between planning and politics often seems to arise from the fact that many planners are not satisfied with collaborating in government activities. They believe that they should have an independent role in devising and implementing public strategies. The suspicion arises that this may be due, not so much to their irrepressible public spirit, as to their inability to understand the technical problems and work out useful solutions to the questions on the government agenda. Moreover, it seems to be forgotten that politicians’ decision-making responsibilities are based on an electoral mandate, which planners do not have. And this is probably the most embarrassing aspect of the debate about strategic planning.

Not to consider planning as a form of politics does not mean that we should ignore the political nature of technical planning knowledge or neglect the issue of how to use technical knowledge in political dealings, in other words the problem of the shifting boundaries between techniques and ethics. In his work, a planner always refers to ethical and political values and aims, even if he is not

always aware of doing so. It is possible that the planner’s values and aims agree so closely with those of government and the wider common sense that the planner is led to believe that his action is ethically neutral and that his contribution is solely ‘technical’.

Planning, since it redistributes rights, is nonetheless a process of reform, whether progressive or conservative. Therefore, the state of unawareness can be read as one of ‘mechanical’ reformism. In the sense of a systematic, if not entirely uncritical, implementation of values and aims that are taken for granted, because they are based on values and aims endorsed by majority consent. For example, in the last thirty years mechanical reformism has been driven by the idea of the ‘market’ and of every type of reform being conditional on the resources, and not just financial ones, provided by the ‘market’. In this case too, the redesign of citizenship brought about by planning is following principles but these, paying homage to the ‘value’ of the market, establish that citizenship should be ‘contractualised’. Therefore, individual rights are, directly and indirectly, ‘purchased’ on the market, for example through insurance schemes and contributions in exchange for services.²⁶ Moreover, the production of public goods is conditional on the amount of profits that the urban market generates.

Mechanical reformism can be contrasted with a critical awareness of the values and aims attributed to planning practices. An awareness that takes values and aims not as inalterable givens, but as the products of the competing action of political and technical practices. This state of awareness can be read as one of moral reformism: in other words a state in which the expert reflects critically on the principles and values proposed by societal conversation. To reflect critically in this way implies acceptance by the expert of theories of state and citizenship that form the terms of reference for the values and aims of planning and the ways of pursuing them.²⁷

²⁶ See, for example, Somers, 2008.

²⁷ For moral reformism, the theories of state and citizenship are not easy conditions to fulfil. In the final part of this lecture I argue that the intrinsic nature of spatial planning, an authoritarian instrument of governance, reduces the field to republican theory. Meaning by that a theory in which, also in compliance with the principles of devolution and subsidiarity, the collective interest prevails over individual interests.

²¹ Above all, the effect of this decision is to water down the substance of the expected technical contribution, by rendering its political effectiveness inversely proportional to its recourse to moral arguments.

²² It is probable that the most poorly represented voices are those of the weakest interests, but to give a voice to these interests is, once again, a typically political rather than technical task. To entrust this task to planning in the belief that politicians are unable to carry it out properly, not only creates a form of unfair competition with politicians, but tends to make their unwillingness pass for incompetence.

²³ In the end, and depending on their beliefs, even those planners who, adhering most strictly to particular political decisions, have some political influence on their implementation, but this happens because everyone, in the course of the work, engages, to some extent and sometimes unconsciously, in political activity, and not because they believe themselves to be institutionally bound to do so.

²⁴ Mazza, 1995, 2002.

²⁵ It must be acknowledged that in some cases, for the most varied reasons and more or less explicitly, political decision-makers delegate certain decision-making powers to experts. And it is not easy to act in this situation because there is no formal basis for the delegated power, which can thus be withdrawn unexpectedly and the expert’s decisions overturned; and because the expert often does not have all the necessary skills and information to handle the situation properly. Moreover, delegated powers are often exercised in matters that the political system considers irrelevant, with the result that, whatever the expert’s decision, it is possible that it may never be implemented. In short, only when there is very great trust between decision-maker and expert can the latter be prompted to accept a delegated power that tends to confuse their roles and muddy the decision-making process. Acceptance of this power provides decision-makers with a form of ‘cover’ that can only produce confusion in public debate; therefore, as a general rule, it should be politely refused.

To recapitulate. If we assume that planning is an instrument of government, when the political system and government know how to express clear values and aims, planners have two alternatives. Either to accept those values and aims as givens and to work within that reference framework, or, if they are unable to share those values and aims, to turn down the work. The situation is more complicated when politics and government do not know how to express clear values and aims. To operate in this case, the planner is forced to stand in, an action which rarely dispels the uncertainty in which the government is mired. Moreover, it is very improbable that it will produce any significant political results. The government is very likely to drop the planner's proposals or only take up those which it thinks will satisfy its immediate requirements, ignoring the general reference framework from which the planner has drawn inspiration.²⁸

It could be argued that, in actual fact, there is a third alternative, seeking to modify the values and aims expressed by government. Anyone who pursues this purpose is engaged in political activity, regardless of his professional role and possible use of technical arguments. Once again, it is not a question of preventing experts from adopting political positions, but of clarifying that these positions are such regardless of the technical arguments used. This distinction may appear formalistic, but let us see how it applies in real life.

Let us suppose that an advisor has been appointed to collaborate in drawing up housing policies only to discover that he does not share the government's aims, which he considers to be too subservient to the vested interests of property companies and too insensitive to the issue of social housing. If his attempts to convince the administration to change its objectives are unsuccessful, all the advisor can do is to resign and explain why. To make public the reasons for his resignation is a legitimate and necessary professional step that has an evident political value. But if, after resigning, the advisor begins to campaign against the administration's policy, his action is that of a political activist who uses technical arguments to support the values and aims that

inspire him as a citizen. The problem is not so much of ethical professional practice as theoretical: if a political activist and a politician are entitled to use technical arguments to support a political idea, a technical expert who does so can convince people that there are decisive technical reasons for deciding on a public policy, which is almost always false. A public policy can be analysed and evaluated technically if that means exposing the expected costs and benefits, but it cannot be judged technically because the judgment of the costs or benefits varies according to the values and aims pursued politically.

Government and governance

In talks about strategic planning the opposition between government and governance is almost always cited. The opposition emphasises how strategic planning no longer refers to a government allocating resources and resolving problems, but to governance perceived as the ability to trigger a search for creative solutions by mobilising various players, with different and even conflicting interests, objectives and strategies.²⁹ In other words, a narrowing of the role of the state in favour of greater social involvement in the design of collective action. But this is not the only way of understanding governance that we find in the literature, with the result that we have another polysemic term tending to create more problems than it manages to resolve.³⁰

The opposition between government and governance is possible if government is caricatured as an autonomous institution cut off from its context, autocratic and totally unapproachable. The opposition between government and governance is of analytical value provided that governance is not considered as overtaking government. Because governance is, if anything, an instrument of government, which retains powers and responsibilities that no form of governance can

replace or limit and that, on the contrary, are reinforced by good governance.

Some authors seem to believe that with the appearance of governance the processes of government have changed. Whereas it is primarily our ways of describing them that have changed and with positive effect. The links between government and vested interests have become more explicit and less confused and are covered by procedures that tend to render them more transparent and more controllable. This does not mean that governance itself should be able to «trigger a search for creative solutions differing by territory»,³¹ unless one believes that the 'creativity' of a public decision-making process is proportional to the number of interests involved and not to the planning and leadership skills of the manager of the process.

Governance and institutional planning are useful instruments within the framework of a clear and sound political strategy. While in a complete turnaround it seems that at times we expect that strategy can be the product of governance and institutional planning. It is possible and desirable for a circular process to be triggered between the three components but the trigger can only be political strategy.

Development and space

Many supporters of strategic planning processes identify two dimensions: «One dimension of this process is the value attached to the qualities of places and to appreciation of their diversity; another dimension is the accent on integrated socio-economic approaches, which go beyond the mere physical dimension of traditional planning».³² In the last ten years, perhaps because of the ever increasing number of large-scale town plans, there has been a particular focus on 'places', whose qualities and differences have been emphasised. Healey stresses the role of places in connection with strategy-making, which she considers to be «the development and deployment of a strategic imagination about the qualities of the places of urban areas».³³

The first dimension revisits themes already dear to early twentieth century authors, such as Geddes and Unwin, and ever present in Italian culture. In reverting to them now we ought to be aware that these themes did not become

²⁸ In brief, if the political system does not provide reference values and goals that the expert considers appropriate, there is no space for his planning activity. This does not mean that other experts, because of their beliefs or for gain, may not share those goals and values that the political system recognises and pursues.

²⁹ Albrechts, 2005, p. 271.

³⁰ For example, governance is now used not only to indicate informal non-vertical ways of organising decision-making processes, but to indicate new forms of government, so that the distinction between governance and government eventually disappears. To take account of the different interpretations of governance Healey resorts to the expression 'urban governance landscapes' and acknowledges that the «new organisational forms for governance activity raise difficult questions about how the accountability and legitimacy of such activity can be established and blur the boundary between the 'public' and 'private' sectors». Healey, 2007, p. 19.

³¹ Albrechts, 2005, p. 271

³² Albrechts, 2005, p. 269.

³³ Healey, 2007, p. xi.

less topical due to lack of attention or knowledge, but because of choices made in the context of modernist poetics and social philosophies characterised by egalitarian welfarism. To consider the quality and diversity of places is a choice based on values and objectives. From a technical perspective, to consider the quality and diversity of places is just as valid as not doing so. For example, it was not considering – or only very partially considering – them that enabled the construction of the «autostrada del sole», the 'Motorway to the Sun' which linked the north and south of Italy for the first time. Therefore it is incorrect to assume that this dimension is a technical aspect of strategic processes; rather, it can be traced to the 'poetics' of planning.

The second dimension – the accent on integrated approaches – was widespread in the early twentieth century among English planners, even though they had been trained in the schools of architecture and engineering. It was then lost before re-emerging in the issues addressed in the British debate, between the end of the '50s and early '60s, about recovering and integrating the socio-economic contents and effects of land-use decisions. This was the debate that would lead to the subregional strategic plans of the '60s and to structure planning. If nowadays we are again addressing the same topics, we have to ask ourselves why in the span of a century we have not made some advances in the process of integrating physical and socio-economic questions.

The associations between the physical and socio-economic dimensions are taken up within a wider and more problematic consideration of the associations between the processes of developing territory and governing territory, the subject of two essays by Palermo and Pasqui. Their argument is that ways and forms of thinking about possible contamination between the two planning logics are still very unsatisfactory.³⁴

For Palermo «the very unsatisfactory results of integrated territorial development programmes in Italy, are over the last ten years perhaps partly due to certain limitations cited here. On the one hand, a certain overestimate of the wealth of identity, and quality and relational capability of local systems. On the other hand, the generally artificial and often opportunistic nature of networks and contingent coalitions;

as well as the difficulty in interpreting and managing multi-scale and multi-level dynamic relationships».³⁵ Pasqui, in particular, complains about the excessive number of instruments used in the last few years and their negative results, and the terms that he uses to describe these results are 'failure' and 'washout'.³⁶ According to Pasqui, the errors can be traced to three factors. First, the inadequacy of the main human and procedural components of government processes. Second, the inability of technical cultures to acquire a thorough grasp of the nature of planning topics and their differences in order to handle them properly.³⁷ Third, the idea itself of reform, too little attentive to social intelligence, and to the embedding and institutionalisation of development policies.

Pasqui's observations are thoroughly convincing when they address general questions such as those just described, while they are a source of perplexity, mainly for the reasons already set out in the section on 'politics and planning', when they address technical questions. If, on the one hand, mixing political and technical themes enriches political argumentation, which is better

constructed and more persuasive as a result, on the other hand it burdens planning activities with expectations that are too high and historically bound to end in disappointment. 'Societal conversation' is a political activity that is possible when the relevant players are willing to debate the chosen subject, but this willingness is increasingly rare, especially in large cities. The impression is that many strategic planning approaches refer more to an imaginary society than real society.

Does not happen for that in the last few years disappointment with general strategies has resulted in a shift of attention to specific strategies and especially strategic projects that attempt to treat an area according to its main functional aspects: activity and mobility. Strategic projects very ambitiously present themselves as integrated development projects. Despite citing functional and symbolic values, they actually are above all instruments for breeding capital. In the majority of cases large urban projects, justified by plans, are strategic above all to their investors. Even though they have significant implications for urban dynamics, in terms of public costs rather than benefits. Politically, they use the cover provided by neoliberal culture by the emphasis on partnerships between the public and private sectors, and by the processes of subsidiarity and modernisation. Rarely they are based on overall visions and rarely their possible effects are evaluated in advance. In the majority of cases in Italy, they are explicit forms of privatisation of the processes of urban transformation.

If the technical contribution merely recognises the interdependent aspects of these large urban projects – economic and social action, spatial configuration, and institutional agreement – in order to handle them more efficiently, it ends up in their tow. Therefore, rather than resigning and restricting ourselves to mere analysis after the event, the problem seems to be that of identifying what the collective goal of large urban works might be, so as to base their design on this goal and use it as an instrument for evaluating them. I shall return to this point later on.

Palermo's article, though using technical arguments, is not only a reflection about territorial and development policies, but a political essay.³⁸ With reference to Donolo,

³⁵ Ivi, p. 109.

³⁶ Palermo, Pasqui, 2008: «... the consequences of this overlapping of instruments which are often very similar, but characterised by different sources of financing and procedures, have been numerous and almost all negative. ... a factor of uncertainty, instead of a vehicle for collective learning» (pp. 20-21) And with regard to new planning and integrated development policies, «the steps taken over the last fifteen years can hardly be called a success» (p. 25) and on the following page: «the experience of territorial development policies could actually be considered a total wash-out». An absence of leadership, partnerships incapable of building coalitions, inadequate project management, processes of institutionalisation that in certain cases become a brake, and unnecessarily complicated and unsatisfactory vertical relationships, are some of the main reasons behind the regulation mechanism breakdowns that have represented «factors of uncertainty and instability» (p. 30). Pasqui believes that the connection between territorial development and transformation has been largely overlooked and that there has been a failure to «interpret productively the possible forms of contamination between the two design logics, because of the limits having to do with institutions and politics; with interests and with society; and with forms of knowledge and forms of technical rationality» (p. 31).

³⁷ «The missing link between analysis and design of policies and substantive interpretation of territorial development dynamics, in all their variety and ramifications and their physical effects on the territory, is perhaps precisely the area in which we need to invest, also in terms of qualified personnel and training strategies» (Ivi, p. 80).

³⁴ Palermo, Pasqui, 2008, p. 5.

³⁸ Ivi, 2008, pp. 101-134.

Palermo proposes an idea of development consisting in the «qualitative evolution of forms of social rationality» and a reflection about «the relationships between physical transformations and visions of development» that could be «a way of putting innovations and hopes to the test».³⁹ For Donolo, and for Palermo, reference to the principles of economic efficiency and public authority (i.e. the traditional roles of the market and state) is not enough. Other «mechanisms of social regulation must be considered, in the context of reciprocity, and capacity for self-organisation and networking».⁴⁰ Lastly, according to Palermo, to usher in a new season of development policies it is necessary to implement the following principles: «shared strategic vision, hierarchy and selectivity of investments, subsidiarity of commitments and responsibilities, and a federation of sector policies on a territorial basis».⁴¹ With the warning that such strong demands can be satisfied only if we manage to make a «new social and territorial pact for development», and to recreate a social fabric imbued with shared values.

REPUBLICANISM AND PLANNING SYSTEMS

However, the re-creation of a social fabric imbued with shared values is a purely political theme. It requires a rich conception of the political community and the possibility that the moral purposes of the community may be incorporated by the state. All this is missing today. During the last few centuries the state has become a secular state, a state which no longer has a religious or ethical basis. The secularisation process and emancipation of the individual create the need for a new community and homogeneity of secular values, which, in place of religious ones, may serve as a basis for state action.

Everyday experience shows that even a secular state accepts certain ethical assumptions, and its citizens participate in public conversations which have ethical contents. It has been observed that this need for values generates an internal contradiction: to develop its action the state needs to support it with certain ethical assumptions,

without which its power might be delegitimised. But it is not difficult to discover that, to legitimise its action, a democratic secular state demands values and presuppositions which it cannot reproduce and guarantee.⁴² In their debates, political philosophers have held for some time that the non-denominational or secularised state has therefore a need for «meta-political references, without which its power is at risk of undergoing a delegitimation process».⁴³

Nowadays this contradiction, which the state cannot solve on its own, is if possible even more glaring. It reverberates through ideas of citizenship, which have always been developed with reference to notions such as political community and the common good. Due to a lack of shared value systems, these notions are nowadays increasingly problematic, with the consequence that planning activities have less legitimacy than in the past and have lost their basic term of reference: public interest.⁴⁴

A solution to the internal contradiction between the need for values to support state action and the inability of the state to guarantee these necessary values, has been sought by resorting to the classic model of «civil religion».⁴⁵ Ten years ago Rusconi proposed that the concepts of republicanism and civil religion be retrieved, reformulated as «models potentially capable of supplying common motives ('presupposed values') for politics, and of producing ties between citizens that go beyond their ethical visions. Values that in the language of republicanism are called the virtues of public spirit and civic integration».⁴⁶

Underpinning the republican outlook is, instead of civil religion, constitutional patriotism:

finding oneself to be part of a shared history and feeling a political obligation to implement the constitutional contract. In short, the republican paradigm is revisited «from two essential angles: redefinition of the nature of the ties of citizenship and acknowledgement of a shared history identified as being the history of a nation».⁴⁷ A position partly recalling that of Taylor, who says that patriotism consists in collective identification with a historical community founded on certain values,⁴⁸ adding immediately afterwards that the essential values of that community must include liberty. In the republican tradition, in the context of the rule of law, citizenship and liberty are generally considered as equivalent terms, and the law as a source of liberty.⁴⁹

In referring to Rusconi's proposal I am attempting to find an answer to the difficulties that spatial planning encounters when it tries to raise itself above the local dimension and to constitute a system that carries coherent and cooperative visions and decisions across the various levels of government.⁵⁰ Developing strategies is very difficult, not to say impossible, if the state does not retrieve its authority and commitment to coordinating planning functions at all levels. Designing and implementing coherent strategies requires a community with common motives, capable of producing bonds between citizens and limiting as well as providing scope for individual and group behaviour.

When one believes that the ultimate, even if unconscious, purpose of planning is to redesign citizenship, a republican approach seems necessary precisely in order to rediscover common motives among citizens and restore authority to the state. If a new social contract is required in order to develop

³⁹ Ivi, pp. 103-104.

⁴⁰ Ivi, p. 106. The market «may not be able to ensure sustainable development processes»; it is necessary for society and politics to come into play. For Donolo, territory is «a matrix and constituent form of social complexity, a heritage of common goods exposed to various levels of relationships, a dynamic network of spatial and temporal flows that requires an ability to govern processes» (p. 105).

⁴¹ Ivi, p. 120.

⁴² Bockenforde, 1986, p. 121.

⁴³ Rusconi, 1999, p. 40.

⁴⁴ Vujosevic, 2004. The description he gives of the shortcomings of planning is valid outside the confines of Yugoslavia, but one comes away with the impression that the author's idea of planning is too demanding.

⁴⁵ In the American experience a reply to this need has been granted by the classic model of «civil religion», which is an official fusion of values and religious formulas and of the democratic «faith». In the French experience we find a secular republican variant of the same reply. Where there was no «civil religion» this homogeneity was initially guaranteed by the idea of nation; the unity of nation was a substitute for unity based on religion. When the building process of the nation-state was concluded, the democratic secular state tried to find in a community of values and beliefs its basis and legitimisation.

⁴⁶ Ivi, p. 7. According to Rusconi «Republicanism and civil religion have the same roots. They are two ways of promoting the idea of civic integration and civism» (p. 47).

⁴⁷ Rusconi, 1999, p. 26. Rusconi writes of the «politics of history» ... in the sense of «keeping in mind a path of history open to conflicting interpretations, but at the same time not losing sight of the value of republican democracy as the point of arrival and the criterion for judgment» (p. 96).

⁴⁸ Taylor, 1989, cited by Habermas, 2001, p. 116. For a comparison between the liberal and republican models, see also Sandel, 2005 and Vertova, 1999.

⁴⁹ Pettit, 1997, pp. 36-39. With the side note that, according to Pettit, republicans are less concerned with freedom from interference than freedom from dominium (Dagger, 2002, p. 147).

⁵⁰ In Italy territorial planning is entrenched almost exclusively at local level. There are no forms of national territorial planning, even for those key services that require it, and regional territorial planning is often a fiction.

planning, and especially to design and implement strategies, I believe that the meta-political pre-conditions for this involve the creation of a cultural and social context typical of the republican tradition; also because it is this tradition that embraces an idea of citizenship which, more than any other, can be adopted as an analytical and normative standard for constructing and evaluating planning decisions.

As an alternative to liberal, social democratic, communitarian and ethical approaches, a republican approach is certainly one possible choice; but even with regard to the mere notion of citizenship, it must be acknowledged that a republican approach is anything but unambiguous in the literature.⁵¹ Various authors identify the features of the republican model and contrast them with the liberal model. Taylor and Habermas, for example, highlight the instrumental nature of institutions in the liberal approach, while in the republican approach participating in government is seen as an essential component of the role of a citizen, as a value in itself and as the essence of liberty.⁵²

According to Sandel, the republican idea of liberty consists in participating in self-government, an idea that in itself is not inconsistent with the liberal idea of freedom.⁵³ Vertova does not hesitate to use the term republican within a liberal approach,⁵⁴ and Dagger coins a sort of oxymoron, republican liberalism, based on the common commitment by both theories to the rule of law. But Dagger is forced to conclude that republican liberalism cannot be a satisfactory form of liberalism, since it involves a vision, even if perfectible, of a good society.⁵⁵

Therefore, the multiple meanings of citizenship accompanying the Republican model are no less ambiguous when a comparison is made with the liberal model. However, crucial to the republican model is the theme of self-government, which can constitute a benchmark for evaluating public policies, in the sense that it holds out the option of considering good policies to be those functional above all to the development of democracy as self-government. For example, improvement of the population's living conditions, as pursued according to the social democratic concept of equality, does not in itself ensure self-government.

In the republican approach, improving living conditions is not considered a pre-condition for exercising political citizenship. Rather than the objective of social citizenship, as a pre-condition for exercising political citizenship, the objective of the republican approach is the exercising of an active political citizenship. The difference is not marginal because it is assumed that political citizenship may/must be exercised also in unfavourable economic and social conditions, and that in any event it must be this that produces an improvement in those conditions.⁵⁶ In the liberal tradition and the social democratic one, citizenship is often reduced to different forms of contractualisation linked to the market and the state, while in the republican model citizenship involves substantive participation in the community.⁵⁷

The theme of self-government does not conflict with constitutional patriotism because the republican idea of citizenship cannot be separated from the idea of being a member of a nation. And especially because obligations play a role in the public life of the community, alongside and before the rights of citizens.⁵⁸ But active conceptions of citizenship may not be distinguishable from ethical and communitarian conceptions, and the risk of over-estimating the dimension of local community is ever present. For example, Walzer, following a long-standing tradition, has proposed recognising neighbourhood, district and ethnic communities as effective political

and moral bodies, and he believes that community is probably the most important of the goods that are distributed. But he adds that distribution is in the hands of the majority of the citizens of a country and that it would be unrealistic to think of communities with completely open boundaries.⁵⁹

Despite these variations and ambiguities, the republican approach is still indispensable to thinking about a new social contract in which, also in line with the principles of devolution and subsidiarity, the collective interest prevails over the individual interest, and also to thinking about a form of planning that is acknowledged to have the redesign of citizenship as its ultimate goal. Outside a republican scheme, planning activities are principally instruments for legitimising vested interests and facilitating their investments. And, outside the republican scheme, the resolution of the conflicts that arise between the planning decisions of the various levels of government becomes at least impracticable.

Planning can generally be practised if it is possible to refer to the authority and syntheses expressed in and by statehood, which suggests that in a democratic system planning is republican by necessity rather than by choice. One could reasonably object that a republican choice is a political choice to which planning can only adapt itself. But cultural processes are not so linear, even if technical culture takes part in the societal conversation that chooses the political models of living.⁶⁰

I believe it is legitimate to argue that there are no stand-alone principles of planning, and that any general principle can only be worked out in terms of political philosophy and metaphysics. One can consider a planning system to be efficient if it facilitates the operations of the urban market, or one can consider it to be efficient if it favours transparent forms of self-government. One can consider expropriation to be a violent form of state intervention that disrupts the market and damages ownership rights, or one can consider expropriation, when properly compensated, to be an input towards the production of the goods and rights that

⁵¹ See Bobbio, Viroli, 2003.

⁵² In contrast with an individualistic and instrumentalist concept of the role of citizen, characteristic of the liberal model, there is a communitarian and ethical concept typical of the republican model; whereas for liberals political citizenship is a form of membership on which the citizen's legal position is founded, for republicans it is membership of an ethical and cultural community which is self-determined. «The reference point for the republican concept is the problem of self-organisation of society, once it has been admitted that the substance of the concept of citizenship should be sought in the political rights of participation and communication» (Habermas, 2001, pp. 113-125).

⁵³ Sandel, 2005, p. 10.

⁵⁴ Vertova, 1999.

⁵⁵ Dagger, 1997.

⁵⁶ This theme is developed by Brandeis and Croly, the two advisors to Woodrow Wilson and Theodore Roosevelt during the presidential race in 1912; their common concern was what type of citizens the organisation of the economy would have generated.

⁵⁷ Delanty, 2000, p. 9.

⁵⁸ Hindess, 1993, pp. 26-28; Bellamy, 1993, p. 71.

⁵⁹ Walzer, 1983, p. 39.

⁶⁰ For example, even recently in Italy, many difficulties were encountered during an attempt to draw up a 'law setting out the principles for governing the territory', because of the difficulty in identifying convincing planning principles.

nourish citizenship.⁶¹ One can consider town planning to be instrumental to the functional transformation of space and particularly attractive aesthetic results. Or one can consider town planning to be instrumental to the reinforcement of constitutional patriotism, by respecting the traces left by history in the urban form and, for example, by making changes in the form conditional upon functional and symbolic values held to be important in terms of self-government.⁶²

Even if it is not the task of planning to contribute directly to the political debate on the approaches that must form the reference framework for the action of government, technical planning culture has a responsibility to clarify which theoretical approaches should underpin the principles on which techniques base the models for possible planning systems and which principles these models wish to follow.⁶³

CONCLUSIONS

The paper argues that the difficulties encountered by strategic planning may be mainly explained by the characters of three uneasy relationships: planning and politics, government and governance, development policies and spatial planning. In the last decades many planners have been thinking that their judgement might be better than politicians', because of their technical knowledge and moreover because their cleverer skills in involving, understanding and representing the public. Planners have been assuming to have the right and the duty, as planners, of participating in planning decisions on the same standing as politicians. In this perspective it is understandable to prospect an opposition between governance and government, forgetting that without the

government authority planning may be only a more or less convincing propaganda. Focusing on ambitious development and spatial policies planners may forget that actual planning actions are a political choice the government may or may not take. Planning is not a governments' compulsory task, and governments often use planning as a 'window dressing' to introduce and cover their real policies. What governments cannot escape is land use control which is an indispensable component of national and local geopolitics, but the need of property defence and territorial control are not sufficient to support a complete planning system. Local spatial planning is somewhat necessary, but the development and implementation of consistent national, regional, and local policies and the solution of inevitable conflicts within the government tiers, demands a shared idea of public interest, which only a republican culture can provide.

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⁶¹ Compatible with republicanism is the notion of citizenship consisting in the «right of access to particular goods in the form of rights (civil, social, political) which are waiting to be generated. To be citizens does not only mean enjoying one's goods and rights but making a committed contribution to generating them. Rights are costly goods and commitment by citizens to assuming their share of the cost ... is ... a form of behaviour intrinsic to the status of citizens, who recognise that they are bound by ties of reciprocity» (Walzer, 1983, p. 35).

⁶² See Mazza, 2007.

⁶³ For example, the principles of transparency, efficiency, cooperation, argumentation of choices, etc, which the planning system must follow and which allow the efficient pursuit of the values expressed by the political system.

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CHALLENGES, RESPONSES AND PARTNERSHIP FOR ACHIEVING SUSTAINABLE TOURISM AND HERITAGE PRESERVATION

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The process of globalization has created the situation where the expectations of tourists are the same both with respect to the quality of services in all destinations and with respect to the authenticity based on local attractions and experiences, which should be unique and different for each destination. The key element in maintaining destination attractiveness is the protection and presentation of natural and cultural heritage and its sustainable utilization for tourism development. The sustainability concept is of equal importance for long-term tourism development, destination competitiveness and heritage protection. The paper deals with the main challenges to achieving sustainable tourism and points to some key responses to them. Participation, cooperation and partnership should be a vital prerequisite for the implementation and performance of sustainable tourism and heritage protection. This attitude has been tested on several examples of good practice in heritage protection and the sustainable development of tourism destinations in Serbia.

Key words: authenticity of tourism destination, sustainable tourism, protection of natural and cultural heritage, challenges, responses, partnership for sustainability.

INTRODUCTION

The authenticity/uniqueness of a tourism destination is based on the existing and potential natural and cultural attractiveness of space and created activities. Space attractiveness for tourism development is evaluated both on the basis of the attractiveness of tourism resources and on the basis of the quality of spatial accessibility and arrangement.

The basis for creating a tourism product and developing a tourism destination is provided by the cultural and natural heritage and socio-cultural specifics of local communities. Therefore, one can speak about complementarity and interdependence along the following lines: tourism development, protection and presentation of cultural and natural heritage, preservation of the authentic culture and identity of local communities.

The basic tendency is to have entire tourism becoming sustainable as integrated sector. In

fact, it is the question of the concept being of equal significance and interest both for long-term tourism development, competitiveness and sustainability of tourism destinations, and for the protection of heritage as the basic tourism resource.

The paper deals with the main challenges to sustainable tourism development, which are of significance for the protection and sustainable utilization of natural and cultural heritage, such as: dynamic growth management, climate change, poverty reduction and support to heritage protection. The responses to these challenges should rely on the basic principles and approaches concerning the development and implementation of sustainable tourism. The paper analyzes only several most significant responses that are of common interest for sustainable tourism development and heritage protection – the observance of sustainable development boundaries, promotion of sustainable consumption and climate change adaptations.

It is held that participation, cooperation and partnership among key actors are a prerequisite for the implementation of the

concept of sustainable development and heritage protection. This has been tested on several examples of good practice in the protection and sustainable utilization of cultural heritage, and in tourism development in Serbia.

THE ROLE OF ATTRACTIVENESS IN TOURISM DEVELOPMENT

According to Keller (2002), the process of globalization has created the situation where the expectations of potential tourists are the same with respect to their comfort and quality of services for all destinations, on one side, and with respect to authenticity based on local attractions and experiences that are unique and typical for different destinations, on the other.

The authenticity of a tourism destination is decisive for satisfying the human needs to change the routine and experience a new and different environment and way of life. The authenticity/uniqueness of a tourism destination, understood as its difference from other destinations, is based on existing natural and cultural attractiveness and created

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tourism-related (and recreational) attractiveness. The more significant the attractiveness of a destination – the greater the potentials for its development (ibid.). Weaver (2006) argues that there is no consensus on the definition of tourism attractions and space attractiveness. However, their central role in tourism development is indisputable.

Space attractiveness for tourism development is evaluated both with respect to the attractiveness of tourism resources and with respect to the quality of spatial accessibility and arrangement. From the aspect of tourism development potentials, space is more attractive and more significant if it is located in the vicinity of attractive cultural and natural heritage; if it has more locations that meet the basic spatial arrangement criteria and if it enables the conceptualization, evaluation and selection of the option for organizing the facilities of tourism-related demand in space and for sustainable destination development. From a tourist's viewpoint, space is more attractive if it is arranged, has aesthetic qualities and enables freedom in selecting activities and experiences in the creation of the tourism product. In this connection, one must bear in mind that the attractiveness of a tourism destination reflects one's beliefs, feelings and attitudes concerning the spatial potentials for satisfying his/her tourism-related needs.

In any case, the basis for creating a tourism product and tourism destination development is provided by the cultural and natural heritage and socio-cultural specifics of local communities. Therefore, one can speak about complementarity and interdependence along the following lines: tourism development, protection and presentation of cultural and natural heritage, as well as the preservation of the authentic culture and identity of local communities (Maksin-Mičić, 2003). Roter-Blagojević et al. (2009) notifies the need for maintaining authenticity and traditional values of historic sites, their architectural and intangible heritage, as well as modern understanding of the role and utilization of protected historical sites as basic part of integral sustainable development of the region.

INTERDEPENDENCE BETWEEN SUSTAINABLE TOURISM AND HERITAGE PROTECTION

The notion of sustainable tourism appeared in the early 1990s, when tourism became a big

global industry. It designates tourism which is based on the aims and principles of sustainable development.

Underneath this notion is the aim to have tourism as a whole become sustainable, regardless of the form of tourism. It is held that every form of tourism is sustainable should it continuously contribute to the environmental improvement, social well-being, economic prosperity, preservation of natural and cultural heritage and resources, cultural values and identity of a local community. In fact, it is the question of the concept of equal significance and interest for tourism development, competitiveness and sustainability of tourism destination, as well as for the protection of heritage as the basic tourism resource.

The concept of sustainable tourism development and its application are not unambiguous.

There appear more flexible (loose) and more restrictive (strong) interpretations of the concept in accordance with the specific features, significance and vulnerability of available resources and goods, space attractiveness for tourism and socio-cultural specifics of local communities. A more restrictive sustainable tourism strategy is applied in planning and managing the development of regions with relatively preserved and vulnerable natural and cultural heritage and significant or limited natural resources with the aim to prevent their destruction due to the negative impacts of more intensive tourism development. A more flexible sustainable tourism strategy is applied in planning and managing the development of regions which have been distinctly modified by anthropogenic impacts, such as central urban zones, urban and industrial centres, built tourism-related attractions, rural areas and settlements in the zone of influence of infrastructure corridors and exploitation of mineral raw materials and the like.

Achieving sustainable development is a continuous process of tourism planning, management and improvement, which implies:

- Participation and consensus of all actors;
- Significant involvement of public authorities at all levels, and
- Monitoring if the environmental impact of tourism and undertaking of necessary preventive or corrective measures (WTO, UNEP, 2005).

In essence, planning and achieving sustainable tourism consist in supporting positive regional development tendencies, while at the same time reversing negative ones.

The implementation of the concept of sustainable tourism implies the minimization of the negative impacts of tourism on the environment and available resources and the maximization of the positive ones. The key issues of concern are the identification, monitoring, assessment and management of the impacts of tourism on the environment, values and resources.

The essence of sustainability lies in finding a proper measure, that is, a balance between the development of tourism and tourist regions, on one side, and the protection and preservation of the environment, resources and values of regions and local communities, on the other (for more detail see: Swarbrooke, 2005). This also implies supporting the view that sustainable tourism can be achieved only as an integral part of sustainable regional development.

The World Tourism Organization (WTO) set out twelve aims for sustainable tourism. Proceeding on the topic of this paper, we single out several aims for sustainable tourism.

The preservation and observance of cultural diversity represent one of the key sustainable development principles. Tourism must contribute to the protection, understanding and observance of cultural heritage, authentic local culture, traditions and specifics of local communities. Tourism must provide support to the efficient management and protection of cultural heritage, primarily by ensuring the cautious management of tourists and the provision of financial support to heritage protection based on earned revenues. It is necessary to maintain cooperation with local communities in order to ensure the adequate presentation of authentic local culture, carefully conceived interaction between the population and tourists, formation of tourist experiences and overcoming of cultural differences.

Spatial integrity, significant for destination attractiveness, is achieved by planned spatial arrangement, preservation and improvement of the aesthetics of regions and built spaces, and the prevention of spatial degradation. Planned spatial utilization and arrangement ensure the harmonization of tourism development with the potentials and restrictions of space utilization, local resources, heritage and local

communities. Necessary support is provided by using different codes (for the utilization of vulnerable and tourist attractive spaces, spatial arrangement and the like), monitoring and control system, as well as the activities related to the arrangement and maintenance of open spaces, areas and structures.

Local control implies inclusion, capacity building and assigning competences to local communities in tourism planning, decision making and development management, in consultation with key sectoral actors. It is proceeded on the fundamental principle of sustainable development that people should assume the responsibility and control over their lives. Second, tourism destinations that include local communities in the planning and implementation of tourism-related projects are much more successful in ensuring sustainable development and gains for the local population. In order to have local authorities, local stakeholders and local population take an active part in tourism development and decision making, it is necessary to ensure their training, the raising of their awareness of the values of heritage and other regional resources and the impacts of tourism on the local community and timely provision of information to the public.

The complementarity and interdependence between sustainable tourism development and sustainable natural and cultural heritage and landscape protection has been addressed by International Organizations such as: UNESCO (World Heritage Convention, 1992; Managing Tourism at World Heritage Sites, Manual No. 1, 2002; Operational Guidelines for the implementation of World Heritage Convention, 2008, World Heritage Cultural Landscape, Paper No. 26, 2009, etc), UNWTO (Agenda 21 for the Travel&Tourism Industry, 1996; Making Tourism More Sustainable, 2005, etc), WCPA, IUCN, UNEP, ICOMOS and other organizations. The scope of activities has been even wider at EU level, from European Charter for Sustainable Tourism in Protected Areas (1995) to Agenda for a sustainable and competitive European tourism (2007), from European Cultural Convention (1954) to European Landscape Convention (2000) and Draft Framework Convention of the Council of Europe on the value of cultural heritage for society (2005).

All these activities and support for implementing the concept of sustainable development steered the connections and coordination among different stakeholders in

tourism and heritage protection, and with government bodies.

The Lascaux Cave can serve as an example of the sustainable protection and presentation of cultural heritage. The Lascaux Cave is a complex of caves which consists of six rooms and several connecting corridors. On the cave walls and ceilings there are 2000 paintings and 900 can be identified as depicting animals.

After the Second World War, the cave was open to the public, but in 1955 already there appeared the traces of degradation on its paintings caused by the concentration of carbon dioxide emitted by 1,200 visitors per day. In 1963, the French authorities closed the cave to the public in order to restore the paintings. Their restoration was completed in 1973, but the cave has remained accessible only to research and conservation/restoration teams to the present day.

In 1983, due to the great interest taken by visitors, an exact replica of the Great Hall of the Bulls and the Painted Gallery, known as Lascaux II, was opened to the public in a cave in the village of Montignac.

In this way, cultural heritage is protected for future generations, while the created attraction is open to visitors. In 2000 and 2008, due to the appearance of fungi, the Lascaux Cave had to be completely closed and restored once again.

On both occasions, apart from the competent government bodies, French tour operators also took part in the rescue mission, including the visit to Lascaux II in their package tours as the main attraction (www.culture.gouv.fr/culture/dp/arheo)

Another example is the imposition of the conservation fee in Belize, a country in Central America, where 42% of the territory is under some form of protection, due to its rich natural heritage (the world's second largest coral reef, rain forests, the largest cave system in Central America, the world's only jaguar preserve, 500 protected species, several national parks) and cultural heritage (numerous archaeological sites of the Maya culture). In 1996, the Protected Areas Conservation Trust (PACT) was formed with a view to providing funds for the protection, sustainable development and management of natural resources and protected areas in Belize. The conservation fee of \$7.5 is paid by tourists at the point of entry into the country. During the period 1997-2004, thanks to this fee, the amount of \$1.7 million

was collected. The fee is also paid by cruise ship passengers, but it is lower than that charged to stationary tourists by 20%. The recreation permit fee and concession fee for protected areas are also charged. Grants from corporations and individuals represent a significant source of finance. The Trust finances different projects, especially those which are launched by local medium and small-sized enterprises with the aim to improve the quality of life of local population and heritage and resources protection (www.pactbelize.org).

THE MAIN CHALLENGES TO ACHIEVING SUSTAINABLE TOURISM AND HERITAGE PROTECTION

According to the World Tourism Organization (WTO, UNEP, 2005), the main challenges to achieving sustainable tourism are: dynamic growth management, climate change, poverty reduction and support to heritage protection.

Dynamic Growth Management

The expected growth of tourism over the next 15-20 years imposes significant pressure on all resources on which tourism development is based.

It is necessary to ensure the responsible management of tourism development in order to avoid serious disturbances and destructions of tourism destinations. This requires a very careful planning of the new development of tourism in space, better management of environmental quality and greater influence on the consumer habits of tourists.

The areas most vulnerable to tourism pressure are:

- Maritime ecosystems – natural habitats and the heritage of aquatic and coastal ecosystems are especially vulnerable to errors in locating tourism-related facilities and contents, excessive concentration of tourists and inadequate or non-existent wastewater treatment systems in tourist complexes and on board cruise ships;
- Biodiversity of the most vulnerable ecosystems – endangered by tourist visits and movements (mountain regions, protected natural resources, etc.);
- Historic cities and attractive cultural heritage sites – especially vulnerable to the excessive concentration of tourists and traffic congestion, which also affect the quality of life of local population.

One of the best known examples of tourism pressure on heritage and a local community is the city of Venice.

Proceeding on the vulnerability of the historic city of Venice and popularity of this destination, the spatial marginal capacity was determined on a number of occasions. According to the analyses made in 1991, the carrying capacity of Venice should be 25,000 tourists per day. In August of the same year, Venice was visited by about 38,000 tourists and excursionists per day. At that time already, the estimated capacity was exceeded every second day of the year, showing an upward tendency in excessive frequency and volume.

Local and national authorities have not taken any steps to direct and manage the volume and intensity of tourism in this city. The adverse impacts of mass tourism, especially excursionist one, have contributed to the movement of the local population out of the historic nucleus and disruption of urban identity (Picture 1), as well as the lowering of the quality of urban life and tourist experience (Swarbrooke, 2005).



Picture 1: Degradation of the historic nucleus of Venice
Source: Maksin et al. (2009), p. 74

Dubrovnik is faced with a similar problem. The high concentration of tourists in the historic city nucleus is further increased by cruise ship excursionists. This impairs the tourist experience and affects the way of life and survival of the local population. Local inhabitants have launched an initiative with the local and national authorities for the introduction of the time zoning of visits to the historic city nucleus. Another problem is posed by the impact of several factors. The real estate prices in Dubrovnik are the highest in Croatia. The attractiveness of the historic city nucleus induced a great number of foreign tourists to buy flats for second homes and other facilities in it. The city authorities did not conduct an adequate policy, thus encouraging the local population to remain in the historic city

nucleus and discouraging increased real estate demand. Thus, the most attractive part of Dubrovnik has almost remained without its permanent residents (1902 inhabitants 2006 in comparison to 5439 inh. 1961) and has been losing its authenticity. Without the culture of life, social milieu, specific dialect and other characteristics of the local population, the protection and presentation of cultural heritage and tourism are suffering a great loss. Dubrovnik will also be faced very soon with the problem of maintaining the buildings that are seasonally used, usually once a year, and the degradation of the cultural heritage of the historic city nucleus will begin (Đukić, Jerković, 2008).

As for the vulnerable areas exposed to constant tourism pressure, some authors (Weaver, 2006) advocate the differentiation of spaces and activities into entities/zones for:

- More intensive tourism development, so-called "front-stage" zones;
- Residential zones and resident population settlements, so-called "back-stage" zones;
- Protective belts between these zones/entities, so-called "buffer" zones.

This approach is unavoidable in the case of cultural heritage in Giza. The attractive cultural heritage area in Giza is a typical example of mixed functions and activities, high concentration and pressures of different users on this heritage and its environment. This causes discontent among foreign tourists, because their experience of cultural monuments is impaired. This also resulted in increased intolerance between the local population that provides tourism services and the residents of Cairo who regard the area as an urban park for rest and recreation. The local and urban populations hold that the problem would be solved by space zoning according to the type of visitors (Weaver, 2006).

Poverty Reduction

The millennium aim of the United Nations is to reduce the world's poverty by half until 2015.

The contribution of tourism towards achieving this aim is based on the use of comparative advantages of poor countries with the preserved national and cultural resources and heritage. As a labour-intensive industry with low entry barriers, tourism is making the greatest contribution to rural areas, which account for about two-thirds of the poor.

The challenge lies in a more equitable

distribution of tourist receipts and finding the way to allot one part of tourism consumption to poor community members.

Another challenge is to reverse the tendencies in the quality of tourism-related activities, especially for the local population by providing adequately paid jobs and career advancement prospects for employees.

Support to Heritage Protection

The world is faced with the problem of ensuring adequate financial resources for the protection of natural and cultural heritage. Financial support to the protection of natural and cultural heritage is partially provided from countries' public revenues. Developing countries earmark less than 30% of funds required for heritage protection, while some countries reduced these funds by nearly 50% during the past decade.

So far, tourism has mostly indirectly contributed to heritage protection, primarily by increasing the income of the regions with protected heritage with the funds coming from: charging entrance fees for protected heritage, fees for the utilization of protected heritage and resources, building permits, concessions and the like. This form of tourism contribution can be increased.

Charging entrance fees for the most valuable natural and immovable cultural heritage is most often practiced as an instrument to control the number of visitors and their impact on the environment and heritage, in accordance with the carrying capacity of protected space and tourism destination. Their use can be differentiated, depending on the vulnerability of heritage to tourism pressure during the year and on the socio-economic characteristics of visitors in order to prevent the economic discrimination of tourists. The purpose of the funds so collected is also important when determining the prices of entrance fees and other charges. It is held that the higher price of an entrance fee or charge is justified when the funds are invested in heritage protection and spatial arrangement, or are used to support local communities.

The City of Zagreb introduced a monument annuity, which represents a share of earned income or profits from the specific benefits of utilizing cultural heritage. The monument annuity is paid by income or profit tax payers who perform their business activities within cultural sites. The amount of such an annuity depends on the significance of cultural site and the size of business space (www.zagreb.hr).

Insofar as tourist fees (for the benefits of utilizing tourism space) and taxes are concerned, the following questions are significant from the aspect of sustainable tourism: (i) are they specifically imposed for sustainable destination development; (ii) who will pay them – tourists or the tourism industry; (iii) are they equally or evenly applied to all subsectors of the tourism industry; (iv) are the amount and purpose of the fee or tax supported by all those concerned; (v) are the collected funds distributed to the local community; (vi) are the funds used to financially support destination management, environmental protection and the social aspects of destination development; (vii) is the use of funds transparent and public, and the like (WTO, UNEP, 2005).

The challenge is to increase the direct contribution of tourism to the protection of heritage and sustainable utilization of protected areas by: investing in heritage protection, environmental protection and spatial arrangement; by providing an additional or alternative source of income to rural households and local communities utilizing natural resources in a sustainable way (organic production, rationalization of water consumption, use of new and renewable sources of energy) and the like (ibid.).

Climate Change

Climate change poses the main challenge to long-term tourism sustainability. It is the question of mutual impact – climate change will influence tourism development, while tourism will contribute to climate change.

The contribution of tourism to total emissions of greenhouse gases is estimated at 5.3%, whereby transport accounts for about 75% (WTO, UNEP, 2008).

Direct climate impacts on tourism will be manifested in two forms – a change in the length and quality of the tourist season and an increase in the costs and disturbances of tourism-related activities. Direct climate impacts on heritage will have an indirect impact on tourism. They will be reflected in environmental and heritage disturbances caused by climate change, which can have significant effects on tourism development in some regions and destinations.

Changes in the quantity and quality of available water and snow resources, loss of biodiversity, endangered agricultural production (e.g. wine tourism), higher risks of natural catastrophes,

bank erosion, flooding, impaired landscape aesthetics and other changes will have a great impact on tourism.

Mountain, coastal and insular destinations, where tourism is based on natural tourism resources, are distinctly vulnerable to environmental change caused by climate change.

In its 2005 report, the World Heritage Centre (UNESCO WHC) points out that the climate change impacts on natural and cultural heritage will affect nature-based tourism, ecotourism, cultural tourism, safari tourism and other tourism products.

The UNESCO WHC (2007) has identified several items from the World Cultural and Natural Heritage List as critical tourism destinations that will be endangered by climate change, including:

- Venice, due to increased sea level; during the past decade, it was under water about 100 days per year (Picture 2);
- Great Barrier Reef, Australia, due to coral bleaching and dying;
- Glacier-Waterton International Peace Park, USA, due to thawing glaciers;
- Kilimanjaro National Park, Tanzania, due to the dramatic shrinking of its snow cap (half a metre per year) and its loss within the next 15 years;
- Chan Chan Archaeological Zone, Peru, due to soil instability arising from flooding and erosion caused by the El Niño phenomenon;
- Monuments in the centre of London (Westminster Palace, Westminster Abbey and the Tower of London), due to increased sea and Thames water levels.



Picture 2: Venice under water
Source: Maksin et al. (2009), p. 81

THE RESPONSES AND ADJUSTMENTS TO THE CHALLENGES OF SUSTAINABLE TOURISM AND HERITAGE PROTECTION

The responses to the challenges are based on the basic principles and approaches concerning the development and implementation of sustainable tourism, including specifically the establishment of a strategic sustainability framework, achieving the sustainability of tourism destinations and products, as well as achieving and monitoring continuous progress towards sustainable development.

The establishment of a strategic sustainability framework includes the application of the following sustainability approaches and principles: a holistic approach, inclusion and mutual cooperation of key actors/stakeholders, long-term strategic planning, overcoming of global and local impacts, promotion of sustainable consumption and the equalization of sustainability with quality. Achieving the sustainability of tourism destinations and products includes the application of the following sustainability approaches and principles: the “polluter pays” principle, prevention principle, product life cycle, consideration and evaluation of several options for the development of destinations, products and/or services, as well as the observance of sustainable development boundaries.

The continuous performance and monitoring of the process of sustainable development include the implementation of the following sustainability approaches and principles: adaptation to changes and indicator-based monitoring of the process (WTO, UNEP, 2005).

The application of the mentioned principles and approaches to the development and implementation of sustainable tourism will have a significant impact on the protection of cultural and natural heritage. This paper points out only several most significant responses of common interest to sustainable tourism development and heritage protection – the observance of sustainable development boundaries, promotion of sustainable consumption and adaptations to climate change.

The observance of sustainable development boundaries implies the readiness and capability to restrict tourism development or the volume of tourist movements within a

destination in accordance with the sustainability requirements, that is, the destination carrying capacity, especially when the regions vulnerable to tourism pressure are in question.

In spatial planning and sustainable development management, spatial capacity is equated with the carrying capacity of a (tourist) region, settlement or centre.

To avoid the consequences of unplanned tourism development, the public authorities in Malta set the marginal spatial capacity at about 41,000 one-time tourists and formulated a tourism development strategy and policy. This is a prerequisite for the use of the resources of the European Structural Fund intended for the improvement of the quality of tourism supply and the protection of the natural and cultural heritage of the island (WTO, UNEP, 2005).

The promotion of sustainable consumption is primarily aimed at influencing the volume and kind of tourism demand with respect to the choice of the tourism product and mode of transport. Priority is given to the development of environmentally sustainable modes of transport and the reduction of traffic congestion.

A radical example is the City of San Marino where the movement of motor vehicles is banned. The City of San Marino is situated on top of Mont Titano (749 m) and fortified by triple walls. Within its walls there are narrow cobbled streets with medieval and renaissance buildings, many of which have been restored and reconstructed. The City of San Marino can be reached directly from the town of Borgo Maggiore by cable car with two passenger cabins. Tourist buses and other motor vehicles are parked at the foot of Mont Titano, or in front of the city walls. Tourists take a sightseeing tour by coach or on foot (ibid).

The centre of London is a good example of implementing efficient measures for traffic congestion and pollution reduction. In the designated zone the charge for the use of individual cars is paid from 7 a.m. to 6 p.m. (Monday through Friday). The groups of motorists and subsidized vehicles using hybrid fuels are exempt from the charge. The implementation of this measure is controlled by the camera network. In addition, all modes of public transport in London have been improved. Within three years, the number of individual cars dropped by 19%, while emissions of carbon dioxide and other harmful gases were reduced by 16% and 7-14%

respectively. Annual savings (measured in terms of fuel consumption, reduction of emissions, etc.) amounted to €140 million (EEA, 2008).

All destinations will have to adapt to climate change to a greater or lesser degree. The tourism sector is developing various modalities and combinations of destination adaptations to climate change in the fields of technology, destination management, coordination of different policies, researches and monitoring of changes in the endangered regions and appearance of risks, education of the employed, tourists and the public, etc.

As for the most vulnerable regions, all forms of adaptation to climate change are adjusted to the crucial problems related to the protection of resources and heritage, preservation of attractiveness, sustainability and competitiveness of destinations. This refers, above all, to mountain and winter destinations, insular, coastal and natural and cultural heritage destinations.

The adaptation of natural and cultural heritage destinations to climate change is based on the combination of different approaches and measures, such as:

- The implementation of plans for adaptation or responses to climate change – for water supply in arid destinations, seawater desalination (the case of Mallorca), assessment of risks and responses to natural catastrophes (beach and mountain soil erosion, avalanches, winds, etc.), development of early warning systems (for floods, winds, etc.);
- The implementation of the research and monitoring programme relating to changes in ecosystems and cultural heritage, and the undertaking of appropriate measures for biodiversity and heritage protection;
- The diversification of the destination product in order to reduce pressure on heritage – new micro destinations and attractions for disburdening the most popular and most vulnerable natural and cultural heritage sites;
- Redefining the scope and regime of protection and the utilization of protected space – expansion of the scope of protected space, differentiation of zones with different space protection and utilization regimes, formation of ecological corridors for the migration of different species, etc. (Maksin-Mičić, 2003);
- The reconstruction and stabilization of cultural heritage, especially architectural and

archaeological structures and entities by using traditional materials and skills in order to preserve their aesthetic values and attractiveness, in combination with modern engineering and technologies, thus ensuring the long-term effects of undertaken protective measures;

- The relocation and introduction of endangered species in other habitats, or keeping genes and seeds on ice;
- Increasing the adaptive capacity of local authorities and improving destination and protected heritage management;
- Education and strengthening awareness about the minimization of stresses caused by climate change;
- Improving the management of tourist movement patterns and traffic congestion – in order to prevent pressure and threats to heritage;
- Ensuring the active participation of local communities in policy formulation and the management of destination adaptations, etc. (WTO, UNEP, 2008).

One example of the responses to such challenges is the MOSE Project intended for Venice flood control (MOSE – acronym for Modulo Sperimentale Elettromeccanico – in English, Experimental Electromechanical Module; the name MOSE is also a play on the Italian name of Moses – Mosè). The realization of the MOSE Project worth about €4.5 billion started in 2003 and it should be completed in 2012.

The project intended to protect the city from flooding consists of 79 mobile gates (barriers), erected under the water at three lagoon inlets and along Lido. They will be raised whenever the sea level increases by 110 cm. The gates will be about 30 m high and about 20 m wide (www2.comune.venezia.it).

PARTNERSHIP FOR SUSTAINABILITY

In the “Agenda for a sustainable and competitive European tourism” (2007) it is emphasized that to achieve the aims and deal with the challenges, it is necessary to take coherent action, supported by the sustainable management of destinations, integration of sustainability into the process of decision-making and management of tourist enterprises, as well as raising both public awareness and awareness among tourists about the significance of the sustainability concept.

Among other things, the European Commission promotes sustainable destinations by implementing the pilot project "European Destinations of Excellence" (EDEN) with the aim to apply their experiences to other European destinations. At the same time, the European Commission invited International Organizations (UNWTO, UNEP, UNESCO, etc) to contribute by identifying synergies between their field of activities and the European Agenda.

We are convinced that participation, cooperation and partnership among key actors and the visionariness and enthusiasm of individuals are a prerequisite for the implementation of the sustainable development concept and tourism complementarity and synergies with heritage protection.

Are there such examples in Serbia?

Gradac Monastery is a women's monastery having the most educated sorority (with university education) in Serbia. Within its compound there are the icon painting, weaving, embroidery and packaging workshops. The nuns are also engaged in painting churches in Trebinje and Dalmatia.

Gradac Monastery is a women's monastery having the most educated sorority (with university education) in Serbia. Within its compound there are the icon painting, weaving, embroidery and packaging workshops. The nuns are also engaged in painting churches in Trebinje and Dalmatia.

It is planned to open a girls' boarding high school within the monastery where, apart from the classical subjects, church history, singing and the Church Slavonic language would also be taught. It is also planned to organize small icon and fresco painting schools so as to acquaint visitors with the basic painting techniques and the Orthodox approach to them. Father Vitalije, a graduate electrical engineer, develops computer programs. He has also made an Orthodox ABC book for the first grade of elementary school.

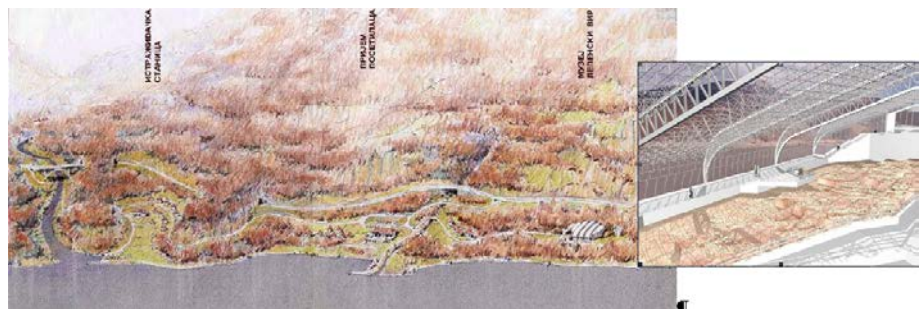
For four years already, Gradac Monastery has been the venue of the cultural event entitled "The Days of Helen of Anjou". One part of the programme is devoted to the life and work of Helen of Anjou, that is, nun Jelisaveta, while the other part includes various cultural contents. The theme of the event organized on 10 May 2009 was chivalry, which had to reflect the spirit of this Serbian queen. It was organized by the chivalry association SVIBOR (Politika, 15th May 2009).

As for Lepenski Vir, one of the most significant archaeological sites in this part of Europe, nothing has been done over the past 30 years or, more precisely, since its relocation due to the construction of the Djerdap Dam and formation of a storage lake, except for the erection of a temporary protective wooden structure.

The elaboration of the plan and designs concerning the protection, arrangement and presentation of the Lepenski Vir archaeological site started at the end of 2006 (Picture 3). The key partners in the elaboration and realization of the project are the Tourist Organization of Majdanpek Municipality (having its seat in Donji Milanovac), Republican Institute for the Protection of Cultural Monuments from Belgrade and the ministry in charge of tourism. The funding is provided under the National Investment Plan.

The persons responsible for the realization of the project are: Vesna Vandić, Director of the Tourist Organization of Majdanpek Municipality, and the authors of the project Marija Jovin and Siniša Temerinski from the Republican Institute for the Protection of Cultural Monuments.

The detailed regulation plan covers the riparian belt with the surroundings of the Lepenski Vir site, which extends over an area of about 55 ha, in order to enable the planned arrangement and presentation of the protected archaeological site and natural heritage of the Djerdap National Park and reception of visitors from the Danube (docking point) and mainland in the visitor centre.



Picture 3: The protection and presentation plan of the Lepenski Vir archaeological site
Source: www.temerinski.com

The basic assumption of the project for the Lepenski Vir Museum is to preserve the atmosphere of an open-air prehistoric settlement. Therefore, it is anticipated to dematerialize the structural members and roof and to retain the view of the Danube under full daylight (www.temerinski.com).

The key problem concerning the protection and presentation of Viminacium near Stari Kostolac, in the vicinity of Požarevac, the archaeological site of one of the most

important Roman military camps on the Danube and, for some time, the capital of the Roman province of Upper Moesia, is its conflict with lignite open-pit mining and processing (Drmno Thermal Power Plant, Picture 4).

However, it is possible to convert this conflict into a compromise and winning combination for heritage protection and tourism development through cooperation among key actors.

This is proved by the exploration, protection and arrangement of Viminacium site and tourist turnover (50,000 visitors in 2007 and 2008).

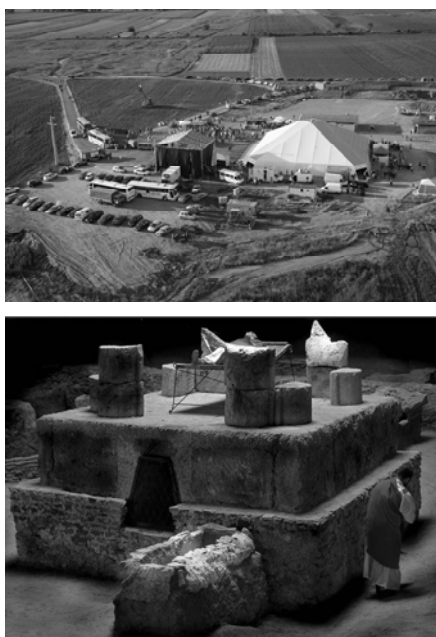
The key partners are: the Archaeological Institute of the Serbian Academy of Sciences and Arts, Ministry of Culture and Public Enterprise "Electric Power Industry of Serbia".

Visitors are greeted by professional guides dressed in Roman togas and tunics, who will take them to three sites (Picture 5): Porta Praetoria (the northern gate of the camp, history of the Roman camp and town), Termæ (thermal baths, the centre of social life in ancient Rome) and Imperial Mausoleum (Roman beliefs and customs concerning the afterlife and the elements of Roman sacral architecture).

The visitors can experience ride by Roman chariot and taste Roman dishes and beverages from the replicas of antique cups and plates.



Picture 4: Viminacium and lignite open-pit mining site
Source: Maksin et al. (2009), p. 138



Picture 5: The presentation of Viminacium

Source: Maksin et al. (2009), p. 140

The construction of the visitor centre, including the research centre, laboratory, library, multimedia centre, exhibit gallery and storage, is nearing completion.

In 2008, Emma Shapplin, a neoclassical artist of international repute, held a concert in the Mausoleum of Roman Emperor Hostilian, within the event entitled "Roman Night". It is planned to organize theatre performances, film showing, fashion shows, exhibitions and the like at the same site (www.viminacium.org.rs).

The project is realized by the multidisciplinary team led by Dr Miomir Korać from the Archaeological Institute of the Serbian Academy of Sciences and Arts.

CONCLUSION

What are the preconditions and possibilities for heritage protection and the development of Serbia as a sustainable, authentic and competitive tourism destination?

The first precondition is to provide a legal and planning basis for the implementation of the sustainable development concept and, within its scope, sustainable tourism. Among other things, this implies the adjustment of the legal basis with the set of environmental protection laws, in particular. Insofar as the planning basis is concerned, it is necessary to establish the procedures and mechanisms for planning coordination and integration, which especially refers to the coordination and integration of

sectoral tourism plans with the spatial ones and planning of environmental and heritage protection.

This is also a precondition for achieving coordination and cooperation among key actors concerning heritage protection and sustainable utilization for tourism development.

In this connection, the role of national level government is especially significant in formulating the modalities for making public-private arrangements and mechanisms for encouraging the participation (investment) of the private sector. Then only it will be possible to speak about the establishment of efficient formal and informal partnerships among key actors in the public and private sectors in the development of Serbia as a sustainable and competitive tourism destination in the European surroundings.

Although the above mentioned preconditions have not been fulfilled, the paper points to the examples of good practice in the sustainable development of tourism and cultural activities, based on the protection, presentation and interpretation of our cultural heritage. The key problem, which should be relatively easily solved, is that we have only begun to recognize the attractiveness of cultural heritage and cultural values of different regional entities for the development of tourism destinations in Serbia. Another problem is posed by insufficient human resources investments and the relatively low cultural capital of the greatest part of the territory, with the exception of several largest urban and university centres. This significantly restricts the action potential of the population and individuals to take a proactive part in new tourism development initiatives and adequately evaluate, protect and present heritage and cultural values.

To overcome this problem, it is necessary to ensure continuous incentives at all levels of government, especially at the republican one, concerning the provision of quality human resources and the strengthening of the cultural capital of destinations with the most attractive natural and cultural heritage and, in particular, the possibilities for the acquisition of new knowledge on the part of the local population, entrepreneurs and employed in local self-government units concerning the activities related to the protection and presentation of heritage and tourism development. Only the well-informed and educated actors can successfully coordinate and integrate the activities related to the provision of sustainable

heritage protection, sustainable tourism and complementary activities, which is confirmed by the nuns of Gradac Monastery and the employed in the Majdanpek Tourist Organization and Viminacium Centre for New Technologies.

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APPROACH TO IDENTIFICATION AND DEVELOPMENT OF MOUNTAIN TOURISM REGIONS AND DESTINATIONS IN SERBIA WITH SPECIAL REFERENCE TO THE STARA PLANINA MOUNTAIN

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This paper deals with theoretical-methodological issues of tourism offer planning and regulation of settlements in mountain destinations. The basic determinants of the development of mountain tourist regions destinations in EU countries, in which respectable development results have been achieved, first of all in terms of income, together with appropriately adjusted development and environmental management system, have been emphasized. The ongoing transition and structural processes in Serbia will have an impact on application of these experiences. At the same time, a basis for competitiveness of mountain regions will not be determined only by spatial capacity and geological location, but also by creative-innovative developing environment. Taking into account the spatial-functional criteria and criteria for the development and protection, the possible spatial definition of mountain tourist regions/destinations in Serbia are presented. The justifiability and positioning of tourism development projects are analyzed aiming at uniform regional development, where two segments of demand are of particularly importance, i.e. demand for mountain tourism services and for real estates in mountain centers. Furthermore, holders of tourism offer will be analyzed through a contemporary approach which may be defined as the development and non-commercial and market and commercial one. International criteria which are evaluated while selecting city/mountain destination for Winter Olympic Games are particularly analyzed. Considering experience of countries with higher level of development of mountain regions, the main starting point for positioning projects for sustainable development of tourist destinations are defined by specifying them according to specific local and regional conditions. A rational model for spatial organization of tourism offer is shown on the example of the Stara Planina tourist region.

Key words: regulation of settlements, tourism offer, tourist region, sustainable development

INTRODUCTION

Mountain regions consist of various regional entities, sub-entities and parts which need to be physically and functionally organized and regulated with the aim to preserve natural values, develop and regulate system of tourist centers and settlements and tourist-recreational infrastructure. Mountain

destinations cannot be considered only as spaces for rest and recreation, but also as "economic enterprises" which function organizedly as, more or less, spatial entities, and which require appropriate urbanization that would direct development towards creation of authentic ambience, use of local materials, energy efficiency and, in certain sense, typizations in terms of urban planning, architecture and development (Marić, 2002). Urbanization is, as a rule, directed in two directions, towards the points of intensive tourism offer, such as mountain

centers/resorts, and towards the places of less intensive tourism offer, i.e. towards traditional or new settlements in mountain regions. Urbanization of mountain regions may be concentrated or dispersive one, each having certain limitations. Concentrated development influences creation of large urbanized areas which may have an impact on natural balance and requires a long realization period, as well as an impact of works on the nature; danger due to non-functioning of sewage system, etc. Dispersive development has the following deficiencies:

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greater soil erosion and cost of the provision of infrastructure; greater number of polluters during the heating season; greater number of waste disposal locations and waste collection problem, occupation of greater land areas, etc. Possible solution may be found in limiting the urbanization in the most attractive parts of altitude zones according to the capacity of space and nature protection regime, as well as in activation of several smaller localities in lower parts and sub-mountain villages by including local population in tourism development. In cases where there are several mountain tourist centers and settlements in a mountain region, regulation includes infrastructure linkage, linkage of tangent facilities of tourism offer in the area, connectivity between the protected areas, development of public services adjusted to the needs of tourists, local population and functions of settlements, etc.

Integral development of mountain regions is based on several strategic goals (ESDP, 1999; Zanetti, 2000; Ravbar, 2003): integral and sustainable spatial development; balanced and polycentric development of metropolitan regions with functional zones of sustainable and dynamic functional integrations and partnerships between urban, rural and mountain regions, thus enabling the strengthening of economic competitiveness of mountain regions; resolving the problem of development in scarcely inhabited mountain areas by creating conditions for population to stay and return and conditions for rest and recreation of urban population; development of infrastructure, better access to traffic and improvement of access to information; development of mountain tourist centers/resorts according to natural conditions and standards of planning, regulation and development by forming organized and compact clusters thus enabling greater competitiveness; greater authenticity and better image both through integration with local cultural and natural environment and through application of spatial and urban planning standards by investors, promoters, developers and operators in tourism.

Defining the strategic development goals is only an initial phase in determining strategies for a long-term development of mountain regions in Serbia. The goals are conditioned, just like the development itself, by the need to make selection and choice of priorities in the development of mountain regions. However, this is not possible unless prior regionalization of these regions is done and, within it, also

identification of tourist regions as the most appropriate functional spatial parts for stabilization and acceleration of a mountain region with tourism as a key driving force. Determining priorities according to the goals for the development of mountain regions is conditioned by the scope and structure of available natural, human and capital resources, as well as economic, social and ecological effects of the realized and current development processes. Availability and structure of development resources, and particularly realization of socio-economic effects expressed through overall national income, in particular by the level of national income per capita, which is dynamically conditioned by greater capital investments and realized employment rate, markedly vary from mountain region to mountain region in Serbia. Some parts of mountain regions, spatially limited, but naturally predetermined for contemporary economic activities, primarily tourism related activities, have far greater chances for the development compared to other mountain regions which are, otherwise, underdeveloped in Serbia (Milijić, 2005). The choice and determination of priorities in interwoven development, spatial and ecological contexts is conditioned by existence of a limited number of mountain complexes with opportunity for faster development based on tourism as a major driving force. To assess, analyze and determine these priorities, it is necessary to make regionalization of mountain regions, however, less by principles of homogeneity, as the regional geography does, but more by principles of development and ecological (protection) functionality. At the same time, spatial and environmental planning should have an important role both in identification of mountain tourist space and in coordination and integration of various fields of planning in achieving a sustainable regional development (Maksin-Mičić et al., 2009). Regionalization of mountain regions according to indicators of and criteria for development-ecological functionality requires the tourism, as a driving force with reciprocal effects of the development and connections and relationships which may be ecologically controlled, to be spatially defined and designated by the system for identification of tourist regions and destinations. In this way, including analytical deliberations and comparisons, one gets an insight in diverse possibilities for their development and ecological protection, which is a basis for the choice and determination of priorities for the

development of mountain regions and their hierarchical-functional rating, thus finally enabling planning, regulation and development of mountain destinations.

Starting from the goals for integral development, the regional differentiation of mountain regions lies in a criterion for determining the level at which they are integrated into national economy. By applying this criterion, they are classified in three groups: *integrated mountain regions* – with growing population and employment, due to realization of projects for tourism and complementary activity development, as well as due to established image of a destination with developed tourism market; *insufficiently integrated mountain regions* – with population stagnation and prevailing sources of income coming from agricultural production, which are relatively remote from urban centers and without developed tourist capacities and tourism market; and *neglected mountain regions* – with lowest population density and income, worst qualitative and quantitative population structure, economic activities and road network. Support from the EU structural funds is directed based on the level of development, i.e. on the level of mountain region integration. At the same time, there are certain differences which are dependent on whether greater attention is paid to development of tourism, agriculture and diversification of activities in order to provide additional sources of income, or to renewal of settlements and infrastructure, provision of higher level of public services and other services and improvement of quality of life in mountain regions and their immediate environment.

APPROACH TO IDENTIFICATION OF MOUNTAIN TOURIST REGIONS IN SERBIA

Regionalization of mountain regions in Serbia into tourist regions does not follow steps, but rather regionalization processes based on analytical manifold identification of natural and created potentials and disparity as key dynamic and not static physical indicators and criteria for designating the regions as developmental spatial entities and subjects. However, designating mountain regions as tourist regions leaves large parts of these regions outside development impetus, thus widening the problem of non-uniform regional development. This problem arises in a wider context of an approach to the development of

mountain regions, but in the context of the objectively considered and checked development possibilities susceptible to interaction between time and space, i.e. certainty and uncertainty in the sense of fluctuation, cycles, rise and fall, and particularly non-uniformity. What the regionalization of mountain regions proves is that the development in space is not uniform and that there are many procedures for defining regions, depending on the final goal, demands and expectations. Regionalization of mountain regions in Serbia for the purpose of determining development priorities requires identification of tourist regions and destinations, which further requires application of a specific procedure. This may be realized by using rich scientific professional and practical experience of western developed countries.

The selection of primary mountain destinations and choice of development priorities of mountain regions in Serbia has been made based on analytical deliberations and checking of data and information on differentiation of these spaces relative to the existence of specific development potentials, and, in doing so, the following criteria were applied: evaluation of natural and anthropogenic factors of development; evaluation of capacity of space; possibility for overcoming limitations; and complementarity between the development concept and natural resources in environment and nature protection. Primary mountain tourist destinations as regional entities of integrated offer within tourist clusters have been identified by criteria for participation of a year-round tourist season in: 1) mountain destinations with smaller participation in year-round offer – Šumadija mountains and Kučaj Mountains; 2) mountain destinations with considerable participation of year-round offer – Valjevo-Podrinje mountains; Drina-Tara-Zlatibor; and Zlatar-Pešter, and 3) mountain destinations with a complete year-round offer – Stara planina, Vlasina-Krajište, Kopaonik, Golija, Prokletije with Mokra Gora, and Šar Planina mountains (Dabić et al., 2009). Starting from the possibility for applying experiences of European mountain tourist centers, it has been estimated that, under assumption of improving the management system, a sustainable and competitive development of mountain destinations in Serbia may be realized on a long-term basis, the priorities being High mountain region of Kopaonik (modernization of ski infrastructure, development of tourist places and places for rest, completing, traffic

connections and integration of offer into environment), and Stara Planina (development of tourist places, places for rest and ski centers) associated with an attempt to maintain the status of natural resources.

However, previous criteria must be fitted into procedure for regionalization of mountain regions in Serbia given that selecting priority mountain entity is conditioned and predetermined by this. A comprehensive and detailed regionalization of mountain regions in Serbia directed towards development and protection has not been made to date, and such approach has not been applied in professional practice either. However, partial and mutually uncoordinated identification and delimitation, i.e. selection of homogeneous mountain regions, have been carried out based on (Tošić and Krnić, 2002): physical geographical, primarily morphological and ecological climatic characteristics, which have been identified with mountain systems; socio-economic impacts in transformation of mountain landscapes which relied on cultural social constants established by Jovan Cvijić, and which have today been reduced to giving attributes to certain functions which a mountain region has (tourist and forest functions, function of cattle breeding, etc.); and conditionally integral approach based on complex indicators of geographic, socio-economic and functional parameters used for the needs of selecting tourist regions in the Spatial Plan of the Republic of Serbia (PPRS 1996).

Mountain regions, from the geo-spatial aspect, may be considered at macro, mezo and micro levels. At the macro level, mountain regions are presented as mountain, mountain ravine and mountain valley systems, at the mezo level as mountain area, and at the micro level as inner-mountain landscape entities. Although they are characterized by individuality and integrality, the structure of mountain regions is most often heterogeneous according to tectonic geological, morphological, climatic, ecological and socio-economic characteristics. There is no uniform typology of mountain regions in regional geography, regional sciences and spatial planning, but there are different approaches to their identification and spatial selection.

In the Draft Plan of the Republic of Serbia (Nacr PPRS 2010), regionalization of tourist spaces in Serbia, amongst which also of mountain regions, is identified with tourist clusters in Serbia, which are selected

according to the Decision on Nomenclature of Territorial Units for Statistics and the Law on Regional Development. Thus, the territory of Serbia has indicatively been divided in five tourist clusters, as there are "statistical regions" (Vojvodina, Belgrade, Southeast Serbia, Central and Western Serbia, and Kosovo and Metohija). Tourist clusters, as a resource basis and basic areas of tourism development, should represent spatial functional entities of unified tourism offer, including tourist destinations/regions of related characteristics, city tourist centers and places, spa tourist centers and places, as well as segments of circular and linear tourist directions, etc. Given that they should be based on economic footholds for the further development, the market will have an impact on final formation of clusters. Therefore, such division of tourist spaces in Serbia, in the process of implementing spatial plans should not be considered as strictly physical division, but as partly statistical and progressively functional one, since tourist spaces (destinations / regions) most often encompass the territory of two or more adjoining municipalities, and not rarely the territory of more than one region, which means that a tourist space and/or its parts may be located within one or more administratively competent territorial entities. This has been proven in practice of the developed Western European countries indicating that, in the spatial functional context, the development and protection of priority mountain regions are directed by designating and spatially defining tourist regions and destinations on the basis of the following criteria: presence, quality, equality, attractiveness and uniqueness of natural and created potentials for tourism development; possibility of using potentials in the function of contemporary, complex, integral and year-round tourism offer; geographical position and access to traffic in tourist regions with relation to the existing and potential markets; possibility of extending tourist season to the maximum and secure higher occupancy rate of capacities; the existing and possible rank of protection and regime of the use of natural and cultural values of tourist regions; and the role of tourism as an agent for developing complementary activities, particularly in insufficiently developed regions. Important segments of tourist regions/destinations are tourist localities, facilities, places and centers, which have to be unified in a functional and development sense for the purpose of joint appearance on both

international and home market (Mitrović et al., 2002), which is well laid out in the following scheme (Figure 1).

In order to more comprehensively consider and understand activities and functioning of a tourist region and its abovementioned segments, it is necessary to point out that it establishes business connections based on: complex tourism product, i.e. income; unified appearance on market; coordination of functions for improving the development by continually investment; and by coordinating the protection of space through appropriate systems of developing, regulating and using the covered space (Figure 2).

Depending on dominant economic activities and their trends, a spectrum of development processes is created, as well as tendencies to polarize functions. In this sense, spatial and socio-economic categories represent development poles which are found in parts or surrounding of mountain tourist regions as centers which have capital for activating development of mountain regions or as centers attracting capital, and whose offer is in demand on market. It has been concluded that tourism is a dominant economic activity in mountain regions since it has a capacity for initiating innovative activities, i.e. a capacity for initiating a whole spectrum of complementary activities which have a reciprocal impact on formation

problem of regionalization of mountain tourist regions arises in situations when tourism overlaps with nature protection or other functions of general social interest. In such situations, the region is made conditional upon being semi-functional region consisting of nature protected areas with tourism as one of the specific functions, and which is managed in environmentally appropriate way. This has been proven in practice of regulating the national and regional parks in most parts of Alpine regions.

APPROACH TO DEVELOPMENT OF MOUNTAIN TOURIST REGIONS

For more complete analysis of possibilities for uniform development of mountain destinations, it is necessary to analyze basic elements of justifiability and spatial positioning of specific projects. For the mountain tourism development project, two segments of home and particularly foreign demand market are important, i.e. the demand for: (1) **services in mountain tourism**; and (2) **real estates in mountain centers and settlements**. Also, for projects for development, regulation and protection of priority mountain regions in Serbia, it is necessary to critically consider experiences of countries with higher level of the development of mountain regions, specifying them according to specific local and regional conditions.

Mountain tourism, primarily winter tourism, is one of the fastest growing market segments of tourism as a result of tourists coming from the widest layers of the population, particularly young people who are interested in this form of rest and recreation. After many years of lower demand for mountain tourism, a growing demand has been recorded in Europe, which is evident from the data showing that today over 50% of income from inland tourism comes from mountain regions. Until today, over 600 mountain centers have been developed in European mountain regions, out of which 70% in Alpine countries, which are visited by 60 to 80 million annually tourists. Great number of tourists visiting mountain regions has put greater pressure on the environment, but also an increased pressure on job creation which has prevented migrations from mountain regions and has brought about positive changes in demographic trends. It is anticipated that in coming years the demand for mountain tourism will be doubled, which particularly refers to the South Eastern European countries. The development of mountain tourist centers must be integral, with particular reference to

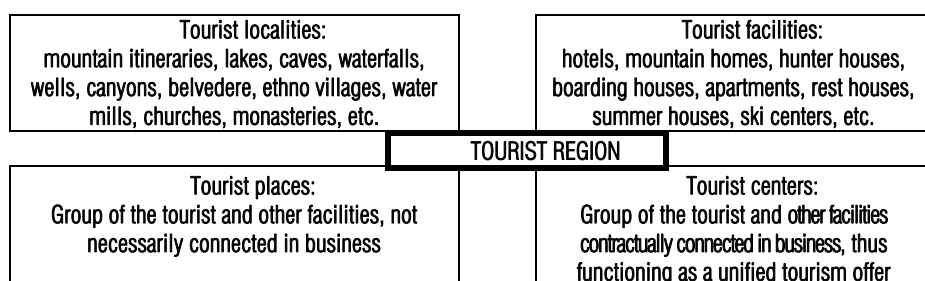


Figure 1: Segments of tourist regions

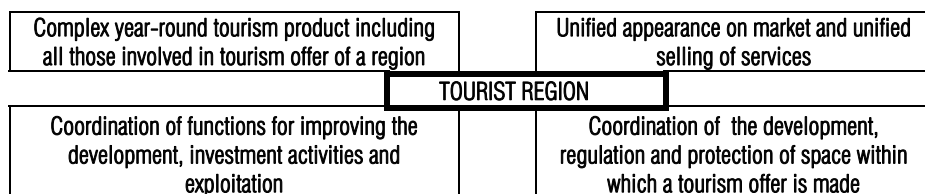


Figure 2: Business connections of a tourist region

To illustrate, but also for comparison sake, we present the number of mountain tourist regions in Alpine countries: Germany 8, Austria 6, Switzerland 6, France 5, and Italy 3. In these mountain tourist regions, where several hundred mountain centers have been developed, respectable development results have been achieved, primarily in terms of income, along with appropriate ecologically adjusted nature and environmental protection system. Also, taking into account the spatial functional and protection criteria and criteria for development, the possible designation and definition of six mountain tourist regions in Serbia have been shown, and they are the following: 1. Stari Ras (Kopaonik and Golija mountains); 2. Stari Vlah (Tara, Zlatibor, Zlatar, Pešter mountains); 3. Stara Planina and Vlasina with Krajište; 4. Prokletije and Šar Planina; 5. Valjevo-Podrinje; and 6. Kučaj-Homolje mountain regions.

and development (Derić, 2001). Tourism is a generator of development which has a capacity to transfer the innovations to agriculture and other industries supplying it with various products, semi-products and services, which may be considered as being crucial for prosperity of mountain regions. Besides, tourism has an innovative capacity oriented towards markets outside the competitive mountain region, which will depend on its competitiveness related to demand for a specific tourism product, i.e. image of mountain regions.

Regardless of spatial coverage size, national and regional development documents take into account territories, potentials and contents of tourism offer which include tourist image and preferably the administrative boundaries of administrative competence of authorities which make decisions on planning. A particular

economic constraints, regarding financial support, and natural limitations, regarding climatic conditions. In coming decades, global warming could lead to reduction in number of mountain centers with dominantly winter offer, particularly those whose locations and ski centers are in lower altitude zones. It has been estimated that two-degree rise in average temperature would lead to reduction of 40%, while rise in temperature for four degrees (expected to occur by the end of this century) would influence the reduction in number of mountain centers with the possibility for providing winter offer to about 200 centres (Milijić et al., 2006). These changes will influence re-planning of existing and development of new generation of mountain centers, i.e. a reduction in the number and change in specialization of high mountain destinations with dominantly winter offer and consequently an increase in the number of mountain centers with dominantly summer offer.

In contemporary approach to development of mountain regions, the holders of tourism offer are present in two categories: development-commercial and market-commercial one (Dabić, 1995). The development-commercial conditions of the development are provided by the national, state and regional, and somewhere, local administration system, and include investment in basic infrastructure development and development of non-commercial public facilities of tourist destinations. The non-commercial bearers of development may initiate, by various stimulative policies, and sometimes also by direct investments, some commercial contents crucial for overall development and for getting large commercial holders of tourism offer interested primarily in opening ski centers through construction of the first ski lift, etc. Commercial holders of tourism offer, as its major investors, come mainly from wider regional environments and partly from local communities (particularly land owners). Commercial holders of tourism offer are interested in directly profitable facilities (tourist accommodation, hotels, restaurants and alike, recreational sports facilities, etc.). Commercial business activities in tourist destinations imply promotion, marketing, accommodation management and public infrastructure facilities, recreation, sports, as well as coordination between these functions within various services, institutions, clubs, etc.

Examples of the development of mountain

Table 1: Example of referent mountain destinations

Country	Name of mountain center – m. a.s.l.	Number of beds	Number of inhabitants	No. of ski lifts/ trails - km	Max. altitude of ski trails - m	Rating of ski trails in % easy-interm.-difficult
SAD	Sun Valley- 1753	6 000	1654	19/150	1036	36-42-22
CAN	Whistler (3 nas.)- 680	40 000	10000	31/200	1609	20-55-25
CAN	Sun Peaks- 1255	2 500	250	6/61	900	15-60-25
CH	Crans-Montana- 1500	37 317	7000	28/140	1500	38-50-12
CH	Davos- 1560	23 824	13000	57/305	2034	20-44-39
CH	Verbier- 1500	15 200	2500	36/190	1830	33-42-25
CH	St. Moritz- 1856	13 200	5589	56/350	1553	20-70-10
CH	Zermatt- 1620	12 653	5634	63/313	2260	22-60-18
CH	Saas Fee- 1800	7 090	1672	22/145	1800	25-50-25
CH	Wengen- 1274	5 278	1405	44/110	1125	20-60-20
CH	Gstaad-1050	3 190	7199	21/90	1100	20-50-30
CH	Arolla- 2000	1 864	50	6/47	1000	25-50-25
CH	Evelone- 1380	983	950	8/42	1273	60-30-10
BUG	Bansko- 925	15 000	9000	11/65	1675	35-40-25
BUG	Borovec- 1300-1600	10 000	1500	9/40	1210	30-60-10
F	Tignes-1600-2100	9 000	2000	43/150	1810	10-65-25
F	Chamonix- 1042	6 100	5900	46/157	2800	20-67-13
A	Saalbach- 1095	17 500	3000	55/200	1003	46-49-5
A	Kitzbühel- 800	8700	8600	56/168	1200	30-40-30
A	Schladming -749	3500	4800	81/175	1243	28-61-11
A	Bad Kleinkirchheim-1100	7200	2000	26/100	1364	11-78-11

Sources: City of Sun Valley; Borovets Ski and Snowboard Mountain Resort in Bulgaria; Ski Independence, Ski resort reviews, off piste and après ski and travel guides; British Columbia Travel Guide; Destinations, Resorts, Cities, Holiday destinations in Switzerland; The Blue Book of European Ski Resorts; Property & Business Directory, Real Estate Services & Information.

destinations (Table 1) indicate that interest of international tourism market depends on the image and offer of a destination in winter and summer season; overall impression of the quality of tourist destination management and feeling of security; availability of snow (natural or artificial) for winter skiing for at least 100 days, and particularly for summer skiing on glaciers; ski lifts with overall capacity of minimum 6 to 8 thousand people simultaneously, altitude difference and great variety of ski trails; at the distance within maximum 4 to 5 hours drive or maximum flight journey time up to 2 hours; quality of hotels and apartments (capacity 2,000-4,000 beds in smaller centers, 4,000-8,000 beds in medium-sized centers, which are considered as being optimal, 10,000-15,000 beds in large centers, and over 15,000 beds in mega-centers or resorts); possibility for infrastructure provision; etc. (Maksin et al., 2009). Locations of mountain tourist centers and settlements are defined on the following basis: distribution of tourism offer and capacity of winter and summer offer in the area (primarily the system of alpine ski centers), evaluation of the terrain favorability for the development at the lowest part of the ski resort, as well as the possibility for easy access to traffic, rational water supply and channeling waste waters.

Real estate market in mountain destinations is, besides tourist infrastructure and year-round offer, an important investment lever for the development. Such approach to development has been proven by various experiences in realization of traditional and new mountain centers in Alpine countries in Europe, as well as mountain regions of America and Canada where 70% of investment for the past two decades relates to certain types of investments in real estates. A precondition for the development of real estate market is in the planned infrastructure provision on building land and for public facilities in tourist settlements. Various forms of real estate management are directed towards regulating the use of capacities and are aimed at revival of mountain centers and profitable commercial real estate business all year round. Due to differences in regional specificities of countries and approaches to planning, the so far urban structure development in mountain destinations has been based on various concepts. In Alpine countries, the concept of tourism development has changed over time and has been adjusted to market demands and specific natural conditions. The first phase of the development of mountain destinations, which took place by the end of 19th century and at the beginning of 20th century and derived from traditional rural and mixed settlements at the foot of the Alps, in which the transformation of rural economy into tourism economy took place (e.g. Courmayeur in Italy,

Chamonix, La Clusaz, Megeve in France, etc.), was not initially based on real estate market. However, in later phases of the development of mountain centers, the Alpine countries have, to greater or smaller extent, also opened their mountain centers for the real estate development, but with much greater external control of the development. First, between 40-ties and 70-ties of 20th century, by the real estate development in uninhabited mountain terrains above traditional settlements on locations at an altitude from 1,200 to 1,500 m a.s.l. (e.g. Sestriere in Italy, Courcheval in France, etc.), and later, between 70-ties and 80-ties of 20th century, by real estate development on locations at an altitude from 1,500 to 2,000 m a.s.l. (e.g. Tignes, Flaine, Les Arcs, La Plagne, Avoriaz and Izola in France, Kopaonik mountain in Serbia, etc.), and from the mid 80-ties of 20th century, by renewing the trend of the real estate development in lower locations and sub-mountain villages at an altitude of approximately 1,000 m a.s.l. along with adequate connections with ski centers/altitude zones of the mountain through vertical transport systems (e.g. Pila, San Sicaio, Biemonte in Italy, etc.), as well as by the beginning of 20th century by modifying mountain ski centers at altitudes above 1,600 m a.s.l., as a consequence of climatic changes and decisions on the way of directing investments towards the mountain regions. Activation of the development in the Alps resulted in the development of complex and, by offer, highly attractive tourist centers within traditional settlements or connected to them, in higher mountain regions, with infrastructure developed to the highest standards, strictly taking into account the capacity of the region and environmental protection, since the majority of mountain centers are located within the boundaries of protected natural resources. In the European mountain regions, the medium and small sized centers dominate and account for about 80% on market demand for mountain tourism (e.g. Wengen, Switzerland, with 5,278 beds and 1,405 inhabitants; Chamonix, France, with 6,100 beds and 5,900 inhabitants; and in Austria, Kitzbuhel with 8,700 beds and 8,600 inhabitants and Schladming with 3,500 beds and 4,800 inhabitants), while there are only several big centers and, as a rule, in highly developed countries (e.g. in Switzerland in Crans-Montana with 37,317 beds and 7,000 inhabitants; Davos with 23,824 beds and 13,000 inhabitants, Verbier with 15,200 beds and 2,500 inhabitants), and rarely new destinations (e.g. Bansko in Bulgaria with approximately 15,000 beds and 9,000 inhabitants). New winter destinations in South Eastern and Eastern Europe are also oriented

towards the real estate development, which has been, in majority of cases, based on experiences of Alpine countries, and due to considerably more liberal approach to the real estate development and disregard of local and regional specificities, which has resulted in a decrease in activities and lessening of the image of mountain centers (IAUS, 2008).

The development concept for mountain tourism in the USA and Canada was different. It was not initiated and conditioned by a traditional mountain settlements and could be realized in the space where the area of mountain region is much greater than in Europe, which enabled conditioned separation of those mountain regions in which the concept of protection and presentation of the nature, i.e. parts of mountain regions with intensive development in which tourists centers are located, was thoroughly dominant. The protection of nature was also an important dimension in the development of these regions, but not a crucial one for decision-making on initiating the development, particularly for implementation, which, in principle, relied more on economic criteria. The protection was given more attention only after the centers were realized, while, at the same time, the nature was undergoing notable transformation and particularly in terms of planning urban structure of mountain centers and ski trails, based on the criterion for optimal protection of forest areas. Regardless of whether the tourist centers are planned on the state or private property, the laws and plans which regulate the construction and zoning activities are applied. In the USA, management system is stricter regarding the construction on the state-owned land due to particular competence of the US Forestry Service (USFS), US Bureau of Land Management (USBLM), US National Park Service (NPS), as well as some other agencies. In Canada, the development of mountain regions is regulated by Integrated Resource Management (IRM) Strategy based on which the Integrated Resource Plans (IRP) are made. One example is the IRM of Eastern Slopes of the Rocky Mountains comprising an area of about 90,000 km² within which several tens of mountain centers are situated (Belyea, 2002). In mountain regions of North America, medium and small sized centers dominate (e.g. Sun Valley, USA, with 6,000 beds and 1,654 inhabitants; Sun Peaks, Canada, with 2500 beds and 250 inhabitants, etc.), while there are only several big centers (e.g. the Whistler resort, Canada, where three settlements are situated with 40,000 beds and 10,000 inhabitants). The ski lift capacity in bigger centers is not proportional to stationary capacity, i.e. it is

much greater than the capacity of centers due to great number of daily visitors coming from urban areas in vicinity of ski resorts (e.g. several tens of centers near Vancouver, Toronto, Calgary, etc.).

Depending on the type in which the realization and image of mountain destinations/centers are planned, and particularly on the type of the real estate market management, the degree of their economic utilization varies, while their prices range from 1,000 to 10,000 euro per m². Today, in successful and competitive mountain centers, as a rule, the price of real estates is not below 3,000 to 3,500 euro per m², while in the most luxurious ones, such as those in Crans-Montana or St. Moritz, the price of real estates is above 10,000 euro per m². Less successful mountain centers record prices of quality apartments of approximately 800 to 1,500 euro per m² (e.g. Bansko), which are mostly influenced by excessive concentration of accommodation and limited ski lift capacity.

In developing and regulating mountain centers of Alpine countries, uniform standards for planning specific tourist and recreational facilities and recreational-sports infrastructure are applied. According to their purpose, they are classified into standards for (Baud-Bovy, Lavson, 1977; Mitrović, 1983, Milijić S., 2005): mountain center location, mountain center size and capacity, alpine skiing, ski trails, vertical transport of skiers/tourists, other facilities and areas of mountain centers, etc. Besides, there are specific standards for spatial organization of tourist settlements and for competition ski trails which are applied in planning and development of top mountain destinations and regions. According to the International Olympic Committee (IOC, 2007), the basic criteria which are evaluated when selecting the candidate cities/regions for the Winter Olympic Games are the following:

- Bus journey average time from the candidate city and settlement (official bed and tourist accommodation) and from Olympic village (accommodation for sportsmen/sportswomen) to Olympic competition ski trails;
- Guarantee of accommodation capacity in radius of 50 km from Olympic competition ski trails, uniformly distributed in tourist centers and settlements and the candidate city, i.e. in various locations of tourist region, with the following capacity: 40,000 – 90,000 beds for the needs of tourists, and 22,800 beds/rooms of various categories for official needs (a total of 60,000–110,000), Table 2 and Figure 3;

Table 2: Overview of some characteristics of the candidate for the Olympic Games 2014

City/region	Beds in radius of 50 km	Capacity of Olympic Village
Sochi-Russia	94.000	5,600 (3,000 in Sochi and 2,600 in snow zone, distance between them being 63 km)
Salzburg-Austria	81.700	6,150 (3,000 u Salzburgu and 3,150 in snow zone, distance between them being 68 km)
Pyeong Chang-Korea	44.780	6,150 (on two locations, distance between them being 37 km)

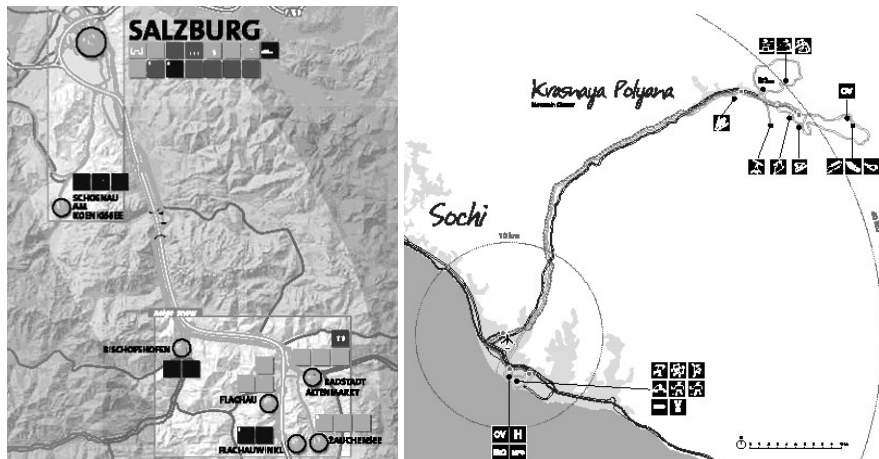


Figure 3: Examples of spatial organization of tourist regions of Salzburg and Sochi in radius of 50 km

- Guarantee of the accommodation capacities for the needs of sportsmen/ sportswomen, within one or more Olympic villages, in favorable locations between the candidate city and the snow zone, at the contact of the best ski resorts, of capacity of approximately 3,000 beds (a total of about 6,000);
- Planned budget for organization of Olympic games, expressed in USD and local currency, for the candidacy and in the year of holding the Olympic Games (according to current statistics of the World Bank);
- Security and preventive measures (which are not evaluated but mandatory);
- Environmental impact assessment and assessment methods (location, altitude above sea level, snow cover, artificial snow, water resources, energy production, hazards, etc.);
- Functional testing of Olympic competition ski trails by organizing international competitions;
- Survey on public opinion of the candidate city and country on organization of Olympic games in % (gradation: extremely supports, supports, it does not matter, does not support, does not support at all);
- Attitudes of representative entities for the organization of the Games (per all levels and in all fields);
- Plans, also showing regions, of the candidate city, tourist settlements, Olympic village, Olympic competition ski trails; etc.

MODEL FOR THE DEVELOPMENT AND SPATIAL ORGANIZATION OF THE STARA PLANINA TOURIST REGION

Stara Planina is a high mountain region with functions of a natural park and a tourist region of priority importance for the Republic of Serbia.

According to natural potentials of the Natural Park and tourist region, the dominant form of tourism will be stationary and excursion mountain tourism, with main activities related to winter sports and recreation – alpine skiing and activities in other winter sports. Considering that dealing profitably with tourism in mountains implies a year-round utilization of capacity, for which this region has enough potential, different other forms of tourism in summer season are also anticipated such as water sports and recreation, on mountain localities and excursion and mountain itineraries, partly using mountain lifts. The following forms of tourism are also envisaged mostly during summer and partly during winter period: cultural tourism, rural tourism, hunting tourism, health tourism, and in Piroć and partly in Knjaževac, the city and transit tourism as well.

The tourist, recreational and sports facilities in the National Park and tourist region of Stara Planina have been zoned and organized in two major altitude zones: the mountain and sub-

mountain one. The mountain zone encompasses higher mountain belt with a dominant mountain tourism offer in the region and new tourist accommodation facilities directly related to this offer (at the entrance to alpine and Nordic ski resort from the ski lift departure points, points of departure of mountain walking and mountain excursion routes, and other mountain facilities within the offer in this space). Sub-mountain zone encompasses lower foot of the mountain and its wider surrounding, with hilly and lowland contents of tourism offer and accommodation in the existing rural and mixed settlements and urban centers. The architecture of the planned facilities and micro-ambience of interiors will be functionally realized by taking into account good models of mountain tourist centers, and designed according to motifs of ethno-architecture of Stara Planina.

Planning criteria and determination for realization of commercial mountain tourist facilities on Stara Planina are the following:

- Achievement of high standard tourism offer in this space (contemporary alpine / snowboard and Nordic ski trails, summer recreational and sports polygons, excursion and mountain tourist routes, etc.), which will be at the same time in the function of tourism development and in the function of presenting the Natural Park;
- Organization of activities and Inadscaping of the Natural Park space for specific types of offer related to ecology, ethno-culture and heritage in this space (ecological and ethno-investigation points, thematic excursion routes – mountain walking, heritage routes along ethnic lines, historic heritage routes, etc.);
- Determination for dispersive distribution of tourist accommodation in tourist centers of "Golema Reka", "Topli Do", "Mramor" and "Senokos" and several mountain settlements (with the exception of the concentrated tourist resort of Jabučko ravnište – Figure 4) depending on availability of space for developing facilities directly related to tourism offer in the mountain zone (particularly ski resort); regime of the Natural Park protection; possibility for water supply and channeling waste waters, and possibility for rational access to traffic; tourist centers are envisaged as polyvalent mountain centers focused on exclusive, highly commercial tourism;
- Rising the standard of existing accommodation and developing new tourist high standard accommodation;

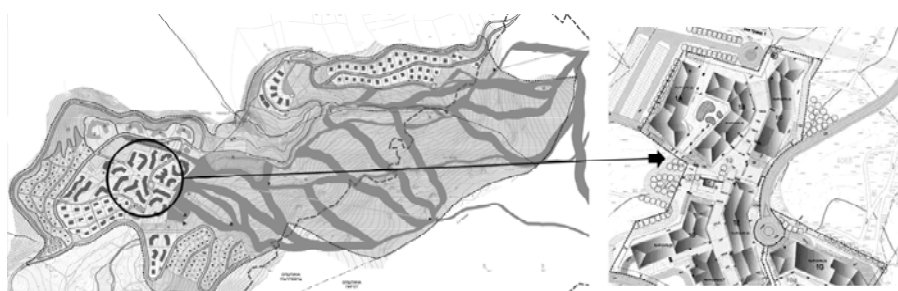


Figure 4: Tourist resort Jabučko ravnište on Stara Planina – the first phase

- Development of new high standard recreation and sports facilities, public services and other services within a year-round offer of the tourist resort, tourist centers and settlements which are at the same time of importance for tourism, functioning of the Natural Park and mountain villages;

- Realization of rational utilization of tourist capacity at annual level (at least 240 days and 60% occupancy), by providing a variety of tourism offer and conducting intensive market research on demand;

- Traffic and functional connectivity of tourism offer for the mountain zone with emitting areas and tourism offer for the sub-mountain tourist zone; and

- Education of all space users on the sustainable development, protection and use of the Natural Park and tourist region, i.e. raising awareness of both local inhabitants and visitors on the tourist development and other resources and values of the region.

Taking into account experiences of countries with higher level of the development of mountain regions, the economic and profit-making interest of tourism market in destinations on Stara Planina will be aroused based on the following:

- International demand for mountain tourism, which will grow faster than tourism offer, due to full occupancy of traditional mountain destinations, first of all in Alps; in European southeastern regions, the demand also exceeds tourism offer, and after an inflow of 6 to 7 thousand euros of average local GDP per capita will cross the limit the demand will grow considerably; and

- Home demand for mountain tourism, which is several times greater than tourism offer, both due to full occupancy of capacities on Mt. Kopaonik and impossibility of going to Brezovica on the Šar Planina mountain, and due to the fact that development potentials of other mountains have not been activated. It is estimated that, in the next 15 to 20 years, the market for mountain destinations in Serbia will generate demand for about 3 million

days of skiing annually, which is much greater compared to the capacity of home mountain tourism offer and which, today, accounts for about 15 % of expected demand, and may satisfy international market demand (primarily in Alpine countries, Bulgaria and Republic of Srpska); considering their potentials, the mountain regions of Serbia cannot achieve the level of development of Alpine countries, but may definitely become closer to them regarding the level of services, tourism offer in space in several top high-mountain tourist destinations, primarily Kopaonik and Stara Planina mountains as leaders of mountain tourism in Serbia which should have higher rating, oriented towards international and quality home market.

Commencement of the Stara Planina development project realization will considerably contribute to materialization of a part of tourist potential of mountain regions in Serbia. Knowledge of methodology from foreign sources and foreign experience in developing mountain regions with relation to different socio-economic systems, organization, cultural patterns, and alike, must be subjected to careful deliberation in order to select procedures which will meet the conditions in Serbia, assuming that these conditions will be, in near future, generally adjusted to EU general principles and conditions for organization. The ongoing transition process and structural changes in Serbia will have an impact on implementation of these projects. At the same time, competitiveness of mountain regions in Serbia will not be determined only by spatial capacities and geo-political position, but also

by creative innovative development environment including the following: products and service activities, technology transfer and, particularly, exchange of information and cooperation between home and foreign experts; regional identity; high level of quality of living and environmental protection; organizational development management forms and adjustment of local competencies, harmonization of system laws, and coordination between policies and activities, which are still lacking and adjusted to regional and local conditions and demand, etc.

The starting points for positioning the development projects for Stara Planina as a tourist region will be based on the following:

- Uniform and polycentric development of several tourist centers (in the category of small world centers with 2,000-4,000 beds) and settlements in immediate vicinity, with functional directions of sustainable and dynamic integrations towards municipal centers of Knjaževac, Pirot and Dimitrovgrad, urban regions and traditional settlements, as well as towards possible realization of tourist resort (Figure 5);

- Respect of basic sustainable development principles as follows; *ecological acceptability*, in terms of tourism development and development of complementary activities, which may be realized in regions with exceptional natural values; *cost-effectiveness*, in terms of investments and active protection of mountain region from a part of income coming from tourism development; and *social acceptability*, in terms of protection of local interests, improvement of living and working conditions, creation of conditions for stay and return of population, active inclusion of local population in tourism offer and protection of nature;

- Development of a tourist resort which may be included in big, organized and compact clusters thus enabling greater competitiveness (marketing and development of products), lower operating costs, possibility for developing appropriate capacities – products for the purpose of risk management;

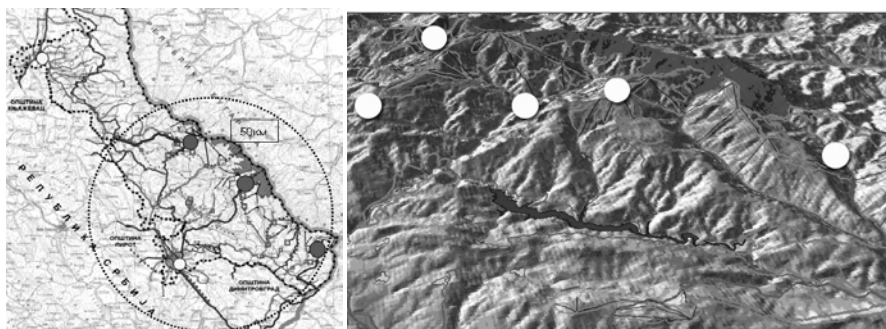


Figure 5: Balanced and polycentric development of the Stara Planina tourist region and Natural Park

- Greater sophistication of the development concept, thus enabling greater environmental control and protection, creating greater number of services with various participants and gaining more experience in the development of tourism products;
- Greater authenticity, thus enabling integration into local cultural and natural environment and local social community;
- Greater diversity of tourism offer by providing different types of accommodation, diverse prices and structure of guests;
- Application of high technologies in tourism development, terrain design, maintenance, operational use, offer of entertainment facilities and animation;
- Establishment of cooperation and unions with investors, promoters, developers and operators in tourism;
- Development of an attractive destination which would be a leader in mountain tourism in South Eastern Europe, with year-round tourism offer in the region and with an image based on traditional values, preserved nature and top conditions for recreation and rest, following experiences and standards of countries with a higher level of development of mountain regions, as well as respecting regional and local specificities;
- Ensuring long-term sustainable development and protection of the Stara Planina National Park and tourist region, for which the Government of the Republic of Serbia and municipalities/ cities in the vicinity will combine their interests in the protection of nature and in propelling the largest public-private tourist project in Serbia;
- Use of relevant methods for development planning and management for the purpose of ensuring competitive and transparent approach to obtaining investors and operations management; and
- Gradual fulfillment of conditions for joint candidacy of Serbia and Bulgaria for organization of Winter Olympic Games, with a candidate city within the Stara Planina tourist region, for which the city of Pirot may fulfill conditions, together with locating and organizing tourist centers and Olympic villages according to the criteria of the International Olympic Committee (a positive example being the initiative of a joint candidacy of Italy, Slovenia and Austria in the three-boarder region of Alps, with the cities of Treviso-Villach-Ljubljana as centers of this transnational region).

CONCLUSIONS

Mountain regions consist of various regional entities, sub-entities and parts not only in the

context of regulation but also in the context of the development of tourism offer. Definition of priorities in the development of mountain regions requires prior regionalization of these regions and, within it, identification of tourist areas - regions and destinations as the most favorable functional spatial entities for stabilizing and accelerating the development of tourism and complementary activities. Regulation of mountain regions requires both the development and the protection to be physically and functionally organized in order to preserve natural values and cultural heritage, and also organized in functional system of tourist centers and settlements. It also requires the development of rational and adjusted infrastructure, without greater ecological consequences. Only a small part of available tourist resources of mountain regions in Serbia has been activated. The major problem of tourism and overall development in mountain regions in Serbia lies in limitations related to their potentials, which are less absolute when considering impossibility for initiating the development (lack of critical mass of high mountain regions and natural resources, degraded nature, etc.) and more relative when considering limitations of some of the development factors (access to traffic, infrastructure, protected regions, etc.). In the contemporary approach to development of mountain tourist regions, a spectrum of development processes is created and the tendency to polarization of functions is strengthened, which is manifested through activation of development of mountain centers which attract capital and whose services and real estates are in demand on market. Spatial coverage of tourist regions, with relation to territorial levels of the country, its administrative units - regions and spatial-functional sub-entities - regions of various purposes, is treated uniformly. The coverage on regional level most often relates to spatial-functional entities of tourist regions, whose final formation is influenced by market. An analysis of experiences of countries with higher level of development of mountain regions leads to the conclusion that there is no uniform model for the development and regulation of mountain regions, and that recommendations and examples of sustainable development should be specified according to the conditions of Serbia and a specific mountain region. In such situation, spatial organization of tourism in the function of sustainable development of the Stara Planina tourist region does not only mean revitalization of interests of

economy and ecology, i.e. realization of economic and social justifiability, as well as protection and preservation of natural resources and values, but also an alternative existence or complete depopulation of this region. Positioning of the Stara Planina development project should be based on balanced and polycentric development of several tourist centers (Golema reka, Topli Do, Mramor, Senokos, and Jabučko Ravnište in the category of small world centers with 2,000-4,000 beds, mostly found in the Alps, and acceptable for specific conditions and potentials of Stara Planina in Serbia) and settlements in immediate vicinity, with functional directions of sustainable and dynamic integrations towards municipal centers of Knjaževac, Pirot and Dimitrovgrad, urban regions and traditional settlements.

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REGIONAL DIFFERENCES BETWEEN RURAL AREAS OF SERBIA IN POPULATION AGING AND AGRICULTURAL ACTIVITIES: CASE STUDIES OF THE INĐIJA AND KNJAŽEVAC MUNICIPALITIES

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As one of the signs of demographic change, population aging influences various spatial categories: economic activities, social features, land-use, perspectives for future development and more. Even though the process is indicative on a national level, there are significant differences among geographically and functionally distinctive regions. Based on considerable regional differences in the development of Serbia, this paper analyses the key problems of rural areas related to the interdependences of population aging and agricultural activities. Research on aging processes, changes in agricultural activities and their features is based here on the examples of two case studies. The Inđija and Knjaževac Municipalities have been chosen to represent geographically different regions – lowland and mountainous. This study uses both quantitative and qualitative approaches in order to achieve a better understanding of the situation. Statistical data were used to illustrate processes of aging and agriculture where data from two census years indicate a trend of changes. Interviews conducted with representatives of local government, entrepreneurs and local citizens from the villages are the source of information for quantitative analysis. Population aging and agriculture are examined separately, followed by an illustration of their interdependences.

Key words: rural areas, demographic change, population aging, agricultural activity, land-use change

POPULATION AGING IN RURAL AREAS

Changes in Population Aging in Rural Areas

Many countries in the world have noted a median age increase in rural areas. Additionally, this process in developing countries has increased more sharply among rural populations than in urban ones (Stloukal, 2001). Census data from poor countries testify that the rural population is older than the urban population (Marocoux, 1994; Martin and Kinsella, 1994). Overall, the most developed

countries in Europe, America and Oceania are more involved in aging process and face more problems in this area than the rest of the world (Stloukal, 2001).

It is a fact that the population aging process is more than just a demographic change. It influences a whole range of social and natural spheres and therefore requires the attention of thorough studies regarding agricultural and rural development as well. In the course of finding appropriate measures to "fight" against aging, an acknowledgment and deeper understanding of the relationship between the aging process on the one side and the social, economic and natural changes on the other side are of great relevance, particularly in the rural context (ibid.).

The causes and consequences of agricultural activities and the aging process are deeply interconnected and their interdependences are not easy to detect. The kinds of agricultural activities and their productivity depend on natural factors (climate, physical characteristics, precipitation, soil quality, etc.) as well as on social ones.

Older farmers are not necessarily less productive. The level of their efficiency depends not only on age, but on external circumstances such as the level of technological development (Stloukal, 2000). In general, developed countries of the world have to deal with more serious aging issues than do developing countries. Namely, among the world's countries listed by median age, mainly

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developed European countries show a medium age over 40, e.g. Belgium – 41.7; Austria – 42.2; Finland – 42.1; Italy – 43.3; Germany – 43.8; and Monaco – 45.7 (Central Intelligence Agency, 2009). In contrast, developing countries in Asia, South America and Africa have very young populations measured by median age: Afghanistan – 17.6; Algeria – 26.6; Bolivia – 21.9; China 34.1, etc. (ibid.). Lately, however, aging is becoming a focal point in developing countries too. Thus, Croatia (41.0), Ukraine (39.5), Bosnia and Herzegovina (39.8) and other developing countries have aging populations (ibid.). Serbia, with a median age of 41.0, belongs to this group, too.

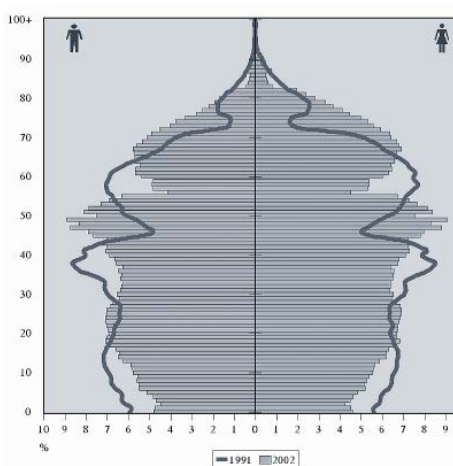
It has been noted that the types of agricultural activities (intensive, extensive, live stocking, cropping, fruits growing etc.) depend on geographic location while population outflow from rural to urban areas depends on type of agricultural activity. Thus geographic location influences demographic structures. The chances of finding the same aging process in geographically different regions are least likely. Therefore, in order to understand different aging structures, it is important to analyse their spatially differentiated contexts.

Regions differ by socio-geographical characteristics: social organisation, cultural patterns, strength of economic cooperation and practices of agricultural production. It is well known how much priorities and efficiency in state policy implementation influence migration. In American society, for example, poverty differences between classes, nationalities and races are obvious (Tarman, 2009). Some regions prosper successfully owing to cooperation with other regions, while others economically degrade because of closed economies, and accomplishments in agriculture depend on the farmer's openness towards innovation. Obviously, ethno-geographic characteristics play a part in the creation of differences between regions and the behaviour of the people living there.

Serbia is among the ten countries in the world with the oldest citizens, and it is currently the state with the highest number of refugees in Europe, taking the 13th place in the world (Vujošević et al., 2009). In the 90s, demographic analyses by all criteria of aging showed that the population of Serbia is in the process of aging (Penev, 1999). These analyses were based on a comparison of regions (Vojvodina; Central Serbia; and Kosovo and Metohija) and/or municipalities (Rančić et al., 1990; Penev, 1999). This

included analyses of the aging of rural and urban populations (Rančić et al., 1990), using a socio-demographic approach. Malobabić and Bakić (2003) argue that the aging process in mountainous areas of Serbia indicates an increasing share of elders in the total population. Nikolić (2003) suggests a problem of depopulation from mountain municipalities, particularly characterised by an outflow of the young population. Additionally, this author mentions parallels between lowlands and mountainous areas in Serbia, but rather concerning the number of members within a household and the structure of agricultural land. Therefore, it appears that, even though rural aging and agricultural potentials have been analysed in general, the particular focus on the relationship between the aging process and agricultural production has not been analysed in parallel. In addition, administrative units (autonomous regions and municipalities) were used for comparison, without the geographic context of lowlands and mountains.

Aging indicators such as the number and percentage of aged (over 65) in the total population, the old-age-dependency ratio and aging index, based on a set of data from Census 1981 and 2002 (SORS, 1981 and 2002), show that the population is getting older. In 2002, all lowland municipalities in Serbia had an aging index under 200, while eight municipalities in mountainous areas significantly surpassed this value.



Graph 1: Age and gender structure – Serbia without Kosovo and Metohija, 1991 and 2002

Source: UNECE, 2007

Causes for Population Aging in Rural Areas

Population aging is only one dimension within the complexity of demographic change. Rural and urban areas possess their own unique features of demographic transition. However, the causes of population aging in rural areas could be natural (biological), social or both natural and social at the same time.

Referring solely to the second half of the 20th century, life expectancy at birth has increased (Peters, 2008) thus effecting the overall population age structure, in rural areas as well. Fertility and birth-rate decrease are biological factors that also contribute to population aging in villages. As is common in demographic transition, mortality rates have also decreased, simultaneously with the above-mentioned processes; thus providing an increase of the aged population (Stloukal, 2000).

Another overall demographic process is the decrease of the mortality rate. The process among the rural population is the same as in urban areas in some ways, but unique in others. Namely, the aging of farmers is more intensive than in other occupations in spite of the fact that the mortality caused by the nature of agricultural activities (external reasons) is much higher (NIOSH, 2004). This is a consequence of the fact that there is no age limit for farmers to be retired, and they are engaged in agricultural activities as long as they are fit for any kind of physical activity; therefore, the risk of injuries and death at work is higher than in other professions (Fullerton, Toossi, 2001).

Beyond the natural (biological) causes such as an increased life expectancy and a mortality decrease, it is considered that the dynamical component (migration) is the greatest reason for aging within the rural population. The number of young people remaining in villages decreases, and those who are eager to come back are few; therefore, the increase in the aged population is mainly not a consequence of an increase in older farmers but of the younger generations going away (ANRA, 2008). Migrations, or more precisely – emigrations, are principally a one-direction process: village – city. Young people are leaving, thus “shortening” the base and the middle of the population pyramid. At the same time, in most mountainous areas in Europe those who return are mainly old people, already retired in the city (European Environmental Agency, 1999; Stloukal, 2000).

Expected earnings and quality of life, as social causes, influence both the emigration of young generations from rural areas and the return to the villages of nearly only those who have already finished their careers.

Such demographic change carries substantial effects on future social demands on agricultural landscape use and thus on rural areas. Thereby, it is defined as both the decrease of the population and the shift in the age distribution ("aging") and in the spatial distribution ("outflow from rural areas" particularly of young people) (Müller et al., 2008).

While the impact on the social security systems and related issues are central in the research interests of demographic change, only a few scientists have actually looked at its consequences on the demands on agricultural landscape use (Kujath, Schmidt, 2007 according to Müller et al., 2008). Three dimensions of relations between demographic change and agricultural activities are apparent in Serbia:

- population aging: in Serbia as a whole, the young population (0-14 years) share decreased from 20.2% in 1981 to 15.9% in 2002, while the old population share increased from 10.3% to 16.4%. In the lowlands, during the time between the two censuses, the share of young people decreased from 19.9% to 15.4% and the share of old people increased from 10.3% to 17%. The same trend is apparent in mountainous areas of Serbia where the share of young people decreased from 20.7% to 16.6% and the share of old people increased from 10.4% to 17.3%;
- population decline: between the two censuses, the total population share decreased by 0.6% in lowlands and 3.7% in mountainous areas²;
- migration: although a significant and evident phenomenon, Serbian statistics do not measure it sufficiently. Social causes are crucial to this phenomenon. After World War II, the Serbian government and the governments of ex-Yugoslavian federal republics intensively favoured industrialisation, which caused accelerated urbanization. Investment in favour of cities, in other words an urban-centric policy (Petovar, 2003), was systematically

implemented and caused a marginalisation of rural areas and agricultural activity, destroying the economic independence of rural dwellers, eliminating agricultural cooperatives, and limiting a farmsteads maximum³.

POPULATION AGING IMPACTS ON AGRICULTURAL ACTIVITIES IN RURAL AREAS

The consequences of population aging can be various: economic, social, social-economic, natural etc. Nevertheless, it is always useful to keep in mind that population aging can also be a consequence. While most consequences bring negative impacts, it is very important to locate any positive implications, if possible.

The first implication, most often, is a decrease of flexibility in the agricultural labour market. Additionally, there is an expectation that older farmers are less motivated to invest in innovation because of the shorter amortisation period left in their lives to experience full advantage of it. In another words, serious changes in the characteristics of agricultural activities are expected to be influenced by the population aging (Stloukal, 2000).

A median age increase does not necessarily have to come with an increase of the older population. As example from Australia shows, the median age increases even if the number of older farmers (over 50) is more or less the same as it used to be a few decades ago. The cause, in fact, is that the number of younger farmers (15-50 years old) has decreased rapidly (ANRA, 2008).

The population aging process depends on certain factors as well: population density, the age and professional population distribution within different economic activities, economic productivity, accessibility of new technologies, innovations, and social and economic policies, too (Stloukal, 2001).

The older a farmer is, the probability of being open to investments and innovations diminishes (Stloukal, 2000). Often, there is no perception of possible innovations, and even if these farmers follow contemporary trends that lead to greater effectiveness in production, they do not consider themselves as investors. That is due to short amortisation time and an overall

shortage of finances that are not likely to pay off. In the end, conducting agriculture is an expensive investment with low benefits. Therefore, the issue of land ownership for future generations is certainly a challenge (UDAF, 2000). Looking further into the next decades at the increased number of aged farmers (over 65) leads to the conclusion that the land will be left without anybody to take proper care of it (Stloukal, 2000).

What happens with agricultural land after its owners come to an age when they are not able to cultivate it anymore? There are only few basic possibilities: the land will remain with its original owners, starting a degradation process; the land will remain with its original owners but its use will change (e.g. forested); the land will be sold to an owner with no interest in keeping it for agricultural activity (followed by land-use change); or the land will be sold to an owner who is not interested in changes in land use and will continue its cultivation.

One of the socio-economic issues is a lack of working places when there is no need for new employees. The increase of the aged population in villages increases needs for a new work force, particularly those who are specialised in taking care of the elderly (Stloukal, 2000). Nursing homes, health services, the strengthening of mobility and accessibility, etc; all of these require a range of new positions in the work force – from low-qualified to high-qualified.

PROBLEMS OF RURAL AREAS IN SERBIA

Rural areas in Serbia cover about 85 % of its territory, in which more than half of its population live (Table 1). Unfortunately, the currently achieved socio-economic development in Serbia has not resulted in a consistent and long-term rural development policy.

Part of the planning solutions for further regional development in Serbia is based on economic prosperity, development and improved living conditions in rural areas, the maintenance and promotion of rural values, a strengthening of the economic position of agriculture and agricultural producers, developing infrastructure and raising utility and public standards in villages. Agriculture, depending on the availability of agricultural funds, with the traditional dependency of local population on agriculture as an economic

² It is also apparent that the number of mountainous settlement with 100 dwellers has multiplied 11 times in the span of 40 years (see more in: Malobabić, Maričić, 2004).

³ Agrarian reform (1945 and 1953) aimed to eliminate large farmsteads and at first appointed a farmstead maximum of 35 hectares, and then of 10 hectares per agricultural producer.

Table 1. The main characteristics of rural areas in Serbia compared with urban areas

Indicators	Serbia total	Urban areas	Rural areas	% of rural areas in Serbia	EU 25 rural areas
Total area (km ²)	77508	11556	65952	85.1	56.2
No. of settlement	4715	811	3904	82.8	
Population in 1991	7576837	3257374	4319463	57.0	16.6
Population in 2002	7498001	3336341	4161660	55.5	
Population density 2002	96	288	63		38.5
Changes in population number (1991-2002) in %	-1.04	2.42	-3.65		
Aging structure					
65+ (%)	16,5	15,4	17,5		16.6
Below 15 (%)	15,7	15,1	16,2		17.6
Employment in sectors					
Primary (%)	23,36	11,26	32,98		13.2
Secondary (%)	30,08	29,32	30,69		28.7
Tertiary (%)	43,74	56,74	33,44		58.1
Unknown	2,80	2,69	2,89		-

Source: MAFWM (2009), Strategy of rural development - draft version

branch and development of agri-industrial capacities, represents one of the most important developmental resources (Maksinić et al., 2009).

Nevertheless, rural areas in Serbia are characterized by several crucial features:

- negative demographical trends: rural areas before the 1990s were characterized by strong emigration trends caused by agrarian exodus, as was the case in other European countries in the 1950s. In the same period, rapid growth and development of other commercial sectors occurred. During the 1990s rural population outflow, mostly from mountainous areas, continued, but at the same time, a large displaced population (a consequence of the wars in Croatia, Bosnia and Kosovo) arrived and settled there.
- high employment in the primary sector – about 1/3 of the active population is employed in the agricultural sector, which points out the great importance of agriculture in the national economy and to the low degree of diversification of commercial activities in the rural areas of Serbia. Agriculture is the main activity in most rural areas and is characterised by small agricultural farms, a low productivity rate and low income per farm.
- decrease of arable land: mostly a consequence of extensive utilization of agricultural land and various degradation

processes caused by man and nature; therefore, the problem of rural development needs to be stressed as a matter of losing a main resource – agricultural land.

Depending on regional differences in geographical and social means, the aging process can be distinguished. A comparison of aging indicators for lowlands and mountains shows that the values for higher altitudes are higher than those in altitudes closer to sea level. The Table 2 presents a distribution of those indicators within the span of approximately 20 years.

The average age distribution in Census 2002 (SORS, 2003), adjusted to average values of lowlands and mountainous areas, testifies considerably that population the aging process of the population has developed further in higher altitudes: 40.6 in lowlands and 41.5 in mountains (Table 3).

A United Nations organisation is conducting an agricultural census, recognizing its relevance in gathering data and following the connections between aging and agricultural activities (Stloukal, 2000). Based on those data, the conclusion is that the type of agricultural activity depends greatly on the age distribution of farmers. Namely, farmers are almost inevitably divided so that the younger ones prefer live stocking and fruit-growing while the older ones are oriented towards crop farming and vegetable-growing but are also mainly active in mountain areas (ibid.). The question, therefore, is whether the population aging process is more serious in the mountains than in the low-lands?

CASE STUDIES

The Indija and Knjaževac Municipalities have been chosen to show relations between geographically different regions in Serbia's lowlands and mountains (Map 1). The essential difference between the cases chosen for this paper is topography. The Indija Municipality is located in the flat area of the Pannonia plane, while the Knjaževac Municipality belongs to mountainous Serbia and embraces the eastern parts of Stara Planina Mountain. Owing to different

Table 2: Aging Indicators in Lowlands and Mountainous Areas of Serbia

	Lowlands		Mountainous Areas	
	1981	2002	1981	2002
65+	459,961	698,277	347,533	534,893
65+ (%)	10.3	17.1	10.4	17.3
Old-age-dependency ration	14.9	23.0	15.5	26.0
Age index	51.8	102.6	50.4	104.0

Source: Calculated from Statistics (SORS 1981, 2002)

Table 3: Indicators related to agricultural activities in Lowlands and Mountainous Areas of Serbia

	Lowlands		Mountainous Areas	
	1981	2002	1981	2002
Average population density	138.1	136.3	73.9	68.5
Agricultural population (%)	16.4	9.2	32,5	13,1
Agricultural area (%)	82.3	79,5	57,3	55,9

Source: Calculated from Statistics (SORS 1981, 2002)



Map 1: Study Areas and Case Study Municipalities – Indija and Knjaževac

* Serbia is shown without Kosovo and Metohija

topographical conditions, but also to different historical and ethnic surroundings, considerable dissimilarities emerged in the sphere of demographic structures and agricultural production. Knjaževac Municipality covers an area of 1,202 km² and its countryside is mostly hilly and mountainous. Indija Municipality covers an area of 384 km² and its relief is characterized by the slopes of Fruška Gora Mountain in the north and fertile plains in the southern part of the territory.

Demographic Analysis

Analysing demographic indicators related to the aging population, differences between the chosen case studies are obvious. The first and very characteristic difference is a trend in total population which has decreased within the span of 20 years (1981–2002) in Knjaževac Municipality and increased in Indija Municipality. At the beginning of the 1980's, Knjaževac Municipality was populated by 48,789 inhabitants, which was approximately the number of inhabitants in Indija Municipality two decades later (Graph 2).

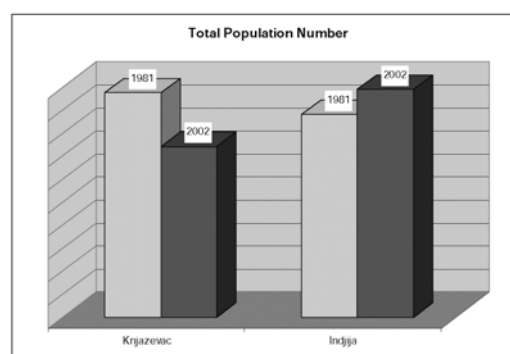
As expected, Knjaževac Municipality depopulation indicates an aging process too, not only a decrease of population. Namely, the old-age-dependency ratio and aging index in both municipalities has increased, but more so in the mountainous municipality. The number of inhabitants over 65 has increased more in the Indija Municipality, but if shown in percentages,

the participation of older segment has increased in Knjaževac Municipality even more. This is a result of the higher increase in population in the Indija Municipality which shows an increase in the number of elderly as well (Graph 3).

The percentage of elderly (65+) in total population increased by 8% in Knjaževac and by 6% in Indija Municipality; however, considering the value of elderly participation (not the intensity of its change within the span of 20 years), the situation in the mountainous municipality is much more serious. In 2002, the percentage of the older population in Knjaževac Municipality was almost double than of the Indija Municipality. Increasing process of population aging and almost one third of the population in the elder age are genuine concern and challenge for the future (Table 4).

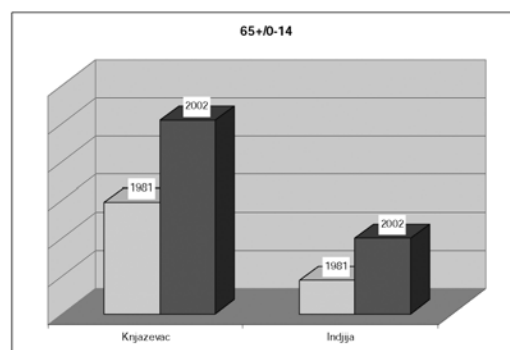
With regard to the future, it is necessary to “read” the aging index, which explains how many individuals in the younger generations will replace the old in five decades. When just the intensity of change is compared, the index increases twice as much in Knjaževac than in the Indija Municipality. Additionally, the aging index values shows that the number of old is twice that of the young (0–14) in the mountainous municipality, while the lowland municipality still has more young inhabitants than old.

In terms of economic activity, the (dis)balance between the old and working populations (15–64) has also changed contrary to what is auspicious. Again, the facts show a much more serious situation in Knjaževac Municipality: an increase of old in total population in percentages is twice as high in 2002 than in 1981 and the share of the old population is twice higher than that of the working population, too.



Graph 2: Change in Total Population Number

Source: Calculated from Statistics (SORS 1981, 2002)



Graph 3: Change in Old-Age-Dependency Ratio

Source: Calculated from Statistics (SORS 1981, 2002)

Table 3: Aging Indicators in Knjaževac and Indija Municipality (1981, 2002)

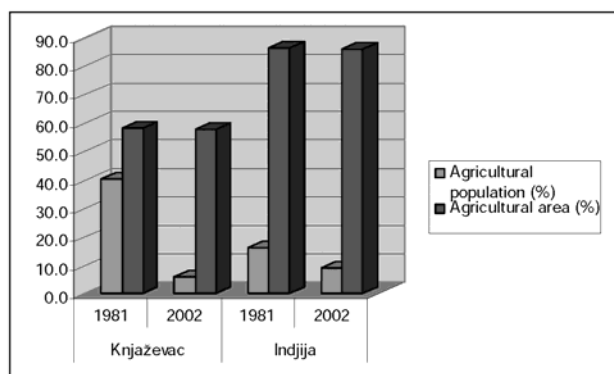
	Knjaževac Municipality		Indija Municipality	
	1981	2002	1981	2002
Total population	48.789	37.172	44.151	49.609
65+	9.631	10.248	4.134	7.729
65+ (%)	19.7	27.6	9.4	15.6
Old-age-dependency ratio	29.7	45.4	13.5	22.9
Age index	146.1	253.8	43.7	99.2

Source: Calculated from Statistics (SORS 1981, 2002)

Agricultural Activity Analysis

When indicators related to agricultural activities for both municipalities are compared, different conclusions can be reached. Although both municipalities, according to OECD criteria on population density, are rural, the difference between population densities of the two municipalities is significant; the lowland municipality is over four times more populated. That presence is not related only to the immigration process into the Indija municipality, although after the turbulent processes in the ex-Yugoslavian region in the 1990's, the Indija municipality has been populated by a lot of refugees⁴.

Although there was not a large change in the total agricultural area in the period between the two censuses (Graf 4 and Table 4), the situation within the agricultural population is remarkable. While the share of agricultural population in 2002 in the Indija Municipality decreased by 7.1 % compared to 1981, in the Knjaževac Municipality that share decreased more than seven times.



Graph 4: Change in Agricultural Population and Agricultural area

Source: Calculated from Statistics (SORS 1981, 2002)

Table 4: Indicators related to agricultural activities for Knjaževac and Indija Municipality (1981, 2002)

	Knjaževac Municipality		Indija Municipality	
	1981	2002	1981	2002
Average population density	41	31	115	129
Agricultural population (%)	40.3	6	16	8,9
Agricultural area (%)	58.3	57.6	86.2	85.7

Source: Calculated from Statistics (SORS 1981, 2002)

⁴ According to the Republic of Serbia Commissariat for refugees Census, in 2001 the Indija Municipality refugee status showed 10,113 persons; after the refugee status revisal (2005), the Indija Municipality had 4,321 internally displaced persons (Source: LAP, 2009)

Relation between Population Aging and Agricultural Activity

In addition to the quantitative analysis, a qualitative analysis for both case studies was conducted, too. A questionnaire, conducted in July 2009, contained open-question structure and was divided into the following three topics: awareness of local government of population aging in the decision-making process; impact of population aging on changes in economic and agricultural activities; and the impact of population aging on land-use change. The case studies were chosen based on following criteria:

- Opposite cases with regard to:
 - Geographic location and characteristics;
 - Spatial relation to functional urban areas (FUA) defined in the Spatial Development Strategy of the Republic of Serbia (2009);
 - Trend in population increase;
- Similar cases with regard to:
 - Good information accessibility;
 - Areas of strategic importance.

regard to its functional relations to centres of FUA. In contrast, Indija is located in overlapping areas of the two biggest FUA – Belgrade and Novi Sad (MESP and RASP, 2009). Another contrast between case studies is the population decrease in all settlements of Knjaževac and only one settlement in the Indija Municipality (SORS, 2004). Also, Knjaževac is one of the municipalities in this mountain area with the oldest population (average age 47.3), while Indija instead belongs to a group of “younger municipalities” in the lowlands (average age 39.7) (SORS, 2003).

Additional criterion in case study choice was good information accessibility, more precisely interviewees open to providing relevant information. Due to the projects and plans developed for area of Stara Planina Mountain by IAUS since 1974, stable and open cooperation with local government and project associates was significant in the choice of interviewees for this paper. As Indija is lately one of the most successful municipalities with regard to development in Serbia, chiefs of several departments were also highly motivated to share information on the demographic and economic changes they had been through. Finally, both Knjaževac and Indija Municipalities are of strategic importance in the further spatial development of Serbia. Knjaževac is included within the Stara Planina Spatial Plan for Areas of Special Purposes (IAUS, 2009) and in the Master Plan of Tourism Development on Stara Planina (Horwath Consulting, 2008). The successful development of Indija and its location within two FUA makes it an example of good practice and a potentially very prosperous area in Serbia.

Interviews in the Knjaževac Municipality were conducted with the chief of the Department for Urban Planning, Communal Services and Inspection and two associates on the Stara Planina projects. In Indija, interviewees were from Municipality Governance - Department for Urban Planning, Communal-Housing Services and Environmental Protection (1); Department for Economy and Local Economy Development (3); and from the Agency for Rural Development (1).

In the planning process, both case studies treat population issue in a similar way. Plans and strategies put economic development in first place and consider that these kinds of improvements stimulate people to stay or even come back, indirectly influencing population aging. Also, both Municipalities are aware that

population aging is a consequence of long-term emigrations within young generations where losses are especially reflected on human capital. However, the Knjaževac Municipality perceives aging as a more relevant issue than depopulation, while in the Indija Municipality the reverse is true.

In both case studies it is evident that population aging influences economic activities to decrease rather than to shift to another activity that is less labour intensive. Nevertheless, in agriculture, considered a primary activity in both the Knjaževac and Indija Municipalities, there is selection and certain types of cultivation where the physical requirements are higher are avoided. It is clear that the reasons for this lie in the aged population structure.

On the one hand, the negative impacts of population aging are recognised in the Knjaževac Municipality because they have led to shortages in the working population (labour). On the other hand, refugees, which have assimilated with the autochthon population and are now a part of the working population, stimulate agricultural production in the Indija Municipality, which could be considered a positive impact. Still, in this lowland case study, villages with no tendencies to become urbanised or to increase agricultural production have seriously fallen into the aging process. Local attitudes (ethno-geography) are named as a main reason.

Regarding changes in land-use, both similarities and differences between mountainous area and lowlands have been identified. Namely, one similarity is that processes of resizing parcels of land to be larger or smaller are running parallel, but with different intensity depending on the municipality. The enlargement of parcels is more common for the Indija Municipality because agricultural production is higher and the type of agriculture (cropping) yields better results if cultivation occurs in a larger area. It appears that seeding structure has changed, too. While there is an increase in vegetable and industrial plants production, corns are less present. In the Knjaževac Municipality, the redemption and renting of land is not significant, but even when it occurs, the reason is not linked to traditional agricultural production but with the aim to use that land for tourism activities. Many parcels of this kind have still not achieved its purpose. It does not appear that population aging is causing this parcel enlargement, but one is certain:

changes in land ownership influences the demographic structure. This is because the new owners are mostly people who come from other regions and municipalities.

The process of parcel fragmentation is directly related to population aging. Inherited land is usually divided between children after parents die or even before. In any case, that land is not used for traditional agricultural production or nor used at all and yet is divided into smaller areas. This process is common in both the Knjaževac and Indija Municipalities. Nevertheless, the increase of non-functional farms in the Knjaževac Municipality is greater than the increase of changes in land-use, wherever population aging is the main factor.

CONCLUSIONS

After an increase induced by immigration during the 90s (following intense migration of refugees from the former Yugoslavia), the Indija Municipality has mainly considered depopulation as an aspect of demographic change. The situation in the Knjaževac Municipality has been different, and the more relevant issue regarding demography is population aging.

Economic activities, especially in the short term, have been shown to change mainly when stimulated by policies and programs of the State Government and spatial plans. Change in the case of the Indija Municipality relates to the type of agricultural activity (e.g. a shift from fruit production to live stocking), while the Knjaževac Municipality streams towards tourism. However, those changes have little to do with population aging. Population aging affects intensity of agricultural activity.

Measures and policies with regard to population aging in rural areas could be initiated in more fields of action. In the same way, measures and instruments to lessen negative consequences of aging, as well as prevention from aging, suggest various actions, if practically implemented.

Agricultural activity was the primary activity in Knjaževac Municipality, but population aging caused a decrease of the work force. When there are not enough people to conduct this activity, agriculture lose the importance it used to have. In the Indija Municipality, agricultural production has been maintained at a high scale.

In the case study of the mountainous area, aging caused a decline of the work force that

left repercussions on land-use. A significant number of agricultural parcels have become meadows, brushwoods or woods. In the lowland case study, intensive agricultural activity prevented land from being deserted; in the Indija Municipality, the conversion tendency is from agricultural parcels to building-land.

The paradox is that the mountainous example shows the greater level of decreased autochthon activity, while, at the same time, investors from other regions and municipalities are the most interested in buying this land. In any case, this land will not be used for agricultural production anymore.

Unfavourable relations between population aging and agricultural activities are more pronounced in the mountainous than in the lowland case study. Namely, more intense aging and worse geographical conditions for agricultural development brings about that process where parcels become smaller by inheritance; therefore, this process is much more intense in the Knjaževac Municipality, while a reverse process of parcel enlargement is occurring in the Indija Municipality.

In order to avoid irreversible consequences of aging, it is essential to maintain the necessary access to information and awareness of the relationships between population aging and social, economic and natural development. In order to move from knowledge to concrete actions, providing objective scientific information about the specifics of the aging process specifics to decision-makers is of exquisite relevance (Stloukal, 2001). When acknowledgment and information already exist and especially if previous opinion articulated an opposite view, it is extremely recommended to work to change attitudes about measures and instruments. Encouraging the acceptance of innovations, new agricultural technologies and practices are also essential.

Regarding measures and instruments that are the responsibility of government, legislation is one of the options. Laws may regulate the flexibility of farmers to arrange their own activities, regulate the level of benefits they might gain, but define responsibilities that diminish village-city migrations, too.

It is of extreme relevance to be aware that both interviews in the Knjaževac and Indija Municipalities have shown that when the local population is not informed about possible subventions, credits and programs or they are not informed in an effective way, governmental

subsidies are not being used and fail as a tool to discourage emigration from rural areas.

Finally, the following action fields were identified as those where measures, instruments and policies dealing with population aging are relevant:

1. Information and data collection (e.g. agricultural censuses);
2. Dissemination of information, data and awareness (e.g. seminars);
3. Change of previously adopted attitudes and actions (e.g. marketing, workshops);
4. Adoption of innovations, new technologies and practices;
5. Legislation; and
6. Spatial and socio-economic planning.

What role does the Serbian Government have in this issue? The National Strategy on Aging 2006-2015 of the Republic of Serbia is conceptually harmonized with the Recommendations and Obligations of the Madrid International Action Plan on Aging (2002) and the Regional Strategy in relation to its implementation, ratified by the UN Economic Commission for Europe, as well as with the Poverty Reduction Strategy of the Republic of Serbia (2003). With the adoption of the National Strategy on Aging (2006), the phenomenon of aging is promoted on the national level as a factor of all Serbian governmental sector policies. The first strategic direction in this document is to animate the integrative process adaptation to the social and economic consequences of aging. In 2005 the Serbian government adopted the Millennium Development Goals Report, which is supported as a priority in Strategy on Aging. One of strategic actions stressed in this Strategy is to reach an economic development redistribution. The main goal of economic development is an economic growth rate acceleration through a transition process that recognizes the negative social consequences of transition mitigation with regard to population aging consequences. Some of guidelines are: promotion of just and sustainable development; adaptation of the labour market to accommodate the social and economic consequences of population aging (where the priority is to reduce the unemployment level, for both men and women, above the age of 45); the encouragement of lifelong education which is an essential precondition for participation of the older population in the labour market (UNECE, 2007).

The Poverty Reduction Strategy Implementation Team has recognized the significance of rural development for poverty reduction. Analysing budgetary support to agriculture and rural areas in Serbia over the period of 2004-2008 it is evident that the main problem is that similar measures are reiterated in different manners, but the effects are apparently missing.

Clearly all strategies related to rural development, agricultural activity and the aging population must be coordinated. Without that approach in the planning process, the sustainable development of rural areas as a whole will not be possible in Serbia.

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VISUAL ILLUSION OF THE CHANGE OF THE SIZE OF ARCHITECTURAL AND URBAN OBJECTS OBSERVED UPON A CHANGE OF THE OBSERVER'S DISTANCE: PARAMETERS THAT INFLUENCE IT PHENOMENOLOGICALLY

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This paper explores the visual phenomena of a seeming change of the target-object's size (as a focus of concrete visual perception) in the function of an observer's motion so that it "seems" contrary to the law of linear perspective (in the sense of an expected increase of the target volume/monumentality – by getting closer or a decrease – by getting farther away).

This phenomenon is described in a geometrical and perceptual aspect; the result of this comprehensive approach led to identify parameters that determine it phenomenologically. It was established that the explored visual phenomenon is a specific "size illusion", i.e. an "angular size illusion" that occurs when influenced by factors of the perceptual kind - activated by a specific dynamic relationship (on a visual plan) between the target object and its surrounding competitive objects, as an observer moves. By understanding the character of this phenomenon (both in a geometrical and perceptual sense), it is possible to apply the acquired knowledge in practice – in programming the visual effects to be obtained (such as to visually optimize or minimize the monumentality of targeted objects) in all architectural and urban fields (planning, designing and reconstruction).

Key words: perspective, visual-direction perception, size-distance illusion, angular size illusion, new Size-Distance Invariance Hypothesis (SDIH)

INTRODUCTION

Objective

The complex structure of constructed setting (urban and contemporary rural), requires planning, designing, analysis and evaluation in term of numerous architectural and urban aspects (such as engineering, functional, socio-psychological, ecological, economic, aesthetic, etc). Each determines specific terms of its own phenomenology. In that sense, the need to simultaneously meet all possible

requirements points out the undeniable importance to appropriately model space on various levels, highlighting the role of geometrical and complementary visual perception parameters, especially those referring to morphological space characteristics, particularly in the function of visibility and recognizability (Đokić, 2003, 2007).

Recognizability also refers to the existence of dominants and accents in architectural and urban spaces/scenes. In this matter, it is important to note that they are not a sole product of relevant dimensioning, materialization and/or colorist processing of individual constituent elements (or compositions) that need to be visually highlighted, but also a product of an appropriate

geometrical organization of physical structure of immediate/farther setting – required to realize a complex visual interaction with the observer, based on visual illusions. Consequently, with an appropriate design of the morphological structure of the urban matrix and taking into account the motion parameter (motion/time), it is possible to program visual phenomena/illusions that some matrix constituents will make even more monumental (or purposefully degraded) – by meeting preconditions that enable the impression of their volume increase (i.e. of decrease), by increasing (i.e. decreasing) the distance of the observer (Zdravković-Jovanović et al., 1995) which, as regards phenomenology, is contrary to the laws on linear perspective (Zdravković-Jovanović, 1995).

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Relevance

In view of the importance of the application of visual illusion in architectural and urban planning, design and reconstruction, this paper represents an attempt at scientifically identifying the determinants of the phenomenology, which, according to the author, are essential for its utility and simple applicability in contemporary architectural practice.

Because visual illusion has not been studied in architecture and urbanism in this manner, this paper represents a specific scientific contribution to the research of its vital determinants.

PREVIOUS RESEARCH

The aim of the phenomena of visual illusion is to divert the system of visual perception with respect to a correct reading of its actual characteristics (foremost size/volume, but also the shape, color and location/distance) of perceived entities (disposed in plane and space), which makes them particularly attractive for many studies in optics, neurophysiology and psychology.

Given that these visual illusions are based on a visual perception whose outcome is characterized by a paradoxical perceptive evaluation of these features (which is why they are called size illusions²), most attempts at defining them were, essentially, based on the implementation of the so-called "Apparent Distance Theory", i.e. of the "classic" SDIH hypothesis (Size-Distance Invariance Hypothesis - Kilpatrick and Ittelson, 1953). In terms of phenomenology, the hypothesis refers to issues of visual perception in the studied field. However, the results of the research that used these postulates were not scientifically satisfying, because for a specific percept's constant linear size "S" and its fixed distance "D" from an observer, the actual/physical visual angle "V(S)" of this size (which in fact identifies a functional relationship between sizes "S" and "D" in the form of: $tgV(S) = S/D$) is not an invariant (supported by the SDIH hypothesis!).

² Typical representatives of this type of visual illusions are: Moon illusion, Oculomotor micropsia/macropsia, Ebbinghaus illusion, Herring illusion, Ponzo illusion, Müller-Lyer illusion, Spiral after/effect, Orbison illusion, Jastrow illusion, Wundt illusion, Meyer wallpaper illusion and Curvature of the apparent fronto-parallel plane (AFFP) (remark by the author).

Since the perception of these "linear/distance sizes", except for monocular and binocular facts, is influenced by numerous contextual surrounding signals (such as distance/depth cues) that determine the perception of these visual angles (Rock and McDermott, 1964; Angular Size-Contrast Theory - Restle, 1970), a more comprehensive explanation of this interdependence was given by: Baird et al. (1990), McCready (1963, 1965, 1983, 1985, 1986, 1994) and Ross and Plug (2002) – with an altered ("perceptual") view that is the origin of the so-called "new" SDIH hypothesis ("New" Perceptual Size-Distance Invariance Hypothesis: McCready, 1963, 1965, 1983, 1985, 1986, 1994; Ross and Plug, 2002).

The new approach is that the target's visual angle is its perceived visual angle "V"³ (Baird, 1970), i.e. that space perception implies a simultaneous perception of visual angles "V" and perception of linear sizes "S" and "D" (perceived linear sizes) (Joynson, 1949; Komoda and Ono, 1974; Gogel and Eby, 1997; Higashiyama and Shimono, 1994; McCready, 1985, 1994), under the influence of distance/depth cues as imminent factors that (dictating changes in dimensions "L" of the percept's retinal image) cause changes in the size of the actual/physical visual angle "V" (in the sense of a certain correction ($V = V \pm \Delta^\circ$)) and henceforth, in the size of the "read" size "S" (neurophysiologic explanation: Murray et al., 2006).

Given that the "size illusion" phenomenon is the result of a diversion of the visual perception system by contextual information of spatial and visual character, its presence (in terms of phenomenology) refers to issues pertaining to a certain dimension correction (increase/decrease) "L" of the retinal image of the percept's linear sizes "S" i.e. of the perceived visual angles "V(S)", which confirms here too the importance of angle "V" (and not the importance of the actual/physical visual angle "V").⁴

On the other hand, the study of "visual size

³The target's perception of visual angles "V" implies perception of angles defined by pairs of eye-rays corresponding to ends of perceived linear sizes ("direction perception," "egocentric distance-signal perception" – Foley, 1980).

⁴ According to the aforementioned, "Size illusions" are, in fact, "Visual angle illusions"/"Angular size illusions" (Baird, 1970; Komoda and Ono, 1974; Roscoe, 1984; Gogel and Eby, 1997; Higashiyama, 1992; Higashiyama and Shimono, 1994; McCready, 1985, 1986, 1994; Murray et al., 2006).

illusions" in architecture and urbanism, in the form of a visual phenomenon related to the impression of an increase of the perceived architectural and urban object that occurs as the observer moves farther away, was conducted on the example of St. Mark's Church in Belgrade, Serbia (Zdravković-Jovanović et al., 1995).

That paper underlined that "one of the most striking phenomena related to the perception of architectural and urban compositions, is the illusion of an increase of the dominant's dimension with regard to the marker, with the increase of the observer's distance from which he perceives them". Here the term "dominant" implies "the perceived object" and the term "marker" all surrounding elements whose dimensions were "memorized" from "previous visual experiences".

However, in line with the chosen approach, this paper interprets this visual phenomenon only from the aspect of descriptive geometry: laws on perspective space perception were used to explain this phenomenon. They are graphically interpreted by constructive procedures intended at presenting 3D space in the central projection (in that sense, the phenomenon itself was considered on an abstract model whose marker was one of the vertical edges of the object (the closest to the observed dominant), while a vertical plane placed parallel to the dominant's main front façade was used for the drawing plane. Consequently, this "engineering approach," on the one hand, did not make it possible to entirely perceive the analyzed phenomenon (from the psychological/perceptual point of view) that is otherwise necessary to adopt comprehensive conclusions. On the other hand, the phenomenon description based solely on the used model (without any reference to the actual situation in a non-abstract setting), left open the issue of a broad applicability of the adopted conclusions in professional practice (and in morphologically different contexts).

That is why the authors of this paper wished to conduct a more comprehensive research of the essential aspects of this visual illusion: especially of the facts that determine its origin and the parameters that describe the principal phenomenology (bearing in mind the influence of the ever-present contextual surrounding signals as the fundamental determinants of perceptual kind).



Figure 1:
*Focus of interest (St. Sava's Temple in Belgrade, Serbia)
with surrounding objects as main segments
of "its" marker volume*



Figure 2:
*Focus of interest (St. Mark's Church in Belgrade, Serbia)
with the surrounding vegetation and objects
as elements of "its" marker volume*



Figure 3:
*Focus of interest
with the surrounding vegetation as the only element
of "its" marker volume*

STARTING CONSIDERATIONS

Definition of terms

In line with the concept of this paper, the main categories and subjects of this research are formulated as follows:

(1) focus of interest "F" (hereinafter "focus") is an architectural and urban object (or its part) that represents the observer's primary subject of interest. It is located in the central zone of the visual field (field of sharp vision); it consists of: (i) focus volume: the composition of all visible focus mass, (ii) the focus contour line (marked with "k (F)" on graphic illustrations: the contour of the perceptible (visible) focus volume in the function of a specific observer's position and (iii) the composition-related focus elements (secondary mass and elements of the façade decoration), and

(2) visual marker "R" (hereafter "marker") is a variable category in the function of the observer's motion, called so because it is assumed here that in a competitive relation with respect to the focus of interest (in the visual sense), it makes the analyzed phenomenon possible; the marker consists of: (i) the marker volume: part of a closer or farther architectural/urban setting of the focus that is partially or completely an integral part of the acquired visual field and (ii) the marker line: the contour of the perceived marker volume (marked with "k(R)" on graphic illustrations) that, in a visual sense, partially or completely "frames" the focus of interest.

Typology of the marker volumes

With respect to this wording, the marker volume consists of one or more architectural and urban

elements or their parts: (i) objects that are visually competitive with respect to the focus of interest (figure 1), (ii) vegetation visually competitive with respect to the focus of interest (figure 2) and (iii) combined - "competitive" objects and vegetation (figure 3).

Geometry of the marker volume

Depending on the geometry of elements constituting the marker volume, the marker line consists of parts of straight lines and/or curves - 2D lines and/or 3D lines, that represent the contours of these elements (in the function of the actual observers' position) and it is visible as a seemingly continuous line - in the form of "outlines" of the marker volume (figures 4 and 5).

A realistic 3D setting is characterized by a large amount of spatial and visual information - located in different space depth planes (at different distances from the observer). The informative quality of such spaces imminently leads to changes of the subject of interest - from closer to information located farther away from the observer (with smaller or larger reorientation of the perception direction - with

or without head or eyelense motion), under the influence of visual, selective and controlled attention mechanisms. (Milošević, 2002). Since this information contains descriptors that generate constituent elements of this setting and its compositions (architectural objects, elements of urban equipment, including vegetation, etc.), as the observer moves through this setting, the imminent feature of the visual perception is an uninterrupted change of the visual field (i.e. perceived space facts), the result of which are structural changes in the perceived marker volume and consequently its marker line (some of its elements gradually disappear from the visual field leaving place for new ones) (figure 6 / (a), (b) and (c)).

Defining the starting hypothesis

Given that, as underlined at the beginning of this paper, this visual phenomenon - in this context and the way suggested here, was not studied, it was necessary for the following starting hypothesis to be defined.

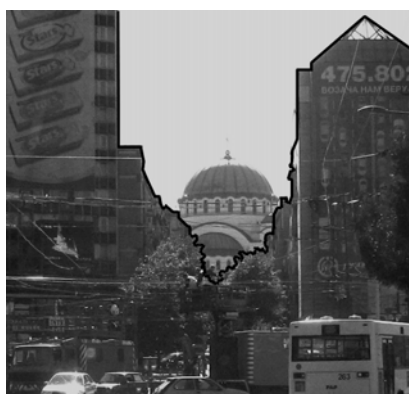


Figure 4: Focus of interest
and a seemingly continuous marker line of "its" marker volume
perceived from a given eye point as a series of straight lines
and curves



Figure 5: Focus of interest
and the seemingly continuous marker line of "its" marker volume
perceived from a given eye point as a series of curves



Figure 6: Gradual change of the marker volume (and the marker line in the form of its contour) as a result of continuous motion: (a) the observer is the closest to the focus of interest; (b) and (c) the following positions of the observer, defined as he moves farther away from the focus of interest

The visual phenomenon referring to a seeming change of the focus volume in the function of the observer's motion in a manner that "appears" to be contrary to the law of linear perspective (in the sense of an expected volume/monumentality increase – by getting closer i.e. its decrease – by getting farther away), is the result of a dynamic relation (in the visual sense) existing between that focus and surrounding objects visually competitive with respect to it. For this dynamic relation to exist, the focus and the marker cannot belong to the same depth-plane.

Defining the conditions required to analyze this visual phenomenon

Since the studied visual occurrence is a phenomenon that belongs to the field of visual perception, it will occur provided the observer consistently completes the process of visual illusion of a specific context. This implies the perception of the focus and its setting (henceforth, the marker), in a manner that will meet the following requirements:

(1) as the subject of the analyzed visual occurrence (henceforth, the perception) is the focus of a specific interest, the route along which the observer moves has to maintain: (i) a "good" visibility, by preserving entirely the visibility of the focus (or at least a major part of its volume) from all potential positions on the route, (ii) a "clear" visibility, able to hold the percept without interruption in the central zone of the visual field (field of sharp vision), from all potential positions on the route and (iii) a continuous visibility, exclusively, in order to secure continuity of the flow of visual experience. Consequently, geometrically speaking, the route has to be continuous and as approximate as possible to a straight line (of any space direction); the visual experience will "last" provided the route is as long

as possible (to the limit to which the perception is possible in accordance with the criteria described); and

(2) bearing in mind the hypothesis that the analyzed phenomenon is the result of a dynamic relation existing between the focus and its competitive setting (in a visual sense), as well as the fact that the marker/marker volume is a part of such setting, it is necessary for the marker also to be present in the visual field i.e. visible from all potential positions on the route – so as to meet the afore mentioned requirements⁵.

Defining the geometry of the used model of the setting

To explain the essence of this phenomenon in a concise but comprehensive way and for the purpose of this study a simplified model of the 3D setting with the following geometrical features was defined:

(1) the marker "R" is represented with two mutually spaced out identical vertical rectangles located on the same plane, with the upper edges horizontal and at the same height; the marker is constant (it does not change with the change of the observer's position),

(2) the route from which the observer perceives the marker and the focus is a straight line and belongs to the vertical plane of symmetry of the related marker composition; the route is horizontal and located on the plane where the lower (horizontal) edges of the rectangle are situated, and

(3) the focus "F" is the hexadron that is visible along the entire route – through the space

existing between the marker rectangles (positioned in the "back" depth-plane); it is positioned so as to lie on a horizontal route plane, so that one of the pairs of its opposite vertical sides is parallel to the plane of the marker rectangles and the plane of their symmetry is identical to the said marker structure symmetry plane.

Therefore, it is necessary to note that: (i) the adoption of a "constant" marker (invariable in the function of the observer's motion) and presented in a simplified manner as described, and (ii) the choice of a straight line route of horizontal direction, are the consequence of the fact that this paper represents an initial study, aimed at identifying the core of this phenomenon (in terms of phenomenology), which can be done by using a model of elementary composition-related structures (geometrically speaking) – with a minimum number of variable parameters. In addition, the positioning of the marker between the observer and the focus (in a depth-plane "closer" to the observer), is the result of a desire to define a model of the setting that is conceptually/structurally in accordance with the realistic ones represented on given figures (including all others in which the foci of interest are monumental architectural buildings that commonly represent urban dominants).

Furthermore, it is necessary to bear in mind that none of these limitations question the validity of this model, because it offers an adequate presentation of realistic spaces with similar morphological features (in the relevant field), and takes into account that the process of structuring respected all "general requirements" introduced in previous sections, which were, in fact, the main descriptors of exactly these spaces.

⁵ Since the marker is not an immediate subject of the observer's interest (but the focus), the "peripheral vision" can be responsible for it (Author's note).

Given that in morphologically more complex realistic spaces there are routes of a more complex geometry, where the dynamic perception of the setting (in motion), is most often characterized by the presence of "variable" markers (that may be located even farther from the focus), the research of this phenomenon in the function of these (more complex) facts, will be the subject of future research, based on the results of this paper.

PROVING THE HYPOTHESIS

The visual phenomenon as an actual phenomenon: physical facts

It is empirically proved (in a realistic setting) that the change in the relation between the "upper" marker line and the "upper" contour line of the focus is clearly visible from greater distances. To research a seeming change of the focus volume with respect to the marker volume, according to the SDIH hypothesis, actual/physical visual angles "V" (in degrees) were used, under which the observer perceives the lines, moving along the route. Naturally, it is evident that as concerns smaller distances between the existing marker/focus and the observer, the visual change of depth-planes to which they belong (in the function of the station point change) is recognizable at every perceivable motion-parallax change between the marker line and any other sufficiently visible composition-related focus element (element of secondary or third façade decoration). The seeming change of the focus volume "F" with regard to marker volume "R" will be considered in this paper by following the seeming change of the height of the upper focus line and upper marker contour line.

To research this phenomenon with a view to proving the hypothesis, a model of the setting with previously described/general geometrical

marker is chosen to be less than the height of the focus (which is common in architectural and urban scenes when the focus represents the space determinant of outstanding monumentality). The length of the observer's route depends on these sizes so that its dimensioning is a consequence of the level of the change of actual perceived visual angle values "V" of the marker, i.e. focus (given the fact that this change is less than 1° from positions 8-9-10 and further). On the other hand, the number of station points (and their mutual distance), is chosen in accordance with the perceived change rate in the sizes of the analyzed angles "V" (so it is significant for each two successive observer's positions).

Figure 7 shows the lateral view of the described model, with actual/physical visual angles "V" of the upper (horizontal) focus contour line "k(F)" (a) and the upper (horizontal) marker contour line "k(R)" (b), perceived for each of 11 observer's positions.

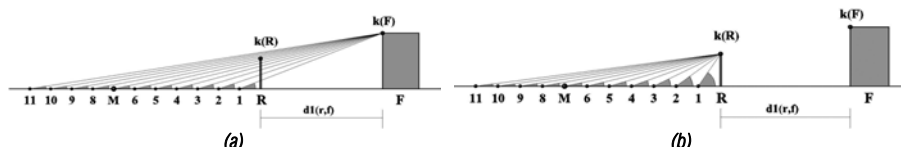


Figure 7: Lateral views of the chosen model of the surroundings with traced actual visual angles "V" of the upper (horizontal) focus contour line "F" (a) or marker "R" (b)

Table 1 features actual values (in degrees) of considered visual angles "V" of the upper (horizontal) marker and focus contour lines ("R" i.e. "F"), in the function of a specific observer's position.

Table 2 features the increase rate "Ψ" of actual values (in degrees) of visual angles "V" of the upper (horizontal) marker and focus contour lines for every two successive observer's positions: "i" and "i+1" ($\Psi = V_{i+1} - V_i$).

Figure 9 shows comparative charts that illustrate the change of the increase rate "Ψ(R)" or "Ψ(F)" of analyzed visual angles of the upper (horizontal) marker contour line (visual angles) (in degrees), responsible for every two successive observer's positions: "i+1" and "i" ($\Psi = V_{i+1} - V_i$).⁶

The following facts can be observed on the chart represented in figure 8.

The increase (decrease) of the values of actual visual angles "V" (in the function of the observer getting closer (getting farther away)), is present as well with the marker "R" and the focus "F", which shows that their perception is determined by a law of linear perspective (in the sense that closer objects seem larger). However, this occurrence of a major increase (decrease) of these values with the marker can be supported by the fact that the observer intensively experiences the perspective change (as a consequence of a perspective deformation) on the perceived elements that are closer to him (Zdravković-Jovanović, 1995).

On the other hand, in the observer's position "11", the actual visual angle of the focus "F" is somewhat larger than the visual angle of the marker "R", which implies that (from that station point) it is perceived as being somewhat higher than the marker. As the observer moves from position "11" to position "M", the actual visual angles of the marker and the focus are simultaneously increasing, but the increase of these angles is more significant with respect to the marker than to the focus

Table 1: Actual values (in degrees) of visual angles "V" of the upper (horizontal) marker and focus contour lines ("R" i.e. "F"), in the function of a specific observer's position.

V (°)	Numbers of the observer's positions along the route										
	11	10	9	8	M	6	5	4	3	2	1
V(R)	7.742	8.505	9.434	10.588	12.059	13.995	16.651	20.498	26.495	36.785	56.228
V (F)	9.248	9.882	10.470	11.209	12.059	13.045	14.203	15.582	17.248	19.299	21.875

Table 2: Increase rate "Ψ(R)" or "Ψ(F)" (in degrees) of actual visual angles V(R) or V(F), for every two successive observer's positions

Ψ (°)	Segments of the observer's route between each two successive observer's positions									
	11/10	10/9	9/8	8/M	M/6	6/5	5/4	4/3	3/2	2/1
Ψ(R)=V(R) _{i+1} -V(R) _i	0.763	0.929	1.154	1.471	1.936	2.656	3.847	5.997	10.290	19.443
Ψ(F)=V(F) _{i+1} -V(F) _i	0.574	0.648	0.739	0.850	0.986	1.158	1.379	1.666	2.051	2.576

characteristics was used. As regards specific sizes of the model elements, the mutual distance between the focus and the marker is arbitrarily dimensioned, where the height of the

Figure 8 shows comparative charts that illustrate actual values of analyzed visual angles "V(R)" and "V(F)", in the function of each of 11 chosen observer's positions.

⁶ In order to obtain a better visibility of the charts, the values of angles "Ψ" have been enlarged two times (Author's note)

(figure 8). Consequently, from station point "M" the observer perceives a levelling of the actual visual angles of the marker and focus, which results in a seeming levelling of their heights. As the observer gets is getting closer to the focus (henceforth, to the marker), the described tendency of the increase of actual visual angles of the marker and focus continues, and the visual angle of the marker is

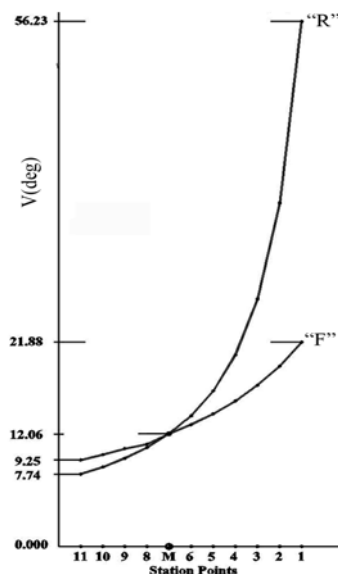


Figure 8: Actual values of visual angles "V(R)" and "V(F)" (°) in the function of the observer's position

significantly increasing compared to the visual angle of the focus. The consequence is the fact that, from position "M" to position "1", there is an impression of a major increase of the marker height with respect to the focus.

As these visual changes in the relationship between the height of the focus and its visually competitive marker are the consequence of a perception of corresponding mutually different visual angles (except in point "M"!)(figure 8), and mutually different rates of visual angle changes between each two station points (figure 9), these facts clearly express a specific dynamic relationship (in the visual sense) between the focus and the marker - revealed when the observer moves (gets closer or farther away).

The visual phenomenon as a visual "size illusion" i.e. "angular size illusion": perceptual facts

In view of the professional orientation of the author of this paper, which determined the approach to this research, the interpretation of the analyzed phenomenon as a visual "size illusion" or "angular size illusion" will be elementary - kept on the

level of commenting on the cues which qualify it as such. On that occasion, the arguments set forth will correlate with a "corrected" perceptual approach (based on the "new" SDIH hypothesis), because of its contribution to a comprehensive explanation of the phenomenology of controversial visual "size illusions" of 2D and 3D spaces (mentioned at the beginning).

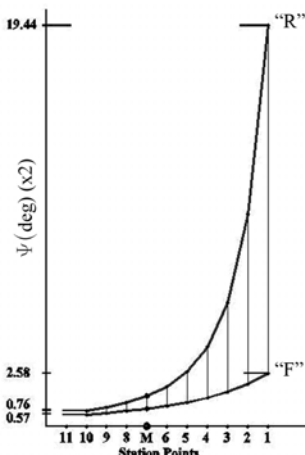


Figure 9: Concurrent illustration of the increase values "Ψ(R)" and "Ψ(F)" (°) for each two successive observer's positions

With regard to the fact that the perception of the setting elements equals the perception of their visual angles "V" (as corrected actual visual angles "V" under the influence of available (visible) distance/depth cues)⁷, which

⁷ On this aspect (as it belongs to the visual perception domain) the scaling of the perceived distances "D", except for the monocular and binocular facts, can also be influenced by: (i) their "equidistance assumptions" (McCready, 1965, 1985) or their "equidistance tendencies" (Gogel, 1965) or (ii) "familiar" distance sizes/equidistances (Bolles and Bailey, 1956; Ono, 1970; McCready, 1965, 1985), while the scaling of the perceived linear sizes "S", except for the monocular and binocular facts, can also be influenced by: (i) "familiar" linear sizes (but this time as an efficient cue to linear sizes "S" (Bolles and Bailey, 1956; Ono, 1970) or (ii) "assumed" or "suggested" linear sizes (Colheart, 1970; Hastorf, 1950).

Also, one has to take into account that important determinants of visual perception of the setting in the domain of visual illusions also are: (i) "equal linear size assumption" "S" of its constituent elements (McCready, 1965, 1985) - as the responsible relative angular size cue to distance on the basis of which the visual system assumes that it is about the same object ("identity constancy" - Piaget, 1954; "equidistance tendency" - Gogel, 1965; "perceptual constancy" - Epstein, 1973; Rock, 1977; Rock et al., 1978) and (ii)

implies multi-stage computing of these angles' sizes, following a comparative scaling of the perceived distances "D" and perceived sizes "S" (Visual Processing Model, McCready, 1965, 1985), the qualification of this phenomenon will be as follows.

Consequently, when the observer moves, the impression that the perceived linear sizes of the focus and the marker are changing in a manner that "seems" contrary to the law of linear perspective (in the sense of expected increase - by getting closer or decrease - by getting farther away), is the result of a simultaneous perception of their visual angles "V" - in a manner that implies correction of corresponding actual visual angles "V(F)" and "V(R)" (actually analyzed here), under the influence of available (visible) contextual signals. In that sense, the said correction may be the impact of one of the three facts mentioned in the footnote (as specific depth/distance cues): (i) the equidistance assumption/equal linear size assumption of the perceived objects, (ii) familiar size and (iii) oculomotor micropsia/macropsia.

Namely, before the observer sets in motion, according to his location/position in the setting and his specific interest, he perceives the visual angles "V" of its constituent elements (i.e. linear sizes "S") that attracted his attention (by scaling the perceived size-distance relationship "S"- "D" under the influence of available distance/depth cues). The final results of their visual angle-size-distance perception are not only sizes "S" and "D" scaled individually, but an impression of their spatial inter-relations (i.e. their "relative" mutual distances). Such perceived values become part of the visual experience. On that occasion, if the observer is already familiar with the setting, the influence of "familiar" sizes on his subsequent perception confirms the validity of the regained impression,

oculomotor micropsia (i.e. macropsia) as a phenomenon that may lead to actual changes of the perceived focus's angular sizes "V" (its decrease i.e. increase), because of eye accommodation and/or convergence with regard to objects located between the focus and observer (i.e. behind the focus); the conducted correction "diverts" the perception system in one of three ways - perceived linear sizes "S" may be seen: (i) as smaller ones (i.e. larger ones), (ii) as farther ones (i.e. closer ones) or (iii) as smaller and farther ones (i.e. as larger and closer ones) (McCready, 1965; Ono, 1970; Ono et al., 1974; Komoda and Ono, 1974; Roscoe, 1989)

recognizing the previously acquired visual experience (Visual Processing Model, McCready, 1965, 1985).

After the observer sets in motion, he has a defined focus of interest (which, by the way, he may dynamically change – a circumstance contrary to this study!), while the objects from the setting that are visually competitive with respect to the focus (one or more), establish a visual marker (become part of the marker volume). If the observer, as he moves, does not change the focus of interest and the visually acquired marker (and if other requirements and limitations mentioned in this paper are met), the dynamic relationship between them (in the visual sense) has characteristics displayed in chart on figures 8 and 9. Accordingly, the visual presentation the observer has of the perceived setting while moving is illustrated in figure 10.

Comparing these figures (as simplified representations of successively generated visual fields), considering the actually present impression of increase of the marker and focus heights (as the natural consequence of the

perspective deformation in the function of getting closer), it is possible to see that as the observer gets closer to the focus, the visual relationship between marker and focus becomes more inconsistent (figures 9 and 10). The fact that the rate of the marker's seeming increase is much more significant than is the focus' (figures 9 and 10), makes the marker a more visible rival of the focus and, therefore, an important cue to its distance from the observer (and a paradoxical one!).

Namely, as the space perceived by the observer is realistic (architectural and urban) – the shape, size, color and position of its constituent elements are largely physical constants (which refers to the focus and marker as well), the visual system (despite initiated motion and present "dynamics" changes) – especially visible on objects closer to the observer) has a tendency to hold them as such (treating them as perceptive constants – "identity constancy", "perceptual constancy"). Accordingly, the focus and the marker (as integral parts of the perceived space) are also treated as perceptive invariants. Consequently, the marker becomes a specific depth cue

(because it "behaves as visually expected" – according to the laws of linear perspective). In case the observer cannot perceive other depth cues, the size of the marker remains the only available cue. In order to preserve the presentation of the perceptive constancy of all physically invariable objects in the visual field (and therefore make the perceived to be similar to the initially acquired visual experience), the marker size can cause a correction of the actually perceived distance of the focus with respect to the observer (in the direction of its increase). According to the "new" SDIH hypothesis, the correction of the perceived size of the actual distance of the focus with respect to the observer (which is causally connected with the size of the perceived visual angle " V "), causes a correction/decrease of the angle of the actual perception " V " and, therefore, a decrease in the perceived focus' size/height (while its linear size " S " remains constant).

As the observer gets closer to the focus, the disbalance between the rate of seeming marker increase and the rate of seeming focus increase becomes more significant (in favor of

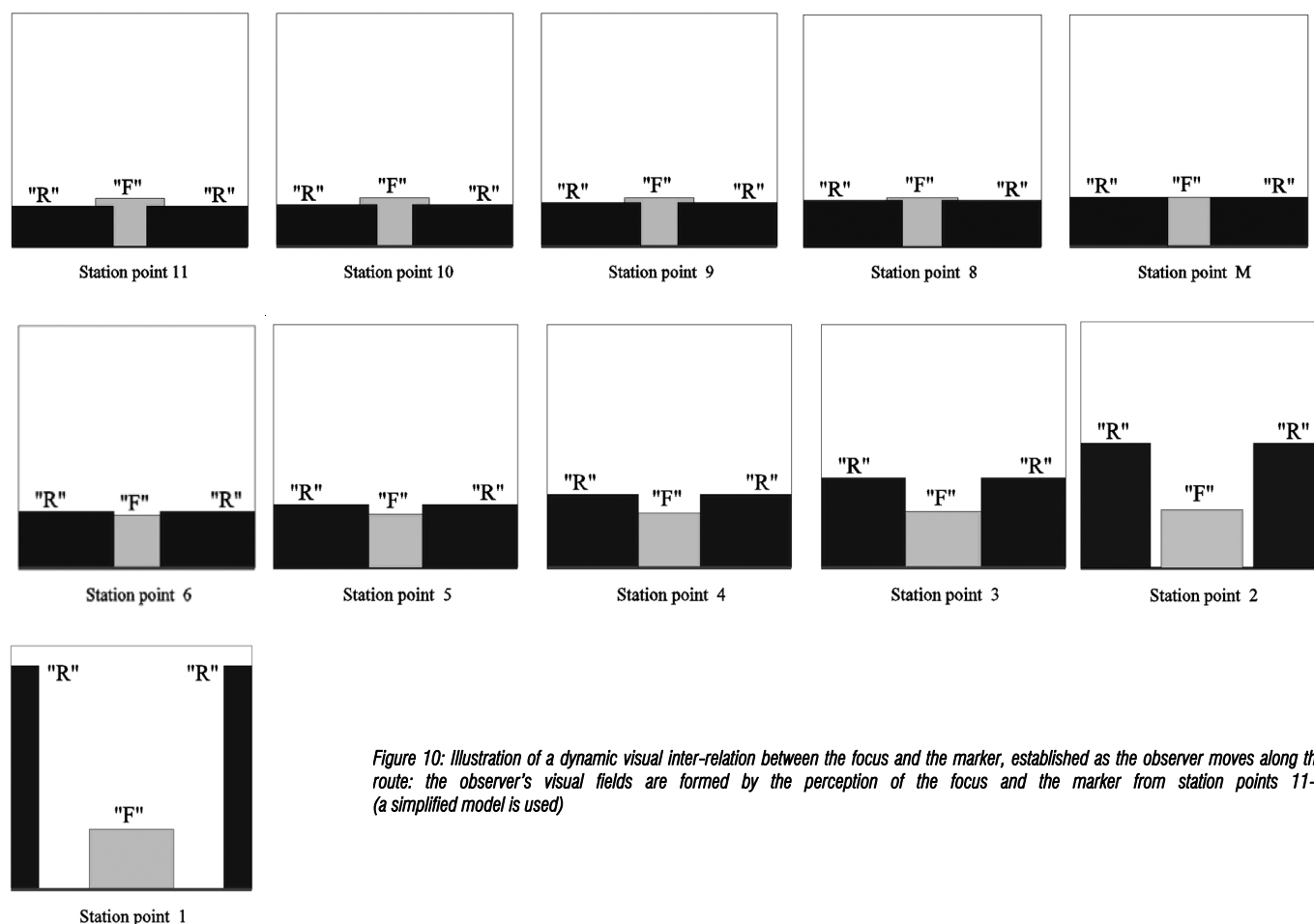


Figure 10: Illustration of a dynamic visual inter-relation between the focus and the marker, established as the observer moves along the route: the observer's visual fields are formed by the perception of the focus and the marker from station points 11-1 (a simplified model is used)

the marker as the “activated” cue of the focus distance from the observer), the above mentioned can be the reason why, from every following position (closer to the marker), the distance between the observer and the focus is scaled more and more (figures 9 and 10). The consequence is an impression that the focus volume/size/height is getting smaller and smaller (relatively – with regard to the marker). According to its role to correct actual focus visual angle sizes, it is possible to tell that, in this phenomenon, the marker represents a specific relative angular size cue to focus distance.

Given that (as underscored at the beginning) in the process of perception of an architectural and urban setting, a large number of objects constitute the marker, their unique marker volume represents a unique relative angular size cue to distance used to scale the distance between the focus and the observer. When the marker contour line seemingly “frames” the focus (not rare in realistic spaces), the observer has the impression that the focus is not decreasing relatively, but generally – as if this impression is determined by all objects within the surroundings that frame the focus partially or completely.

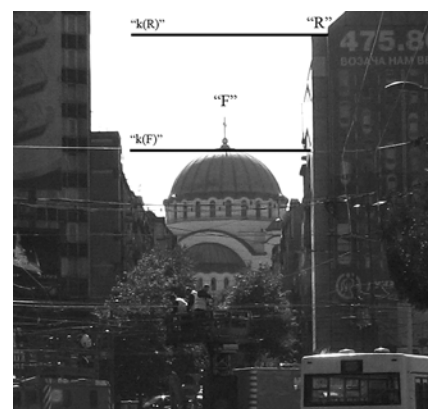
Consequently, the described mechanism of visual perception of the focus creates in observers a powerful impression that, as they get closer to the focus, the focus significantly “escapes” from them.



(a)



(b)



(c)

Figure 11: Seeming change of dimensional relation between the marker and focus occurs when the observer approaches the focus: (a) the observer is at the far end of the focus: the focus is seemingly perceived as “higher” than the “right” marker object (b) the focus “catches up with” the marker in height and (c) observer is the closest to the focus: the focus is seemingly perceived as “lower” than the “right” marker object (focus: St. Sava's Temple in Belgrade – Serbia)

The intensification of the impression that the focus “retreats” (i.e. decreases and/or both) as the observer gets closer, can be influenced by an oculomotor micropsia activated in parts of the route where the marker volume is in the

immediate proximity of the observer (with regard to which “adjustment” of the oculomotor system “to the proximity” will be done). If the described requirement is met, while the observer is getting closer to the focus, the visible seeming change of the marker volume/size/height intensifies – exponentially grows larger (figure 9) and the additional influence of the oculomotor micropsia on the focus perception (at every position) leads to a further decrease of its already corrected perceived visual angles – causing more significant “decrease” of focus volume/size/height (i.e. the impression that the focus is obviously “lagging” in “growth”)⁸.

Given that all described perceptual factors cause a seemingly continuous decrease of the focus volume (i.e. its perceived visual angles “V”) as the observer gets closer, they are all responsible for the creation of the illusion of the focus decrease in the process of closing in on it (despite the fact that, under these conditions, it is really perceived as being even larger). Because the described occurrence is contrary to the laws of linear perspective, this phenomenon represents a specific visual size illusion. However, as this occurrence actually influences the true perception of the analyzed perceived visual angles “V”, it is, in fact, an angular size illusion.

It is obvious that the same effect (but of opposite visual impression), is possible as the observer moves farther from the focus (for example, the perception from the back platform

of a bus or by looking in the rear mirror of the car...). Then too the marker would be a relative angular size cue to focus distance but the occurrence of the oculomotor micropsia (according to its phenomenology), this time, would defy the significant increase of the focus volume as the observer moves farther away (in the sense of a certain decrease of the sizes of the perceived focus' visual angles).

Consequently, one can conclude that an intense dynamic relationship between the focus and the marker (in a visual sense) creates an impression that the focus volume changes in a manner that “seems” contrary to the law of linear perspective (with respect to the created impression of the volume decrease – by getting closer or increase – by getting farther away). If the marker and focus are located in the same depth-plane, the rates of their actual visual angle changes (increase/i.e.decrease) for every specific position of the observer would be mutually proportional, so that this “dynamics” would not take place and, consequently, nor would the relevant illusion. This supports the starting hypothesis.

Naturally, when, in addition to the marker presence (as a significant relative angular size cue to focus distance), there are other available (visible) depth cues, with regard to them, the level of corrections of the focus perceived visual angles “Vi” (from each of the “excessive” station points “i” close to the marker) would be variant.

⁸ Bear in mind that marker is the subject of micropsia oculomotor accommodation/convergence (remark by the author)

Bearing this study in mind, it is clear that it makes no difference whether the marker is an architectural and urban object situated before or behind the focus (as regards the phenomenology of their dynamic relationship on the visual field):

the result of such an inversion is that the analyzed visual illusion will no longer relate to the focus but to the marker and, instead of the influence of the oculomotor micropsia, oculomotor macropsia would be a relevant "corrective" mechanism present during the focus perception.

In support of the hypothesis, the actual existence of this illusion was confirmed through the used model but also in all realistic architectural and urban settings with identical morphological features, as illustrated in figure 11 [illusion of focus volume change (St. Sava's Temple in Belgrade, Serbia) with regard to the marker (Slavija-Luks Hotel), in the function of the observer's motion along Kralja Milana Street)].

CONCLUSIONS

The results of this study have a broad applicability in designing architectural and urban space. It is possible to achieve the effects of this illusion on an already developed matrix, when designing new objects that need to be integrated in the existing setting and when planning and designing completely new urban structures.

Namely, when already constructed architectural and urban objects are to become objects of the illusions, it is possible to intervene on their physical setting so as to make the illusion visually detectable.

Consequently, when designing new objects, by incorporating them into an existing context (with an appropriate modelling, dimensioning and positioning), it is possible to ensure a perception that guarantees the activation of this illusion.

When planning and designing a new urban matrix, one has available the same spectrum of parameters that initialize this illusion, but it is possible to program its effects with less restrictions: not only by modelling, dimensioning and positioning of architectural and urban objects (as the focus of the illusion), but with an adequate modelling, dimensioning and positioning of a broad spectrum of elements located in their closer or more distant setting.

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TRANSFORMATION OF THE NEW BELGRADE URBAN TISSUE: FILLING THE SPACE INSTEAD OF INTERPOLATION

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This paper points to current transformations of the New Belgrade architectural and urban space identifying the process of filling the empty undeveloped areas within the New Belgrade blocks under the pressure of new commercial facilities. Given that these changes are not regulated by plans in an appropriate way, they are manifested in the space as problem situations leading to the production of space which is appropriate for the narrow interests of capital holders, while interests of direct users, as well as interest of a wider public, are most often neglected. The paper presents a critical analysis of the existing conditions and identifies problems emerging in the development and planning of the New Belgrade urban tissue. The space transformations have been explored at the level of urban and physical structure, urban landscape and user's life. Identified problem situations are indicative for further consideration of strategies for urban-architectural planning and design of New Belgrade.

Key words: New Belgrade, open block, urban tissue, transformations, commercial facilities

INTRODUCTION

During the past decades, gradual transformations of Belgrade urban tissue have taken place, basically changing the city's physical and spatial structure, urban landscape and life in the city. Over time, these transformations have assumed a characteristic form which primarily indicates a certain type of relationship between the economic and spatial development², which has not been consolidated by regulation plans in a proper way, thus producing spaces which are appropriate for narrow interests of capital

holders, while interests of direct users, as well as interest of a wider public, have been neglected and even often jeopardized. New forms of connections in space, new types of physical structure, have emerged completely changing the image of the city and everyday life in it, whereas insufficiently articulated relationship between demand and supply has been observed as being the only regularity in this development. The role of capital and market law in the production of space in the city is not questioned, and it has already been elaborated in studies and theory of space which emphasize social component of space deriving from the assumption according to which every society produces its specific space as a specific form of relations of production (in this case, capitalism). The problem arises when, in producing space, economic interests are allowed to be developed without appropriate or often any intervention of the state control and with a minimum of professional regulation ("laissez-faire" capitalism). On the one hand, we observe that a basic concept of design and planning of the city, which implies a

harmonious and scientifically developed relationship between the developed and free spaces in the city, is disturbed. By neglecting the real needs of the existing users and existing models of life in the city, the unsparing usurpation of every empty space in the city occurs. On the other hand, the physical structure in a densely developed city tissue has unsystematically been replaced, in which process a care is taken neither of the existing and future ambiances, nor of living conditions, which are in this way disturbed and/or created.

In both cases, it is a matter of interpolation in its widest sense, the methodological procedure of urban redevelopment which implies the issues of context, fitting in of the new and the old, anticipation of future and spatial framework absolutely respecting and simultaneously systematically reexamining the existing state.

However, the observed transformations of Belgrade city tissue are not consistent with this definition of interpolation it as much as they neglect the existing state in a specific way, at the same time also problematizing the future

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² More detailed investigation of this relationship would certainly call for a comprehensive study, which would gradually, starting from general hypotheses on a notion and role of capital in shaping society, through analysis of such society shaped by capital in "production of space" (see Lefebvre, 1991), lead primarily to the issue of the city as a "projection of a specific society" (Blankar, 2003), and then to the specificities of urban development which are typical for Belgrade and New Belgrade.

state, thus becoming such physical framework in which both current and future models of life have to be fitted into by force.

This paper deals with one of the forms of Belgrade urban tissue transformations which is manifested in the New Belgrade area as filling of free spaces within the blocks under the pressure of development and emergence of new central functions, primarily commercial facilities. The paper first points out the discontinuity in planning and developing New Belgrade, as well as the results of the researches conducted to date which have identified the problem of open, free spaces in New Belgrade and their inert filling. Then, it shows the changes in its urban structure which have taken place as a result of emergence of new commercial vernacular³ in the form of shopping and business centers which are becoming new urban landmarks restructuring relationships in space. In the next part, the attention is focused on the changes in perceiving New Belgrade, which take place in line with changes in its urban structure. Finally, although perhaps the most important issue, the existing state and consequences of these changes in inhabitant's life, primarily the present inhabitants of New Belgrade, are discussed.

NEW BELGRADE AS APOTHEOSIS OF A CONSUMER CITY

One of the manifestation forms of powerful role of capital in shaping Belgrade architectural and urban space to be shown here is an accelerated, most often uncoordinated construction of shopping and business centers as a new commercial vernacular, which has become typical for some parts of the city, primarily those with potential availability of free space for development, like in the case of New Belgrade. Primarily developed as an antithesis of capitalism, which has essentially determined the concept and strategy of its development, New Belgrade today represents an illustrative example of how the market law is manifested, a space of capital. Current urban transformations are colored by specificities of the post-socialist development in which unbalanced role of actors in the development process is still noticeable, which is, amongst other things, reflected in unpromptness

³ The term "commercial vernacular" is here used in the sense as used by Robert Venturi and Denise Scott Brown to indicate a new type of vernacular architecture – commercial vernacular in Las Vegas. See Venturi et al., 1990, pp. 2-14.



Figure 1. Preliminary Urban Plan of New Belgrade, elaborated by the Group for New Belgrade in 1948, led by architect Nikola Dobrović. (Stojanović, 1975, p.200)



Figure 2. The first urban plan of New Belgrade, elaborated within the Master Plan of Belgrade of 1950, led by architect Vido Vrbanić. (MP, 1950)

of political actors in the process of modernization of the building and urban planning regulations, prevailing influence of economic factors, and marginalization of town planners, by which illegal strategies and undesired directions of development are encouraged, such as illegal housing development or, as in the case of New Belgrade, imposition of a new image of "Belgrade Manhattan".⁴

⁴ See Vujović and Petrović, 2007. Authors make difference between four types of actors in the development process: political actors who define development goals and strategies, economic actors who use urban resources, spatial experts who operationalize development strategies, and city's inhabitants-users.

Discontinuity in planning and developing New Belgrade

Historical development of New Belgrade has been marked by discontinuity in developing and planning, where period of stagnation due to political or economic crises have taken turns with periods of adopting new plan concepts. Only during the first ten years of the development, three plans were adopted based on basically different concepts (Figures 1-3).⁵

⁵ Despite all differences in planning concepts, it is observed that they are linked by the fact that they are all developed relative to the principles derived from the Athens Charter. For more details, see Blagojević, 2007, pp. 121-154.



Figure 3. Master Plan of New Belgrade, elaborated in the Town Planning Institute of Belgrade in 1958, led by architect Branko Petričić. (Stojanović, Martinović, 1978)

However, it is important to emphasize that until the 1980-ties (Figure 4.) New Belgrade was planned as an integral entity based on the Regulation Plan adopted in 1962, which is considered the end of the planning phase followed by the “inert filling of space”⁶. Construction of residential buildings in Block 24, which was carried out in the period 1984-1989, represents the first deviation from the Regulation Plan, as well as from the central zone plan which, through the entire period so far, has been a pillar of the development of planning concepts (Figure 5.). At the same time, the construction of the Block represents the beginning of the New Belgrade partial-development practice which culminated in the past two decades. This paper illustrates examples of block 12, built on the space earmarked for greenery, and block 16, which is analyzed in detail later in this paper. The pressure of commercial facilities has resulted in a series of dispersedly distributed shopping and business centers (Figure 6.).

Scientific studies dealing with phenomenon of New Belgrade agree that its architectural and urban concepts are unique. On the one hand, they start from the fact that it is one of the rare cities built in the spirit of Athens Charter and its typical functionalism. The initial enthusiasm and

consistency in implementing plans⁷ has also been indicated. However, these plans were soon replaced by planning strategies which were not based on scientifically proved and real processes of urban development. This resulted in “discontinued construction of buildings, however, neglecting economical parameters in reserving critically big areas of land equipped with municipal infrastructure for the future needs of urban functions”, where the physical growth of the city has been carried out through “mechanical addition of identical units” on the fringe of already developed tissue. The final result is a too dispersed and monotonous city, static relative to the development processes and changes that have taken place over time (Perović, 2008).

On the other hand, the uniqueness of the New Belgrade urban concept is considered from the standpoint of its ideological and political background as a key fact of its emergence and

development (Blagojević, 2007). Although conceived on the basis on the “universal” Athens Charter and thus predetermined to represent universal values of modernism, New Belgrade developed during the time of socialism, which also essentially determined its concept and development strategy. It was conceived as a modern city on the left bank of the Sava River which had to play key role in transformation of image of the city from capitalist into socialist one. However, we are witnesses of how it has, from the concept of primarily aesthetic structure of socialist state, become a city colored with humdrum existence, because of which it has often been identified as urban dormitory. Furthermore, New Belgrade has developed as a city in social ownership, “without inner economical dynamics”, “deprived of conditions for own reproduction”, where everything depended on the intervention of the state, which resulted in inert filling of empty spaces with residential buildings, where the flat was not considered as goods, but rather as use value.

Both studies criticize lack of diverse activities, attractiveness and dynamics, this being a consequence of the strategy of mechanical (Perović), namely inert (Blagojević) filling of space, as well as disproportional and inactive relationship between the developed physical structure and big open areas separating them. The studies problematize the character of urban structures and entities emerging in the New Belgrade space described as monotonous and dispersed, uncompleted.

A remark that the created space acts like a scheme, a sketch (Perović, 2008, p. 177), has indicated the possibility of various development directions, given that it represents a neutral framework, spatial potential with lots of “reserved” areas prone to various experiments and application of various urban theories. Amongst them, particularly favored are “more complex and refined forms of growth of the city, inner growth... by extensions, matching of needs with sporadic spontaneous creation of greater concentration of urban tissue and various activities” which bring the New Belgrade urban structure closer to the traditional concept of the city.⁸

⁶ Ibid, p. 249. The author states that the end of the New Belgrade planning phase, which was followed by inert filling of empty spaces, is actually the Central Zone Plan of 1960 and Regulation Plan of 1962, which have prevented further consideration of planning and design strategies (p. 209).

⁷ See Perović, 2008, pp. 175-176. Perović identified two phases of historical development of New Belgrade. The first one which lasted from 1946 until 1948 and was marked by plans made by Nikola Dobrović (1946), Edvard Ravnikar (1947) and Nikola Dobrović (1948) which were characterized by being in line with the world trends. The second phase lasted much longer and “still lasts” (the first edition of the book was published in 1985, although some of the conclusions may be applied to current conditions) and was characterized by non-critical application of modernism formula, as well as application of halfway results in researches. The author also emphasized that this change in attitude towards the principles of Athens Charter coincided with the changes which derived from the activities and conclusions of the CIAM Congress.

⁸ See Perović, 2008, p. 174. Another study leaves an open issue of its further irreversible extending – possibility that “it extends in accordance with the lessons from the past, whether to leave its extending to the market policy or to put a complex discourse of modern city to the test of contemporary conditions of modernity”. See Blagojević, 2007.

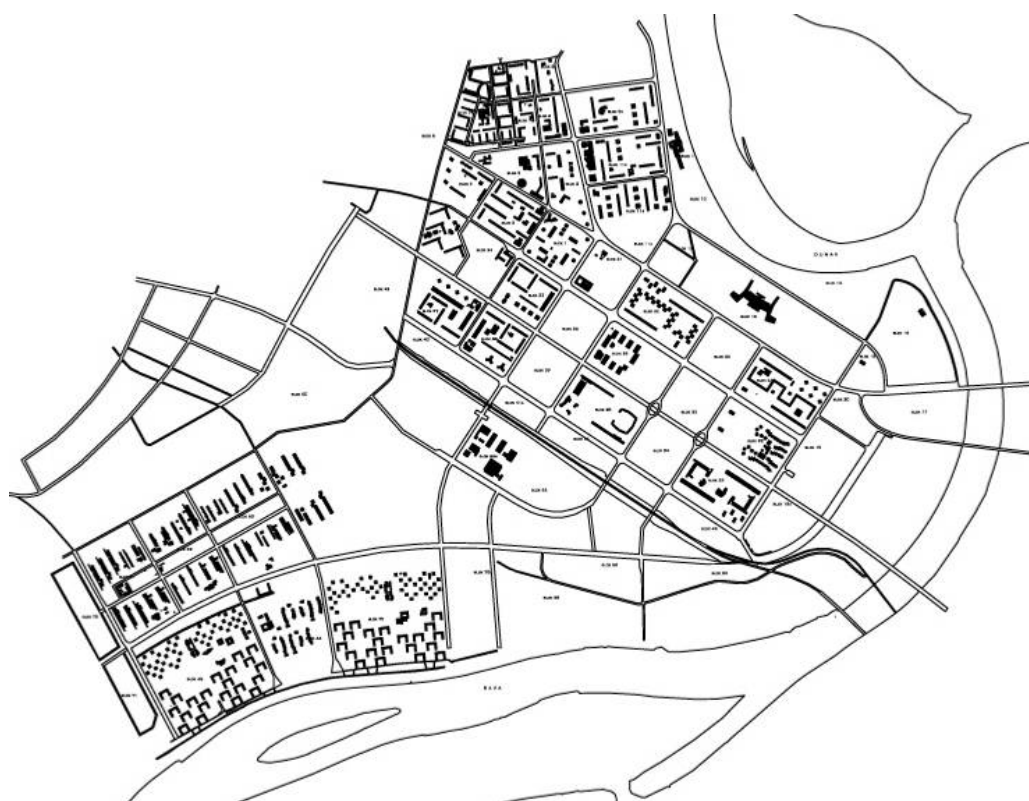


Figure 4. Layout of New Belgrade. The state in 1980.



Figure 5. Layout of New Belgrade, the state in 1990. Deviation from the central zone plan due to construction of block 24.

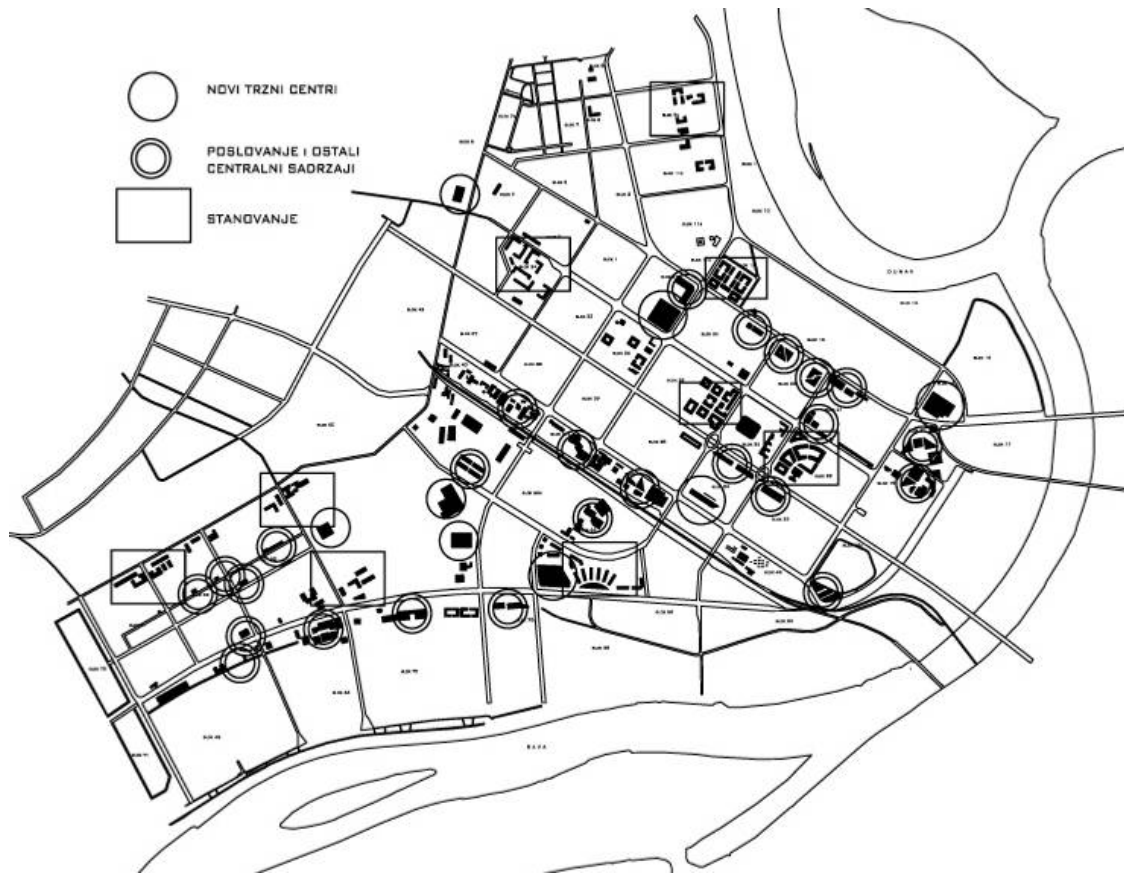


Figure 6. Layout of New Belgrade today. Dispersedly distributed commercial facilities.

In any case, big areas, despite not being integrated in the urban tissue, are a privilege of the New Belgrade's inhabitants, because they are realized as the very space of air, sun and greenery, which is conceived by original Athens Charter as a contribution to improving the dwelling conditions in the city. Besides, the so called New Belgrade spirit has become present not only in everyday life, but also in literature, movies, and music, indicating coexistence of the New Belgrade's inhabitants with their environment. Despite all scientifically identified deficiencies, New Belgrade has become reality as a spatial framework, and it is necessary to adjust all future interventions to its character which is closely connected with the life of its inhabitants. It is necessary to densify the New Belgrade urban structures by fully respecting its present character, and to reduce big open spaces to smaller ones, primarily having in mind their relations with the existing physical structures and users of space.

However, the current building and urban planning practice does not take into account any of these facts, or historical development of New Belgrade, or basic principles of its formation either. Inert

filling of space in the period of New Belgrade formation exists even today as a form of its urban growth, but in the form of inert filling of space of already formed New Belgrade blocks, under the pressure of new urban functions of central and recreational character, primarily trade as the most vital branch of economy. Restaurants, hotels, shopping and entertainment represent important habits of mankind and activities in a consumer society, resulting in spatial concepts and structures which announce the today's commercial vernacular which is becoming ever more present and dominant element of urban landscape.

Master Plan of Belgrade 2021

The current Master Plan of Belgrade 2021 (MP 2021, 2003) adopted in 2003 is a basic urban plan document for the territory of Belgrade and the only one covering the entire space of New Belgrade. The critical analysis of this plan shows that the issues of New Belgrade development and transformation as a unique and specific urban-architectural entity have not been recognized as a current problem (MP 2021, 2003, 1.7.1.). At the same time, New Belgrade is considered as an

important location which is to be activated as a new business city, thus bringing the future commercial functions in the fore and favoring them in relation to other central facilities (MP 2021, 2003, 2.2.9.).

The New Belgrade area is divided into urban entities belonging to different spatial zones and thus it is not treated as integral one⁹. In order to secure ambience unity and continuity of planning character of New Belgrade, it is envisaged to make regulation plans which should not cover the areas smaller than a block. However, it is not required to consider this entity in the context of a wider surrounding, thus calling into question the realization of desired results.

The plan emphasizes the New Belgrade urban structure based on the type of open block as its basic specificity based on which the allowed

⁹ Urban entity 2 – "Original New Belgrade", in one of its parts is out of the Central Spatial Zone framework, which means that different rules of building construction apply to it. See Chapter 7. "Spatial zones and urban entities", point 7.1.4. dedicated to New Belgrade

urban parameters are determined, as well as rules of construction, and insists on the continuity of this type of development. However, the plan does not accept these spaces as a part of specific urban concept, but they are, depending on the theme under consideration, treated in the same way as other urban entities which are, at the same time, very different both from them and from each other. On the one hand, New Belgrade is, according to the criteria of urban block type, classified in the same group with other new settlements regardless of its particularity. On the other hand, urban entities called "New Belgrade Central Part" and "Original New Belgrade" belong to the Central Spatial Zone and they are subject to the same rules of construction valid for other urban entities belonging to this Zone¹⁰, albeit they are, according to their genesis and concept, completely opposed to the concept of New Belgrade. The Plan also recognizes their particularities in historical, functional and ambience sense. Also, the Plan criticizes lack of traditional forms of public urban space (MP 2021, 2003, 5.2.), while free open spaces are recognized as possible fields for building in traditional forms of public urban spaces, which is opposite to insisting on development of blocks of open type, thus negating the original urban concept.

Therefore, despite a declarative attitude that the ambience of New Belgrade as a city of the Modern should be preserved, according to the permitted urban parameters and other provisions of the Master Plan of Belgrade 2021 it is clear that New Belgrade open spaces are recommended for intensive development following the logic according to which more free spaces enable greater scope of new development, not accepting specific character and originally important percentage of plot usage on this territory.

A study entitled "Ways of protecting areas with contemporary architecture and important individual buildings"¹¹, which identified valuable

¹⁰ Permitted maximum percentage of plot usage is the same for the center of the old Belgrade, center of Zemun and center of New Belgrade – 3.5, while permitted maximum plot ratio in New Belgrade is somewhat smaller relative to the other two mentioned central zones and is 60% (point 4.5.6. "Central zone and main city center", Table 49), which is still greater compared to the values existing before urban transformations which are the subject of this paper.

¹¹ The study entitled "Way of protecting the territory with a contemporary architecture and individual important buildings", the second working material for the phase of Draft Master Plan of Belgrade, Belgrade, April 2002, elaborated by: Igor Marić, Aleksandar Stjepanović, Darko Marušić, Bojan Kovačević, Dijana Milišević-Marić and Eva Vaništa-Lazarević.

buildings and architectural-urban entities of the Modern epoch in the regime of partial or full protection, was made for the needs of the Master Plan. The preservation of the existing values of important New Belgrade entities, on which the Chapter 5.3 entitled "The protection and treatment of modern architecture" insists, is precisely the result of this study, while a concrete measure included in the Plan is an obligation to announce a competition for some entities. At the same time, however, the "Recommendations for plan interventions in ambience complexes of urban spaces" (MP, 2021, 5.2.1.) do not refer to the territory of New Belgrade. This leads to the conclusion that individual attitudes are not integrated in other parts of the Plan during the synthesis procedure.

Case of Block 16

Genesis of the process of uncontrolled construction may be observed through the analysis of construction in Block 16, which, by its scope, character of its location and development represents an outstanding example and illustrates the essence of many interventions which have been carried out in New Belgrade urban tissue to date. After the change in ownership of the "Ušće" office building and on the initiative of the investor, who wanted to build new buildings on the empty part of the plot, a general and invitation poll competition was announced in 2003 for preliminary urban-architectural design of the "Ušće" Multifunctional Center. The competition was announced by the Belgrade Land Development Public Agency and "European Construction" company in cooperation with the Association of Belgrade Architects and the Town Planners Association Belgrade, at which both local and foreign architects participated. The obligation of announcing competition for preliminary design has derived from the Master Plan of Belgrade 2021¹², as well as from the need for defining additional urban indicators for elaboration of a regulation plan. Competition requirements were not rigorous given that it was a poll competition, but the continuity of the idea of planning the New Belgrade blocks was required as an important element of the future concept.

¹² It was planned to preserve the character of the Block, with the possibility of extending the appendage part (which was also planned earlier). See part 5.3.6. "Urban planning recommendations for particular entities in the regime of partial protection".



Figure 7. Relationship between the undeveloped and developed areas of block 16 according to the competition concept which won the first prize.



Figure 8. Relationship between the undeveloped and developed areas of block 16 according to the Detailed Regulation Plan of 2007.

The work which won the first prize offered the concept by which a great part of the block was preserved as a green area, a supplemented and strengthened vertical accent, and the new construction was matched with the existing one and got a contemporary expression. Based on the work which won the first prize, an urban plan was made (DRP, 2004). However, during the construction, the deviations from the adopted plan concepts occurred and the investor commenced the construction of the building on a considerably bigger area than permitted. The City Assembly adopted a new plan (DRP, 2007) in order to accommodate the "necessary increase of capacity of the Multifunctional Center" (DRP, 2007, 1.2), thus subsequently legalizing illegal construction and, at the same time, making senseless all previous efforts of professionals in achieving a quality concept for the subject space. Figures 7. and 8. show the relationship between the undeveloped and developed areas of the block according to the competition concept which won the first prize (Figure 7.), and according to the Detailed Regulation Plan (Figure 8.).



Figure 9. The concept which won the first prize at the Competition for Preliminary Urban-Architectural Design of the "Ušće" Multifunctional Center.



Figure 10. "Ušće" Multifunctional Center opened in 2008.

Source: <http://www.kombeg.org.rs/Komora/OpstaA.aspx?veza=299>

The "Ušće" Shopping Center was opened in 2008. Compared to the competition concept by which a connection of communication direction within the building was realized with the surrounding space up to the Park of Friendship and a park surrounding the Museum of Contemporary Art, the realized design is turned towards inner space and does not communicate with its surroundings. In addition, the realized building has greater

surface area and volume then envisaged by the competition design which won the first prize and by the Plan of 2004, so that it, to great extent, obstructs the view of the "Ušće" palace tower and visually competes with it as a new landmark, whereas the competition work of the authors winners of the first prize envisaged an integral whole with a business tower and also affirmed its existing values.

NEW URBAN LANDMARKS

New commercial vernacular in the form of shopping and business centers, hyper-markets, mega markets, supermarkets, and shopping malls, according to the structuralist theory of the city, represents introduction of strong elements¹³ which have fully redefined and reconfigured the space which was till then neutral, namely the New Belgrade structure. They also represent strong and attractive centrifugal elements at the level of the entire city as well, restructuring the usual directions of movement of people towards the new consumption and production centers. These new zones of attraction are the product of the globalization process which, in our conditions, has taken a specific form. However, they do not improve overall urban and physical structure of the city since, due to concentration of attractive facilities in certain buildings, the uniform distribution of tertiary activities on the wider territory has not been achieved. Therefore, they cannot be considered as global zones of connection which, by their attractive architectural envelops and multi-layered facilities, define a specific position of the city in a global and regional hierarchy (Stupar, 2009).

The frequency of movement of people towards New Belgrade, number of daily visitors who do not live and work in it, in particular the number of visitors who spend their leisure time in it, indicates a new function of New Belgrade within the Belgrade metropolitan area. It could be concluded that exceptional location advantage of New Belgrade, deriving from its position between the two formed city cores - Belgrade and Zemun - has been finally realized, so that New Belgrade no longer represents an inert housing tissue, but rather an attractive zone of social happenings. It may further be concluded that the role of connecting city tissue, which once had to be

¹³ According to Roland Barthes, a city is a tissue which is not formed of equal elements whose functions we can enumerate, but of strong and neutral elements which create rhythm, and which further, analogue to the opposition between the sign and absence of sign, between the full degree and the zero degree, constitutes one of the major processes in elaboration of signification. See Roland Barthes, 'Semiology and urbanism', in Miloš R. Perović, town planner, *Antologija teorija arhitekture XX veka*, translated by Irena Šentevska (Belgrade: Građevinska knjiga, 2009.), pg. 422-429. [Roland Barthes, "Semiology and Urbanism," [1967] Roland Barthes, *The Semiotic Challenge*, (New York: Hill and Wang, 1988), pp. 191-201]

taken over by the planned New Belgrade center, has finally become reality in this alternative way¹⁴. However, despite the integrated urban functions which have become reality in the formed physical structures, it may be concluded that an adequate spatial framework, in which primarily current and then future models of life may be included, has not been developed. In its original form with big city blocks and "uncritically large areas equipped with municipal infrastructure for future needs of urban functions" (Perović, 2008, p. 168), New Belgrade has offered a chance and opportunity for application of modern theories of urban growth and development. Today, when these large areas are being filled without a strategy and come into collision with the existing housing tissue and life of inhabitants, we cannot speak about possibilities but about certainties, primarily in terms of problems imposed by a new spatial and physical framework.

The competition of 1986 (International competitions for improvement of New Belgrade urban structure – 1986) has been an attempt to prevent an uncontrolled and partial development of a new urban layer in New Belgrade. Unfortunately, social interest to make a new urban plan based on the competition results which would enable further development in a methodological and conceptual way, was lacking.

FROM THE NEW SPATIAL-TIME CONCEPTION TO THE LEARNING FROM LAS VEGAS

Aldo Rossi identifies three typical phases in transformations of cities and urban entities in whose basis is industry, and which are primarily reflected in the change in relationship

between the place of dwelling and place of work. The first phase is characterized by the end of household economy as a unity of production and consumption, disintegration of the basic structure of medieval town. The second phase is generated by a progressive industrialization which separates dwelling from work, disintegration between neighbors takes place, as well as concentration of mutually dependent services in one place, as the first "cities". The third phase has developed with the development of traffic in terms of individual vehicles, when the dwelling becomes independent of place of work and connected with it by the function of time (Rossi, 2000, p. 249). In this way, first the industry and then traffic have forever changed the image and spatial structure of a city, thus becoming a fact which cannot be ignored in an attempt to simply return to the concept of pre-industrial town and its traditional values. New spatial-time conception¹⁵ in architecture and urbanism implies application of a new and broader criteria in urbanism, which is, on the one hand, reflected in integration of traffic lines into a city "organism" as constitutive elements and, on the other hand, in finding out such relationships between the "high buildings in free space" which would correspond to "dynamic changeable view of our time", namely observing the city while moving through it, primarily by car (Giedion, 1969, pp. 484-513).

The post-industrial society in which mass media have become new industrial plants for production, dissemination and presentation of information, while the so far world, a big supermarket for circulation of information models, introduces a new dynamics in urban system. "From the distance of thirty kilometers, traffic arrows direct you towards

these big centers which are hyper-markets, the hyper-space of goods where a new form of sociability is being developed. It should be seen how these hyper-markets centralize and redistribute entire space and population, and how they concentrate and rationalize time flows, routines – creating enormous movement of people there and back..." (Bodrijar, 1991, p. 79) This may be an explanation of how it was possible "that in the period of one month, November 2007, by not finding one's way, and not finding one's way even today, in New Belgrade, about 1.2 million citizens visited the new city in a part called 'city'?" (Blagojević, 2008).

As an apotheosis of a consumer city with wide boulevards well-suited to high-speed city traffic and landscape in which a sign dominates over architecture, New Belgrade reminds us of lessons of Las Vegas (Venturi et al., 1990), representing, just like Las Vegas, an urban heterotopia, to use the Foucault's term describing an "other space", the structure different from other structures, but connected with them. At the same time, in the context of heterochronism, the principle of heterotopology which indicates that heterotopia is related to small parts and pieces of time, namely, that they completely enter into the function when people find themselves in some kind of break with the traditional time, it represents a heterotopia limited by time (Fuko, 2009). Besides, the "new" New Belgrade represents a realized concept of a place of pleasure in the same sense in which Roland Barthes analyses the role and connectivity of the city center as a space in which subversive forces act and meet, the forces of interruption, ludic forces and all that is not the center: family, flat, identity (Bart, 2009). Venturi and Scott Brown concluded that Las Vegas represented a structuralist conception despite banality of marketing messages, as they say, a context which is new and indicates the need for matching new models with the models of life which it presents (Venturi et al., 1990, p. 9).

THE EXISTING STATE AND RIGHT TO THE CITY

Absence of human dimension is at the basis of criticism of cities based on the principles of Athens Charter (Perović, 2008, p. 176). The phenomenon of "disintegration of relationships between neighbors" identified by Aldo Rossi as a consequence of progressive industrialization, gets its most extreme form within a modern, functional city which is disintegrated,

¹⁴ Miloš Perović realized an exceptional location advantage of New Belgrade which derived from its positions between the two formed city tissues – Belgrade and Zemun – and stated that these advantages were not even partially exploited, primarily in terms of establishment of new relationships in the system of the Belgrade center. "...the central part of New Belgrade, despite enormous location potential and comparative advantages, has a very low level of vitality out of many reasons, so that its impact on other centers within the Belgrade metropolitan area is still negligible. Should the problems of its functioning, identified in this paper, be overcome by a directed action, namely, should a regulatory and physical framework be created that would support natural processes of growth and development and processes of creating a critical population mass for initiating centers and processes of extension and transformation of the existing structures, then one of the possible scenarios of developing the system of centers of the Belgrade metropolitan area could take a form..." (Perović, 2008, p. 197).

¹⁵ "Around 1910, something happened which was, to great extent, crucial: discovery of spatial concept in art. Painters and sculptors have, in their ateliers as laboratories, investigated ways in which they would sensitively revive space, volume and material." (Giedion, 1969, p. 46.) Giedion wrote about changed conception of space which resulted from introduction of time as the fourth dimension. Primarily in painting, in which the objects are broken down, observed transparently, by actualizing the conception of simultaneousness which the objects simultaneously present when observed from different angles, and then in sculpture and architecture, in which the essence of space is in the infinite possibilities of its inner relationships, where the form of space changes depending on the point of observation. New spatial-time conception has its origin also in urbanism. See the next note.

compared to the traditional city and its humane dimension, by wide roads as a basic constitutive element of an urban structure. Additional departure from the principle of a man as a measure of all things has resulted from plan concepts which consist of "reservation of disproportionately large spaces for future development of certain activities" (ibid., p. 177). Such concepts derive from an aspiration towards "realizing an ideal urban environment by a series of concepts determined beforehand..." (ibid., p. 177) but, in case of New Belgrade, precisely these concepts have today become an impetus to growth which has not been considered in the long term, and which is reflected in an unsystematic filling of these large areas, by hyper-production of space satisfying momentary appetites both of investors and beneficiaries of space, but lacking a vision of a wider and more complex future development.

Uncritical and non-scientific approach in transforming these free areas into developed spaces precisely indicates the domination of economic interests and absence of multiple professional control of growth, where real needs and interests of the existing beneficiaries have been neglected, as well as a democratic principle of contemporary society according to which "the right of individuals and the right of the community are mutually conditioned" (Giedion, 1969, p. 508). The theory of needs, as an "elaborated system of state and the 'everyday' in all phenomena" represents a necessary starting point in the procedure of investigating new forms of environment. In this way, an often situation in which sociology decodes the world only when it has already been constrained by its physical limits, can be avoided¹⁶.

This situation is typical for New Belgrade and has been a subject of recent interdisciplinary studies, such as annual project of the Center for Visual Culture (Museum of Contemporary Art in Belgrade) entitled "Differentiated Neighbourhoods of New Belgrade" which deals

with "exploring various meanings of the term *neighborhood* in the context of urban, architectural and sociological language, as well as with the analysis of historical development and current progress of neighborhood urban transformations in New Belgrade" (Erić, 2009). The results of these researches are divided into three thematic fields. The first one deals with the analysis and realization of original concept of New Belgrade. The second one addresses current urban transformations which are manifested through "introduction" of neo-liberal capitalism in New Belgrade empty spaces, while the third thematic field explores the possibility of regenerating the neighborhood by creating new places of gathering which produce a feeling of belonging and identification with the environment. One of the basic hypotheses of these researches is that the city must be given back to its (New Belgrade) inhabitants, namely, to fulfill their "right to the city" or "spatial justice". However, before mentioning jeopardizing of these rights, and they relate to the issues of identity and belonging, higher existential level, and should represent attainment of contemporary society, we lay stress on that the elementary right to sun, air and greenery is in jeopardy, actually the right that has been granted by the original concept of New Belgrade which has derived from the Athens Charter, and which, in this sense, represents conception which is certainly more advanced from everything in the realization that followed afterwards.

CONCLUSION

The Belgrade urban tissue is a rewarding polygon for various comparative researches of its urban structure considering that, on the one side, there is a planned urban matrix of New Belgrade mega-blocks, the part physically separated by natural river flow, and, on the other side, a densely developed urban structure of the old part of the city. It has been shown herein that, in the case of New Belgrade, the main problem of its current and probably future development is a process of filling undeveloped parts of blocks under the pressure of new commercial facilities which basically change the character of space. By the deviation from the Central Zone Plan and Regulation Plan of New Belgrade of 1962, actually by the construction of block 24, a phase of its development which was dominantly marked with absence of such regulation plans which would consider this area as a unique and specific urban-

architectural entity, has begun. However, this phase continues even today, which is obvious from the analysis of the Master Plan of Belgrade 2021. New Belgrade open blocks as a basic particularity of its urban structure are considered by regulation plan in the same way like other new parts of the city, and their construction according to permitted urban parameters is recommended.

Scientific studies which problematize the concept of New Belgrade and its open blocks indicate over-dimensioning of free areas compared to the developed structure, which is reflected in the final effects of the development of the new city which lacked "many layers" in order to become a "real" city meeting all complex needs of contemporary life. Complexity, layeriness, compactness, hierarchical structure, visuality and humane dimension are presented as important factors of urbanity which characterize the cities and parts of the cities developing through time, by choosing, in a given historical moment, appropriate plans and rules of construction. Problems that we are facing today in analyzing urban tissue development and transformations derive from insufficiently developed vision of the future development of the city in the context of contemporary consumer society. Economic factors, which lie in the basis of society, are not in balance with other elements and factors in the city design and planning system, this resulting in space which satisfies only primary capitalist appetites for safe investments and quick capital turnover, while long-term goals in space development have not been considered. Space, which is still the greatest social and state resource of Serbia and a challenge to big capital (Vujošević, 2003), by proper strategy for planning and creating an adequate spatial and physical framework of life in the city, is becoming a capital itself, which should be continuously emphasized as an argument for stronger implementation of designer's recommendations in plan documents.

Globalization process brings about changes in the notion of city which no longer implies a compact entity, but an urban point in wider, existing and evolving regional and global networks. One of the imperatives of the future development of Belgrade is also inclusion in these integrations and new networks, coming out of the position of isolation on the global scene, in which the creation of its new urban identity and image plays an important role. At the same time, the conception of identity and

¹⁶ Branislav Milenković observes a practice relevant in the context of considering New Belgrade urban structure, according to which large areas occur as a technical response to the needs of society, while the studies of sociologists and psychologists with alarming titles, primarily about the fact that the cities are not built according to the measure of man appear only afterwards. He emphasized the importance of prior sociological researches which provide coexistence of the model of life with the model of space (Milenković, 1980).

image in the today's world of consumer society, global networks and global market is replaced with a notion of brand of the city, the term implying its market value resulting from the fact that the cities themselves are becoming a product in great or small demand in the context of various forms of tourism (Stupar and Cenk, 2006).

In this sense, the analysis of Belgrade urban tissue transformations is a contribution to exploration of possibilities for improving Belgrade urban structure through identification of the problem of environment. In further steps, it is necessary to consider the existence of paradigmatic models which may be a starting point of planned transformations, and also successful examples of regulation plans by which the identified problems, as well as concrete consequences of current urban and construction practice in Belgrade in terms of investigation of typology of new vernacular, may be eliminated.

The presented transformations are only one of the forms of capital-space interaction which has brought about transformation of Belgrade urban tissue. The changes which take place in a wider city center in function of dwelling, neglected and abandoned spaces of once industrial areas in the city center and problem of the city expanding outside its center are also essentially influenced by economic factors and indicate the problems which arise from uncontrolled domination of economic interests and absence of plan and legal regulations and, as such, they may be a subject of further researches.

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DEVELOPMENT, CHARACTERISTICS AND COMPARATIVE STRUCTURAL ANALYSIS OF TENSEGRITY TYPE CABLE DOMES

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Tensegrity type cable domes are three-dimensional structural configurations, prestressed inside the perimeter compression ring, in which the continuous tension throughout the roof structure is made by continuous tension cables and discontinuous compression struts. These kinds of structures can be formed like spatially triangulated networks or like networks non-triangulated in space. This paper examines some effects of network geometry on the behaviour and structural efficiency of tensegrity type cable domes. In this paper the roof cover is considered non-interactive with the supporting structure, unlike rigidly clad tensegrity type cable domes.

Since the main bearing elements of tensegrity type cable domes are prestressed cables, they show non-linear load deformation and rely upon geometric stiffness. A geometrically non-linear analysis of non-triangulated and triangulated structures for different load conditions was conducted employing a computer program based on the perturbation theory. The incrementally-iterative procedure, with an approximation of the stiffness matrix by combining the elastic and geometric stiffness matrix, allows detection of structural instabilities.

Keywords: tensegrity type cable domes, prestress, network geometry, geometrically non-linear analysis, perturbation

INTRODUCTION

Tensegrity type cable domes are structures that are highly convenient for large span covering owing to the fact that a comparatively small number of elements are needed to form the structure, their high prefabrication level and easy assembly. Observation of already existing tensegrity type cable domes reveals two basic approaches to the formation of these structures: Geiger's, which forms the dome as a non-triangulated spatial network, and Fuller's, that adopts the principle of spatial triangulation. This paper examines some effects of network geometry on the behaviour and structural efficiency of tensegrity type cable domes.

Campbell et al. (1994) investigated the effects of spatial network triangulation on the behaviour of tensegrity type cable domes combined with the action of a stressed fabric membrane which stabilizes them to a high

degree. Since it is possible to create these systems without the roof cover as a load-bearing element, as can be seen in the first tensegrity type cable dome covered in rigid 'floating' panels (Gossen et al., 1998), this paper will analyze the behaviour and structural efficiency of triangulated and non-triangulated structures without taking into consideration the co-action of roof cover. For the purpose of this analysis, only the cable-strut network was modelled.

Since tensegrity type cable domes must fulfill the condition of equilibrium on the deformed configuration, they were analyzed by means of a software application intended for the geometrically nonlinear analysis of three-dimensional trusses. The programme is based on the perturbation theory (Levy and Spillers, 1995). The procedure applied allows for the detection of structure instability.

DEVELOPMENT AND CHARACTERISTICS OF TENSEGRITY TYPE CABLE DOMES

The emergence of steel cables made it possible to produce structure elements of high tensile load-bearing capacity but of small cross-section. The erection of the arena in Ralley, North Carolina in 1954, fully demonstrated how steel cables could be applied in roof structures. Since that time, many structures, of various shapes and systems, have been erected featuring the cable as bearing element. Among them, those that particularly stand out are the hanging, pneumatic and tensegrity type structures. Those structures turned out to be highly economical, especially in covering large spans. Apart from having decreased the expenditure for materials, the time necessary for erection has gone down, owing to the high prefabrication level. In Serbia, an exceptional contribution to the development of primarily cable-based structures has been made by Đorđe Zloković, architect and structural

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engineer, Professor of the Faculty of Architecture at Belgrade University and member of the Serbian Academy of Arts and Sciences.

Inspired by the idea to put the tension and compression forces within a structure into balance, some authors have developed the idea of integrally tensioned structures (Fuller, 1961). Fuller, Emmerich and Snelson patented structural systems which were fundamentally the same. The definition of tensegrity structure based on the initial patent descriptions would have been along these lines: tensegrity structures are systems established by means of interaction between discontinuous compression members and continuous tension members which, put together, form a stable shape in space. Many authors have investigated the possibilities of applying tensegrity systems in architecture, such as Vilnay, Hanaor, Pellegrino, Pugh, Emmerich and Motro (Motro, 2003). The 'tensegrity approach' has demonstrated a number of advantages over the 'non-tensegrity' approach. Separation of structure members into exclusively tensioned and exclusively compressed leads to the fact that the tensioned members may be only as light as the current technology allows it. The prevalence of light cables in the structure makes it lighter, more cost-effective and visually unobtrusive.

Some authors have focused their research towards the possibilities of tensegrity type cable domes, believing that tensegrity principles would enable bridging large spans while effectively using materials and energy (Pallasmaa, 1997). In 1964 Fuller patented his basic concept of tensegrity dome (Figure 1) after trying out numerous models.

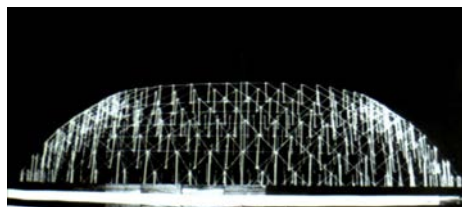


Figure 1 – Fuller's tensegrity dome

Source: <http://www.columbia.edu/cu/gsap/BT/BSI/TENSEGRI/fuller.jpg>

Tensegrity domes were also the subject of research by Miodrag Nestorović (Figure 2), architect, Professor of the Faculty of Architecture at Belgrade University (Nestorović, 1994).

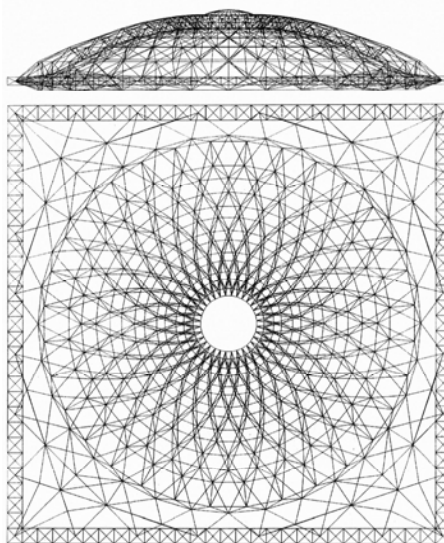


Figure 2 – Tensegrity dome over the square plan
Source: Nestorović, M. (1994)

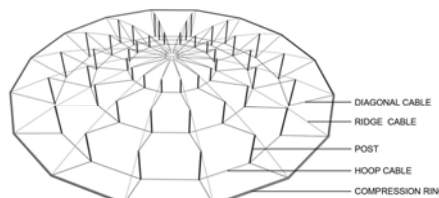


Figure 3 – Geiger's tensegrity type Cabledome

In 1983, Horst Berger developed a solution for the roof structure of the "Sundome" in St Petersburg, Florida. However, after Geiger Berger Associates split in 1983, Berger's solution was replaced by a system developed by David Geiger (Figure 3). Geiger combined Fuller's tensegrity principle with the principle of prestressed cable network formation and thus proposed a new non-triangulated spatial network. He patented the new system and called it 'Cabledome'.

The main principle underlying Geiger's cable domes is in achieving a continuous tension through the roof structure by means of continuous tension cables and discontinuous compression struts. The primary structure is formed by radial cable trusses which are rib-like and which consist of tensed ridge and diagonal cables and compressed struts. The bases of the flying struts are held by diagonal cables attached to the top of the compressed struts in the next outer ring and are mutually connected within the given radiuses by means of tension cables forming concentric hoops. These hoops assume the role that bottom chords of the radial cable trusses normally have. The concentric tension hoops relay the load effects throughout the system, thus minimizing any local effects. Changes in the

tension hoops trigger a response of the entire cable-strut system. Apart from that, the tension hoops resist out-of-plane displacements of radial cable trusses nodes. The structure therefore, while resisting load, relies on geometric rather than conventional stiffness. In this way, a three-dimensional network of cables and struts is formed, prestressed within the perimeter compression ring. One of the main advantages of such a structure is that its weight by square meter of plan does not change with the increase of span. To enlarge it, it is only necessary to insert a new module in the shape of a new concentric tension hoop. Geiger's tensegrity type cable domes have proved structurally efficient in numerous large-span roofs.

Tensegrity type cable domes are cable-strut networks, prestressed within a perimeter compression ring. The fact that they rely on the continuous perimeter ring in order to close the structural system makes them different from other 'pure' tensegrity systems which are self-equilibrated.

The first large span tensegrity type cable domes were constructed in Seoul for the Olympics of 1986 (Figure 4). Two sports halls, of 120m and 93m-spans were covered by Geiger's cable domes (Geiger et al., 1986, Rastofer, 1988, Tuchman and Ho-Chul, 1986).



Figure 4 – Olympic arena under construction

Source: <http://www.columbia.edu/cu/gsap/BT/DOMES/SEOUL/sol-43.jpg>



Figure 5 – Olympic arena in Seoul

Source: <http://www.atpm.com/14.10/south-korea-guam/images/Seoul%20City%20Skyline%20-%20Overlooking%20the%20Olympic%20Park%20with%20downtown%20Seoul%20in%20the%20background.jpg>

Unlike Fuller's high profile tensegrity domes, Geiger's domes display low-profile configuration (Figure 5) which decreases the wind uplift and uneven snow drifting, and significantly reduces the amount of fabric needed for roof covering.

Geiger also developed a system for the erection of tensegrity type cable domes. Tensioning of the diagonal cables and putting the hoops into their final positions is done starting from the periphery and moving to the centre of the structure (Figure 6).

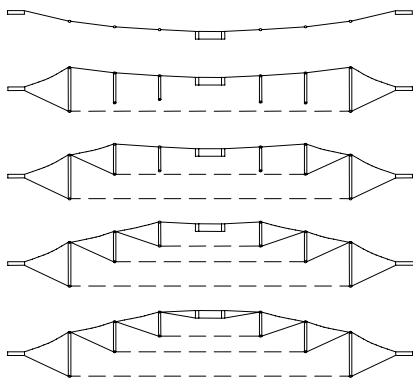


Figure 6 - Erection sequence

The membrane system applied in these domes belongs to the class of lightweight roof coverings, displays satisfactory thermo insulating and acoustic properties and is semi-transparent. Its overall daylight transmission is 6%, which allows for most of the daytime lighting requirements (Krstić, 2006). The membrane covering the domes consists of four separate layers: a waterproof fibreglass fabric, an insulating layer, a vapour barrier and an acoustic insulation layer that are attached to the structure. Radial valley cables are tightened to stress the membrane. In this way, the so-called 'pleated' tensile membrane is formed. The pleated tensile membrane is a system used for the first time in 1983, in the roof of the Lindsay Park Sports Centre in Calgary.

The Redbird Arena, a multipurpose arena built in 1989 as part of the Illinois State University campus, can seat 11,000 spectators and represents the first cable dome erected over an elliptical plan. The roof covering is translucent, as in the Seoul halls, and enables reduction of artificial lighting during the daytime.

The Florida Suncoast Dome was built in 1990 in St Petersburg, Florida. It seats 43,000 visitors. Its unique translucent fibreglass membrane covers the world's largest 'Cabledome' (Figure 7). This structure covers a

roof span of 225m. It comprises four tension hoops. A low profile roof configuration has allowed for minimal fabric costs.

At night, a translucent roof covering gives the effect of the 'fifth facade' when the lights are on – which is illustrated by the Tao-Yuan County Arena built in 1994 in Taiwan (Figure 8). The arena is multipurpose, designed to host sports events and entertainment performances alike. The circular plan of the arena and a wish to secure as much daylight as possible led the design towards the tensegrity type cable dome.

The cable dome spans 120m employing three tension hoops. The structure has been designed to enable quick erection. The whole cable-strut network was preassembled on the ground, and then lifted to the given height and stressed. The roof was completely engineered, fabricated and erected in fourteen months.

The relative flexibility of Geiger cable domes to asymmetric loading was a decisive factor in using the stressed membranes as roof covering in those first structures. Apart from that, the development of the system was motivated by the wish to keep the membrane covering but to develop a structure that would replace the vulnerable large-span air-supported roofs. The membrane covering was widely in use for its light weight and translucency, especially in



Figure 7 - Florida Suncoast Dome

Source: <http://www.columbia.edu/cu/gsap/BT/DOMES/TIMELN/suncoast/sun-06.jpg>



Figure 8 - Tao-Yuan County Arena

Source: http://www.taiyokogyo.co.jp/img/lqr/mk_371.jpg

sports halls which required a considerable amount of daylight, as venues of athletic competition. However, it turned out that rigid cladding of such structures was also a choice, especially in those cases where membrane covering was not desirable for reasons of adequacy or cost-effectiveness. The erection of the first rigidly clad cable dome began in 1994, in North Carolina, where the authorities decided to build an athletic hall to seat 13,000 spectators (Gossen et al., 1998). The project architects developed a circular plan of 99.7m in diameter. A number of roof structures had been taken into consideration and analyzed before the 'Cabledome' cable-strut network was selected. The tensegrity type cable dome offered the best combination of architectural features and cost-effectiveness.

The roof consists of three tension hoops. The roof is segmented radially into 18 pieces. In this design, the typical arrangement of 'Cabledome' elements is somewhat modified (Figure 9). The perimeter compression ring is a conical truss. The top chord of the perimeter compression ring anchors the diagonals and the bottom chord anchors the ridge cables. The cable network is non-triangulated in the central zone of the dome, while it is partially triangulated in the outer compression ring zone by doubling the ridge cables.

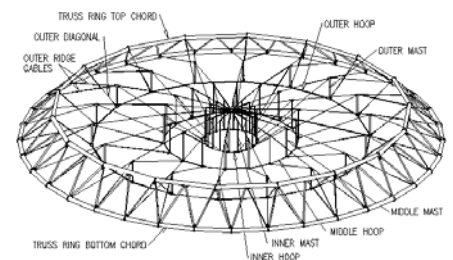


Figure 9 - Axonometry of the roof structure

Source: <http://www.geigerengineers.com/images/techfigs/roofdiagramfig1.gif>

The relatively flexible structure is covered by non-transparent rigid panels instead of the translucent membrane. The panels, made of steel frames, are supported by the cable-strut network. The support points of the roof panels are angular nodes which coincide with the position of compressed struts. The nodes are designed in such a way to allow for the rotation in the radial and circumferential direction. The panels 'float' on the cable-strut network and follow the distortion of its geometry caused by loading. The entire cable-strut network was assembled on the ground and then lifted and put into place. Finally the system was prestressed. The roof panels were mounted last.

In 1992, Georgia Dome was erected in Atlanta, USA. The oval stadium, that can seat 70,500 visitors, was designed and built in thirty months. Apart from sports events, this 'megastructure' hosts fairs, conferences, multimedia concerts and political conventions (Figures 10a and 10b).



Figure 10a - Georgia Dome interior view

Source: <http://www.columbia.edu/cu/gsap/BT/DOMES/GEORGIA/1018-52.jpg>

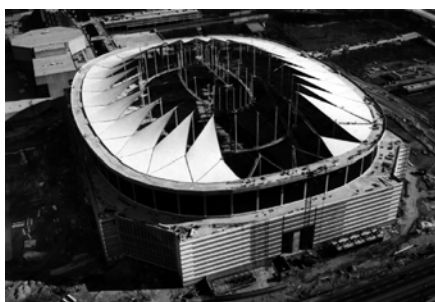


Figure 10b - Georgia Dome exterior view

Source: <http://www.columbia.edu/cu/gsap/BT/DOMES/GEORGIA/geo-21.jpg>

The tensegrity type cable dome, patented as the 'Tenstar Dome', was formed as a triangulated spatial network over an oval plan, 240 x 192m of span and represents the world's largest structure of its kind (Castro and Levy; 1992, Levy 1994; Terry, 1994). The continuous tension through the roof structure was achieved by means of continuous tension cables and discontinuous compression struts. The primary structural system consists of tensed ridge and diagonal cables and compressed struts. The bottoms of the compressed struts are borne by diagonal cables attached to the tops of the compressed struts in the next outer ring and are interconnected by tensed cables that form concentric hoops. These tension hoops assume the role that bottom chords of the radial cable trusses normally have. In this way, a three-dimensional structural configuration was made, which is prestressed within the compressed perimeter ring. Unlike the Geiger system, this one is triangulated in space. This solution follows Fuller's principle of spatial triangulation (Figures 11 and 12).

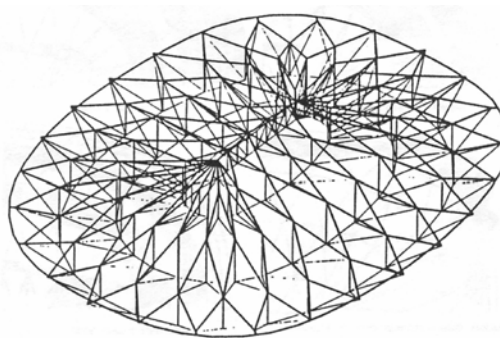


Figure 11 - Axonometry of the roof structure

<http://www.columbia.edu/cu/gsap/BT/DOMES/GEORGIA/geo-23.jpg>

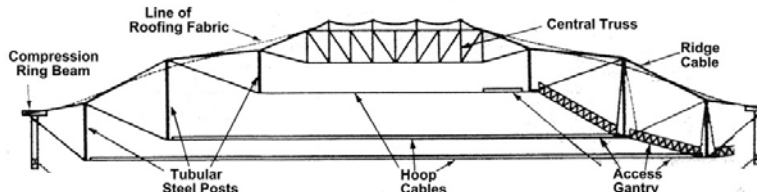


Figure 12 - Roof structure section

Source: <http://www.columbia.edu/cu/gsap/BT/DOMES/GEORGIA/geo-41.jpg>

The structure is clad in diamond shaped panels of PTFE coated glass fibre membrane that follow the geometry of the network. Structural components, joints, steel pipes for compressed struts and steel cables were prefabricated which significantly reduced erection time.

COMPARATIVE GEOMETRICALLY NONLINEAR STRUCTURAL ANALYSIS OF TWO TYPES OF TENSEGRITY TYPE CABLE DOMES

In tensegrity type cable domes, prestressed cables are the primary loadbearing elements, thus their non-linear behaviour due to load action is expected, as well as their reliance on geometric stiffness. Since structures of this type need to fulfil the condition of equilibrium upon a deformed configuration, the analysis of the structures was conducted by means of a software application for geometrically nonlinear analysis of three-dimensional trusses, based on the perturbation theory (Levy and Spillers, 1995). Instead of directly solving non-linear equations, they were being linearized by the application of the incremental approach. Load was determined by a system of consecutive steps, where the final structure configuration at a given step was taken for an initial approximation for the next step. At each step, i.e. within each increment, the geometrically non-linear analysis was reduced to the application of Newton's iterative method

to the equations describing perturbation conditions, with the approximation of the stiffness matrix by combining the elastic and geometric stiffness matrix. A quantitative analysis of the combined system stiffness matrices allowed for the detection of structure instabilities. During the incremental-iterative solution procedure, the determinant of the system matrix is monitored. When this determinant goes to zero (singular stiffness matrix) the structure is said to be unstable. Conventional analytical methods for system instability prediction could not be applied to structures of this type.

In this paper, the computer program for geometrically nonlinear analysis of three-dimensional trusses - P3-TR3DNL was used for the analysis of structures. This program was given on a disk as an integral part of the book "Analysis of geometrically nonlinear structures", written by Robert Levy and William R. Spillers, 1995. The original computer program was partially adapted (reprogrammed) for the needs of the analysis, so the different modulus of elasticity-E of the cables and struts could be taken into account.

Two analogous models (Figures 13a and 13b), based on the basic premises of these structures, were formed for the needs of comparative structural analysis of non-triangulated and triangulated tensegrity type cable dome for different load conditions (Nenadović, 2004). The network geometry was



Figure 13a - Non-triangulated tensegrity type cable dome model



Figure 13b - Triangulated tensegrity type cable dome model

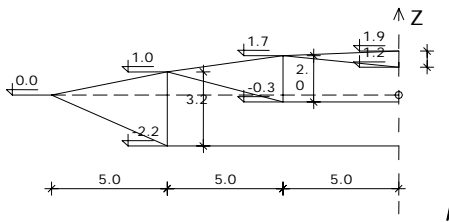


Figure 14 - Cross-section of tensegrity type cable dome model

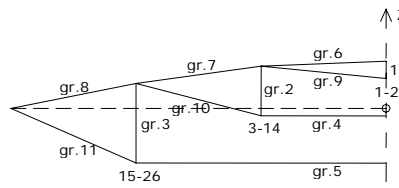


Figure 15 - Groups of elements and nodes

established in such a way that it resembled already constructed tensegrity type cable domes. This yielded in low profile domes in both cases (Figure 14). Both domes were formed as two-hoop configurations. Either model was developed as a cable-strut network, i.e. a three-dimensional truss. The cables could only take tension forces. The loads were given only at the system nodes. Both models were developed and analyzed without taking into consideration interaction with the roof cover.

The structures were analyzed for prestressing of the cable network and for different combinations of snow, wind and temperature loads. The prestress introduced into the structure, which carried dead load only, was determined relative to the condition that cables had to remain tightened for all load conditions and relative to the defined deformability expressed as allowed deflection under the most unfavourable load conditions. During the geometrically non-linear analysis of the structures, the software application reported the possible structure instability under various load conditions.

For the groups of load-bearing elements in non-triangulated and triangulated structure, from 1-gr.11 (figure 15), comparative maximum force graphs are given for the analyzed load conditions. For the nodes of non-triangulated and triangulated structure, the comparative maximal horizontal and vertical displacement graphs are given for the analyzed load conditions (nodes 1-2 – in the central

zone; nodes 3-14 – the inner tension hoop; nodes 15-26 – the outer tension hoop).

Loads:

- Dead load – $g=0.25 \text{ kN/m}^2$
- Snow load – $s=0.75 \text{ kN/m}^2$
- Wind load – $w=0.9 \text{ kN/m}^2$
- $q_w'=-0.63 \text{ kN/m}^2$ $G_z=2.0$ $q_w = -1.26 \text{ kN/m}^2$
- Thermal load $\Delta t = \pm 30^\circ$

Load conditions:

- LC-0 – dead load and prestress without fabric membrane
- This load case is used as the input condition for load conditions I through IX
- LC-I - LC-0/snow load
 - LC-II - LC-0/asymmetrical snow load
 - LC-III - LC-0/wind load
 - LC-IV - LC-0/temperature decrease
 - LC-V - LC-0/temperature decrease / snow load
 - LC-VI -LC-0/temperature decrease/asymmetrical snow load
 - LC-VII - LC-0/temperature decrease/wind load
 - LC-VIII - LC-0/temperature increase
 - LC-IX - LC-0/temperature increase/wind load

Influence of the network geometry on the behavior and structural efficiency of tensegrity type cable domes

Prestress level – LC-0

The prestress level in the triangulated structure is 15% higher than in the non-triangulated structure.

Initial (referent) stress intensity and stress distribution after prestressing – LC-0 (Figure 16)

In the triangulated structure, a differential distribution of stress was noted, i.e. a differential force flow from the periphery towards the structure's centre. While the non-triangulated structure was characterized by practically linear dependence in the increase of tension forces from the centre towards the periphery, the tension force flow in the triangulated structure was significantly disturbed in the outer tension hoop zone. The prestressing forces in the triangulated structure, which were significantly higher in this zone than in the non-triangulated structure, decreased rapidly toward the central zone. In spite of the higher intensity of initial prestress, the prestress, i.e. stiffness, was lower in the central zone of the triangulated structure. It was obvious that the triangulated network geometry partially impeded the distribution of the initial prestress, which was particularly reflected on the lower prestress in the central zone.

Horizontal and vertical displacements after initial prestressing – referent position

The referent position of the nodes in deformed structures, measured in comparison to the span, was slightly changed (0.3 – 1.2%) after the introduction of initial prestress.

Force intensity in load-bearing elements – stress distribution – load conditions I – IX

The effect of network geometry on the structure sensitivity for different load conditions was analyzed. The structure sensitivity was defined as the relation between the maximum force values for the given load conditions and the maximum force values for the basic load case (LC-0) in different element groups. Besides the comparative analysis of structure sensitivity, the relation between the stress intensity was analyzed, as well as the stress distribution after loading.

Comparative maximum force graphs for the analyzed load conditions I – IX in different groups of load-bearing elements are given for both the triangulated and non-triangulated cable domes (Figures 17-25).

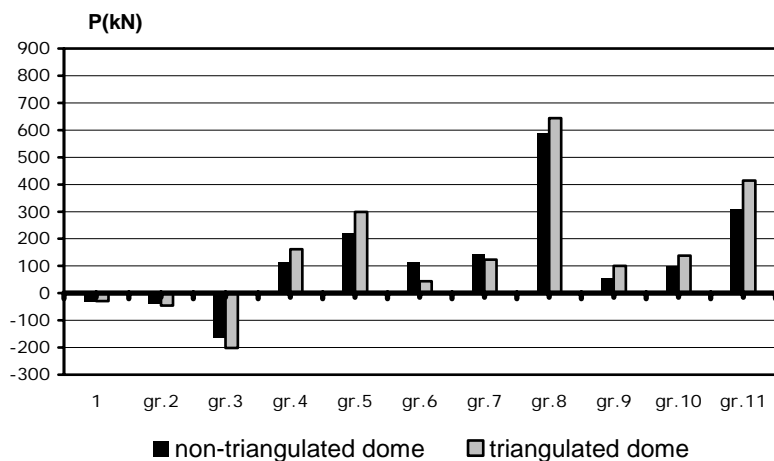


Figure 16 – LC-0

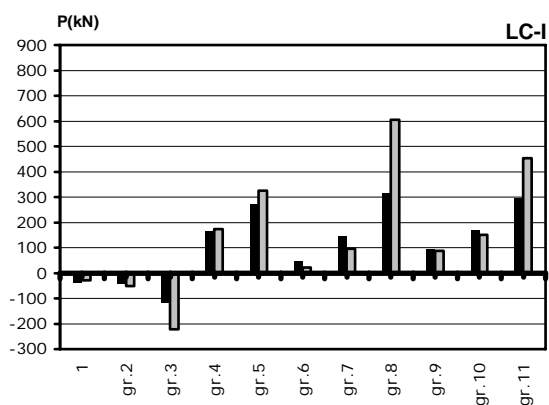


Figure 17 – LC-I

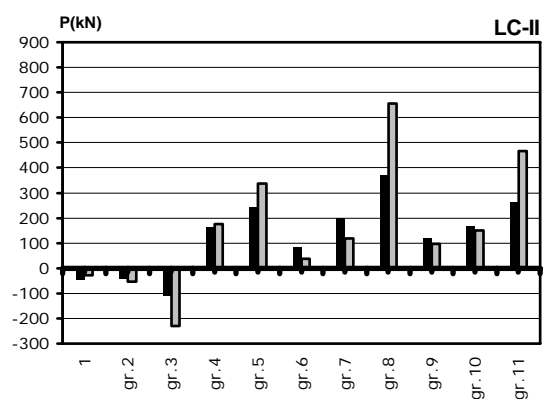


Figure 18 – LC-II

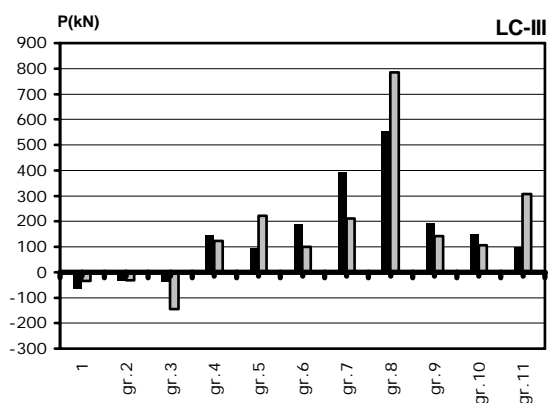


Figure 19 – LC-III

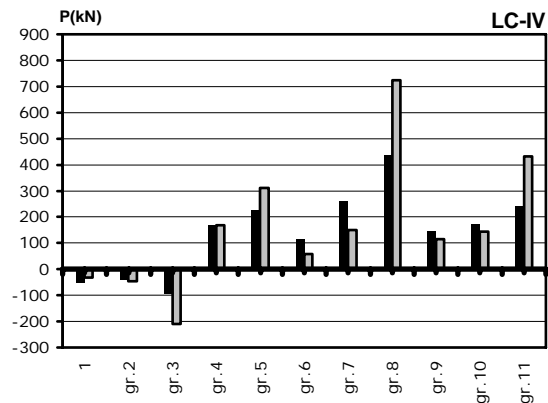


Figure 20 – LC-IV

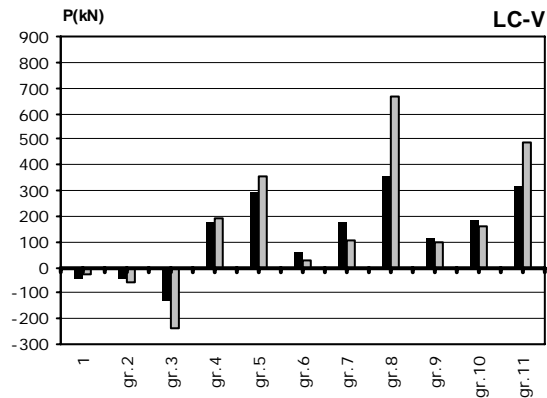


Figure 21 – LC-V

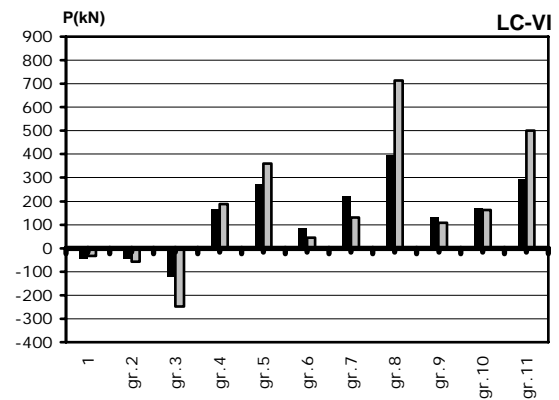


Figure 22 – LC-VI

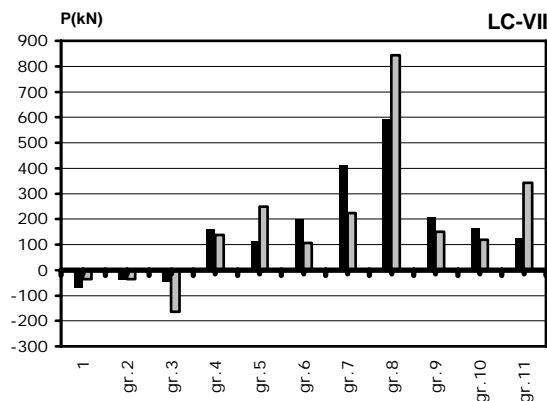


Figure 23 – LC-VII

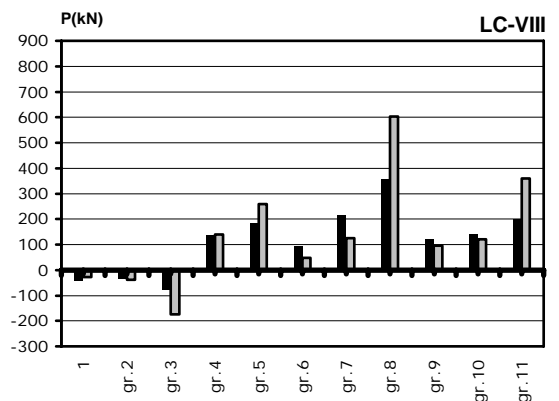


Figure 24 – LC-VIII

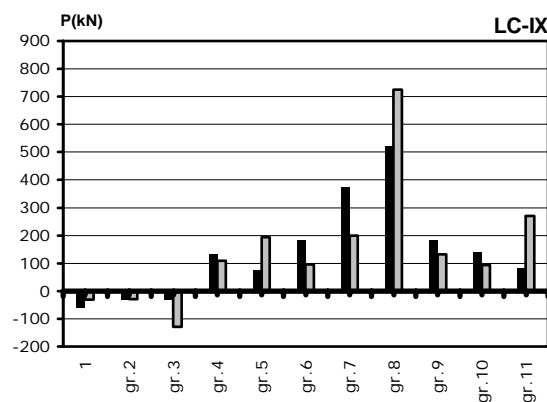


Figure 25 – LC-IX

LC-I – On the whole, the triangulated structure was less sensitive to snow load than the non-triangulated one. The triangulated structure showed a higher sensitivity to the given snow load only within the central zone, in which there was a significant drop in the prestress of ridge cables.

LC-II – On the whole, the non-triangulated structure was less sensitive to an asymmetrical snow load than the triangulated one. The non-triangulated structure showed a higher sensitivity to the given load only in the zone between the perimeter compression ring and the outer tension hoop, where a lesser drop in the tension force intensity in ridge cables was noted.

LC-III – On the whole, the triangulated structure was less sensitive to wind load than the non-triangulated one. The triangulated structure showed a higher sensitivity to the given load only in the zone of the inner tension hoop, where a decrease in tension force was noted, which was reflected as a lower prestress in the central zone.

LC-IV – The structures analyzed showed similar sensitivity to temperature decrease.

LC-V – Sensitivity of the analyzed structures to temperature decrease and snow load varied depending on the system zone that was analyzed. The sensitivity of the non-triangulated structure increased from the centre towards the perimeter compression ring, while the situation was reversed in the triangulated structure.

LC-VI – The non-triangulated structure was less sensitive to temperature decrease and asymmetrical snow load than the triangulated structure.

LC-VII – On the whole, the triangulated structure is less sensitive to temperature decrease and wind load than the non-triangulated structure. The triangulated structure showed a higher sensitivity only in the zone of the inner tension hoop, where a decrease in tension force was noted and which was reflected as a lower prestress in the central zone.

LC-VIII – The triangulated structure was slightly less sensitive to temperature increase than the non-triangulated structure.

LC-IX – Sensitivity of the analyzed structures to temperature increase and wind load varied depending on the system zone analyzed. The sensitivity of the non-triangulated structure

increased from the centre towards the perimeter compression ring, while the situation was reversed in the triangulated structure.

The distribution of stress in the given structures after the application of load did not change significantly relative to the basic load case; it changed only in the non-triangulated structure after the application of wind load, after temperature decrease and wind load and after temperature increase and wind load, where a significant decrease in tension force intensity in the outer tension hoop, as well as a linear decrease in tension force intensity in diagonal cables from the centre towards the periphery of the structure was noted.

However, in spite of the noted differences in structural sensitivity and stress distribution after the given load application, it should be noted that the maximum force values in the load-bearing elements of the non-triangulated and triangulated structure were present at the same load cases: at temperature decrease and snow load, a temperature decrease and asymmetrical snow load, and at temperature decrease and wind load.

Vertical and horizontal displacements – load conditions I – IX

For different load conditions, the effect of network geometry on structure displacement relative to the referent position was analyzed, i.e. the effect of network geometry on structural stiffness was analyzed.

Comparative maximum vertical displacement graphs are given for different node groups of non-triangulated and triangulated cable domes, for given load conditions I – IX (Figures 26, 27 and 28).

Comparative maximum horizontal displacement graphs are given for different node groups of non-triangulated and triangulated cable domes, for given load conditions I – IX (Figure 29, 30 and 31).

LC-I – At snow load, the triangulated structure proved stiffer than the non-triangulated one in the zones of the outer and inner tension hoops, while the non-triangulated structure proved slightly stiffer in the central zone.

LC-II – At asymmetrical snow load, the triangulated structure was significantly stiffer than the non-triangulated one.

LC-III – At wind load, the triangulated structure proved stiffer than the non-triangulated one in the zones of inner and outer tension hoops. In the central zone, the triangulated structure

proved slightly less stiff than the non-triangulated structure.

LC-IV – At temperature decrease, both structures proved similarly stiff. The triangular structure was slightly less stiff in the central zone, while in the zones of outer and inner tension hoops it proved slightly stiffer than the non-triangulated structure.

LC-V – At temperature decrease and snow load, the triangulated structure proved stiffer than the non-triangulated one, in the zones of inner and outer tension hoops, while in the central zone both structures had the same stiffness.

LC-VI – At temperature decrease and asymmetrical snow load, the triangulated structure proved vertically stiffer than the non-triangulated structure. However, in the central zone and in the zone of inner tension hoop, the triangulated structure showed higher deformability in horizontal direction than the non-triangulated one. It is only in the zone of the outer tension hoop that the triangulated structure showed greater horizontal stiffness.

LC-VII – At temperature decrease and wind load, the triangulated structure proved stiffer than the non-triangulated one in the zones of inner and outer tension hoops. In the central zone, the triangulated structure proved slightly less stiff than the non-triangulated one.

LC-VIII – At temperature increase, the triangulated structure proved stiffer than the non-triangulated structure.

LC-IX – At temperature increase and wind load, the triangulated structure was stiffer than the non-triangulated one in the zones of inner and outer tension hoops. In the central zone, the triangulated structure was slightly less stiff than the non-triangulated one.

However, in spite of the noted differences in the system stiffness at different load conditions, it should be pointed out that the maximum horizontal displacements in triangulated and non-triangulated structure occurred at asymmetrical snow load, and maximum vertical displacements occurred at temperature increase and wind load.

Load-bearing elements weight – material consumption

The overall load-bearing elements weight (steel pipes and steel cables) of the non-triangulated structure was 56% lesser than that of the triangulated one.

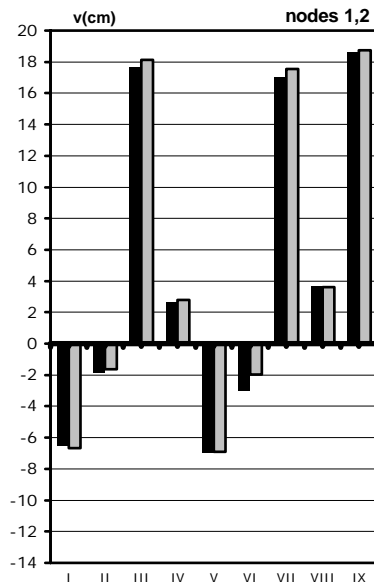


Figure 26 – Maximum vertical displacements – nodes 1, 2

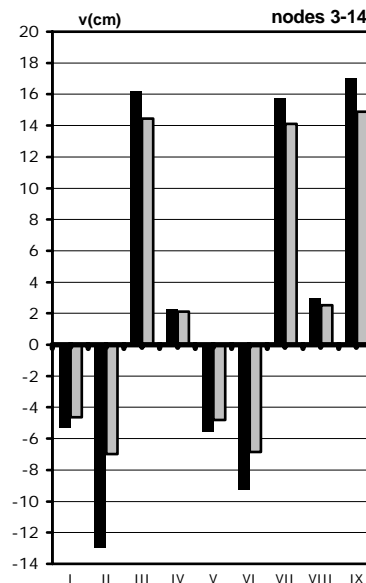


Figure 27 – Maximum vertical displacements – nodes 3-14

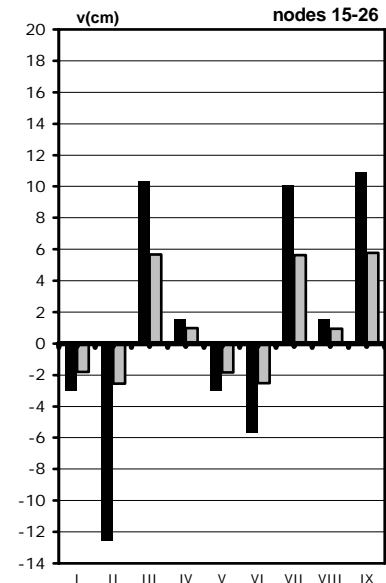


Figure 28 – Maximum vertical displacements – nodes 15-26

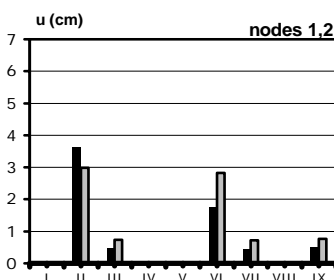


Figure 29 – Maximum horizontal displacements – nodes 1, 2

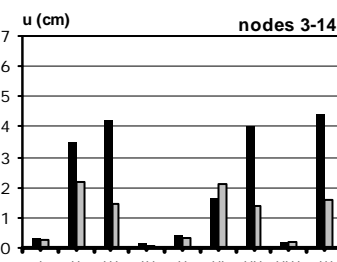


Figure 30 – Maximum horizontal displacements – nodes 3-14

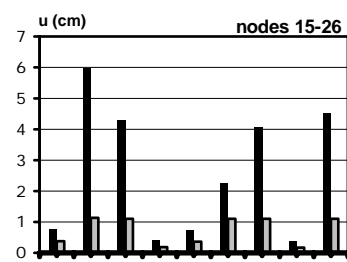


Figure 31 – Maximum horizontal displacements – nodes 15-26

Maximum support reactions – load conditions I – IX

Maximum vertical support reactions for the non-triangulated structure show relatively lower intensity, bearing in mind lesser overall weight of the network load-bearing elements. This allows for the formation of a secondary structure with a smaller cross-section of the bearing elements. The maximum horizontal support reactions in the radial direction were 25% lower in intensity than the respective support reactions within the triangulated structure. This allows for the formation of the perimeter compression ring and secondary structure of the lesser cross section.

CONCLUSION

On the basis of a geometrically non-linear comparative analysis of triangulated and non-triangulated tensegrity cable domes, it can be noted that the introduction and distribution of prestress in the triangulated structure appeared to be partially impeded, which particularly reflects itself on the lesser prestressing of the central zone. The sensitivity of the analyzed structures varied under different load conditions and between different systems zones under analysis. Within the triangulated structure there was a greater number of occurrences of central zone sensitivity, which was a result of its lesser prestressing following

the introduction of initial prestress. The stress distribution within the given structures, following the application of different loads, did not change significantly relative to the basic load case, except in the non-triangulated structure where, upon the application of wind load, a significant decrease in tension forces in the outer tension hoop occurred, as well as a linear decrease in tension force intensity in diagonal cables from the centre towards the periphery of the structure.

On the whole, the triangulated structure appeared to be stiffer than the non-triangulated structure. However, in its central zone, a significant decrease in stiffness occurred due to

its lesser prestress (in spite of the greater intensity of initial prestressing forces), to the degree where the maximum vertical displacement of the structure nodes in this zone, in the majority of cases, proved to be higher than in the non-triangulated structure. It should be noted that those displacements were also related to the defined deformability of the system. In non-triangulated structure, greater horizontal displacements of nodes occurred. The non-triangulated structure would require less material for its construction, as well as for construction of the perimeter compressed ring and secondary structure.

Significant decreases in the tension force intensity in the outer tension hoop and diagonal cables of the non-triangulated structure, especially at asymmetric load action and with comparatively great horizontal displacements, showed that this network geometry has its disadvantages, especially in rigid roof cladding solutions. Geiger's 'pleated' roof membrane that is applied in tensegrity type cable domes is system based on the interaction of the membrane fabric and cable-strut network in bearing the load. The membrane has a stabilizing effect on the structure, but is flexible enough to follow its displacements. Unlike membrane fabric, rigid roof panels 'float' upon the load-bearing structure, i.e. the cable-strut network, and do not exert the stabilizing effect of the membrane fabric. In such cases, the structure experiences significant displacements. In order to control the displacement, especially horizontal displacements of non-triangulated structure in case of rigid sheet cladding, it is possible to intervene with the network geometry by introducing partial triangulation in the critical zone. The example of a successful combination of the triangulated and non-triangulated network is the first realized rigidly clad tensegrity cable dome, where the network is partially triangulated in the zone of the outer tension hoop, while in the inner tension hoop zone it respects and follows the geometry of Geiger's non-triangulated network, which enables a higher prestressing level and a higher stiffness in the central zone.

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PARAMETRIC CURVES AND SURFACES MATHEMATICA DEMONSTRATIONS AS A TOOL IN EXPLORATION OF ARCHITECTURAL FORM

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Through their work in the field of generic explorations, authors of this paper have developed a series of demonstration projects, based on the software package MATHEMATICA, related to the parametric representation of curves and surfaces in space. The main purpose of the demonstrations is exploration of generic potential of curves and surfaces in order to apply it to the process of generating architectural form. The paper presents the developed demonstration projects and their application within the generic explorations of architectural form.

Key-words: Mathematica demonstrations, parametric curve and surface, architectural form

INTRODUCTION

Wolfram Demonstration Project has been developed by Wolfram Research software company. The aim of this project is to educate in science, technology, mathematics, art, finance and other realms². With help of Mathematica, one of the most powerful computer program for calculus, wide auditorium got chance to illuminate many scientific concepts. Project is growing daily, because the Mathematica users are allowed to make and upload demonstrations, which could be used with free software – Mathematica Player.

The development of Mathematica has been started by Stephen Wolfram. His idea was to build a computer program for simulating natural phenomena. Unexpectedly simple algorithms gave results, which initiated the exploration of generic forms (Wolfram, 2002). Since the idea of generic concept is in basis of Mathematica, there are many demonstrations which illustrate the most important ones: fractals, L-systems, cellular automata (Bogdanov et al., 2007; Petruševski et al., 2009; Devetaković et al., 2009).

As a support for their own exploration³ and to help their students within the courses Mathematics in Architecture⁴ and Generic Explorations⁵, Faculty of Architecture, University of Belgrade, the authors of this paper have developed series of Demonstration projects⁶ which graphically represent parametric curves and surfaces. The main purpose of these demonstrations is exploration of generic potential of curves and surfaces, in order to apply it to architectural form exploring and generating process.

PARAMETRIC CURVES AND SURFACES

One way of representing curves and surfaces, in Cartesian coordinate system, is parametric.

A planar curve L is a map of interval I in two-dimensional space ($L: I \rightarrow R^2$). For each $t \in I$

$$L(t) = (x(t), y(t)), \quad (1)$$

where $x: I \rightarrow R$, and $y: I \rightarrow R$ are real-valued functions (Shelden, 2002).

If we choose Cartesian coordinate system for two-dimensional space representation, then $L(t) = (x, y)$, represents a set of points with coordinates

$$x = x(t), y = y(t), t \in I \quad (2)$$

These equations are called parametric representation of curve L (Pottmann et al., 2007).

Example: Ellipse in Figure 1a) is represented with equations:

$$x = 5\cos(t), y = 2\sin(t), t \in [0, 2\pi] \quad (3)$$

Ellipse in Figure 1b) is represented with equations:

$$x = 2\cos(t), y = 5\sin(t), t \in [0, 2\pi] \quad (4)$$

A space curve L is a map of interval I in three-dimensional space $L: I \rightarrow R^3$,

$$L(t) = (x(t), y(t), z(t)), t \in I \quad (5)$$

where x , y and z are real-valued functions,

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² Wolfram Demonstrations Project

³ Web resource: Generic explorations

⁴ Web resource: Mathematics in Architecture

⁵ Web resource: Generic explorations, elective course

⁶ Web resource: Demonstration projects by Milana Dabić

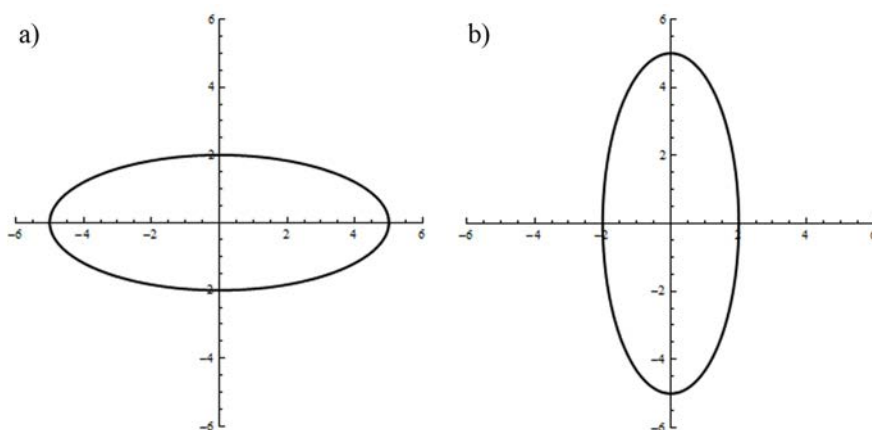


Figure 1 - Parametric representation of ellipse

$$x: I \rightarrow R, y: I \rightarrow R, z: I \rightarrow R$$

Points of space curve L have coordinates $L(t)=(x,y,z)$, hence equations

$$x=x(t), y=y(t), z=z(t), t \in I \quad (6)$$

are parametric equations of space curve L . One could notice that parametric equations of planar and space curves are functions of one variable t .

A surface S is a map of $I \times J$ in three-dimensional space: $(I \times J \rightarrow R^3)$, where $I \times J$ denotes Cartesian product of intervals I and J . For each $u \in I, v \in J$,

$$S(u,v)=(x(u,v),y(u,v),z(u,v)) \quad (7)$$

where x, y and z are real-valued functions of set $I \times J$. Coordinates of surface points $S(u,v)=(x,y,z)$, are functions of two variables, described with equations:

$$x=x(u,v), \quad y=y(u,v), \quad z=z(u,v), \quad (8) \\ (u,v) \in I \times J$$

These equations are called parametric representation of surface S .

Parametric curves could be discretized by finding the polyline (polygonal curve) that represents curve. For surfaces, it is desirable to cover it with planar panel elements and use polyhedral surfaces (Pottmann et al., 2006). One could also control how precise that representation could be. As higher number of line segments or panels is, the curve or surface is better represented.

In parametric representation of curves and surfaces, it is possible to replace constants with additional parameters. Thus, collection of

curves or surfaces, is created, which have different shape or position for various values of these parameters. In Example, by adding parameters a and b instead of constants, collection of ellipses is created

$$x=acos(t), y=bsin(t), t \in [0, 2\pi], \quad (9)$$

which is for parameter values $a=5, b=2$ shown in Figure 1a), and parameter values $a=2, b=5$ in Figure 1b).

One of the challenging issues in understanding parametric representation, is seeing parametric object as static set of points, without noticing connection between functional relationship of parameter values and assigned points (Filler, 2007). Solving this problem was one of the motives for authors of this paper to develop parametric curves and surfaces demonstrations.

WOLFRAM DEMONSTRATIONS FOR REPRESENTING CURVES AND SURFACES

The authors of this paper have developed following projects as a tool for generic explorations: "Circle, Ellipse, Hyperbola, and Astroid", "Cycloid and Archimedes's Spiral", "Looped Curves", "Four Space Curves" and "Parametric Representations of Four Surfaces". Paper describes demonstrations: "Looped Curves", "Four Space Curves" and "Parametric Representations of Four Surfaces", illustrated respectively in Figures 2, 3 and 4.

In the above mentioned demonstrations several geometric objects are presented. After one of them is chosen, parametric equations are displayed. Also, there are sliders for choosing

parameter values in equations. With change of parameter values, graphic preview of object changes simultaneously, so one can notice how particular parameter affects graphic interpretation. This way, geometric object is not seen as a static, but as a dynamic object, which improves understanding of parametric representation.

Figure 2 presents "Looped Curves" demonstration with chosen curve

$$x=asin(k_1t)cos(k_2t), \quad (10) \\ y=bsin(k_1t)sin(k_2t), t \in [0, 2\pi]$$

for parameter values $a=5, b=5, k_1=3$ and $k_2=5$.

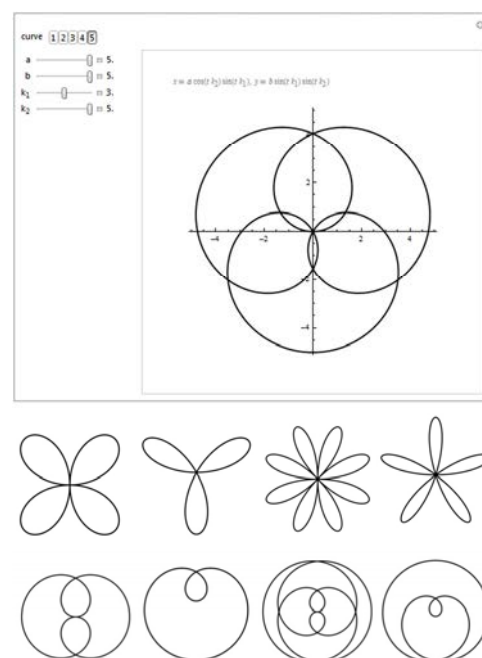


Figure 2 - Demonstration "Looped Curves"

In the first row of illustrations, below demonstration in Figure 2, there is a curve described with equations (10) for various values of parameter k_1 , while parameters a, b and k_2 are constant. The values of parameters are $a=5, b=5$ and $k_2=1$, while parameter k_1 is equal, respectively

$$k_1=2, k_1=3, k_1=4, k_1=5. \quad (11)$$

The second row illustrates the same curve, represented with equations (10), for various values of parameter k_2 , and constant values of parameters a, b and k_1 . Values of parameters are $a=5, b=5$ and $k_1=1$, while parameter k_2 is respectively equal

$$k_2=2, k_2=3, k_2=4, k_2=5. \quad (12)$$

⁷ Demonstration projects by Milana Dabić, Op. cit.

Demonstration "Four Space Curves", shown in Figure 3, describes parametric equations of circle, Archimedes's spiral, helix and conical spiral. Figure 3 shows demonstration where Archimedes's spiral is chosen:

$$x = at \cos(t), \quad y = at \sin(t), \quad z = c, \quad (13)$$

$$t \in [0, 2\pi]$$

for parameter values $a=3$ and $c=0$.

Illustrations in the first row, under the demonstration, present a conical spiral with parametric equations

$$x = at \cos(t), \quad y = at \sin(t), \quad z = ct, \quad (14)$$

$$t \in [0, 2\pi]$$

for parameter c values, respectively

$$c=5, c=0 \text{ and } c=-5, \quad (15)$$

while parameter a has constant value ($a=5$).

It is noticeable, by reviewing the illustrations, that Archimedes's spiral is in conical spiral collection too, and it could be described with equations (14) for parameter value $c=0$.

The second row of illustrations in Figure 3 presents a helix with parametric representation

$$x = a \cos(t), \quad y = a \sin(t), \quad z = ct \quad (16)$$

for constant parameter values a and c ($a=5$, $c=1$), but parameter t takes values from

interval which has various size. Parameter t takes values within the interval, respectively

$$t \in [0, 12\pi], \quad t \in [0, 8\pi], \quad t \in [0, 4\pi]. \quad (17)$$

"Four Surfaces" demonstration shows sphere, ellipsoid, surface eight and hyperboloid, and enables change of parameters which figure in parametric equations. In Figure 4, demonstration shows surface eight with parametric equations:

$$x = a \cos(u) \sin(2v), \quad y = b \sin(u) \sin(2v), \quad z = c \sin(v) \quad (18)$$

for parameter values $a=5$, $b=5$, $c=5$, $u \in [0, 2\pi]$, $v \in [-\frac{\pi}{2}, \frac{\pi}{2}]$.

The first row of illustrations shows surface for various values of parameter a , b and c :

$$a=2, b=2, c=5; \quad a=2, b=5, c=5; \quad a=5, b=5, c=3; \quad (19)$$

while, interval sizes for u and v stays the same:

$$u \in [0, 2\pi], \quad v \in [-\frac{\pi}{2}, \frac{\pi}{2}]. \quad (20)$$

The second row illustrates change of those intervals, while parameters a , b and c stay constant. For all illustrations $a=5$, $b=5$, $c=5$,

while respectively

$$u \in [0, \pi], \quad v \in [-\frac{\pi}{2}, \frac{\pi}{2}];$$

$$u \in [0, 2\pi], \quad v \in [-\frac{\pi}{2}, \frac{\pi}{4}]; \quad (21)$$

$$u \in [0, \frac{7\pi}{4}], \quad v \in [-\frac{\pi}{2}, \frac{\pi}{8}].$$

CREATING DEMONSTRATIONS

In order to create a demonstration, it is necessary to become familiar with Mathematica's programming language. It is a specific language which provides a great number of functions for mathematics calculus and geometric visualization. Several commands developed within Wolfram Demonstration Project made possible to see the results of some function for various values of its arguments.

There are series of functions for defining and visualizing curves and surfaces. In the source code of previous demonstrations function *ParametricPlot*, which enables visualization of parametric plane curves, and function *ParametricPlot3D*, which enables visualization of parametric space curves and surfaces, are used. Buttons and sliders are implemented with the available functions for demonstration building.

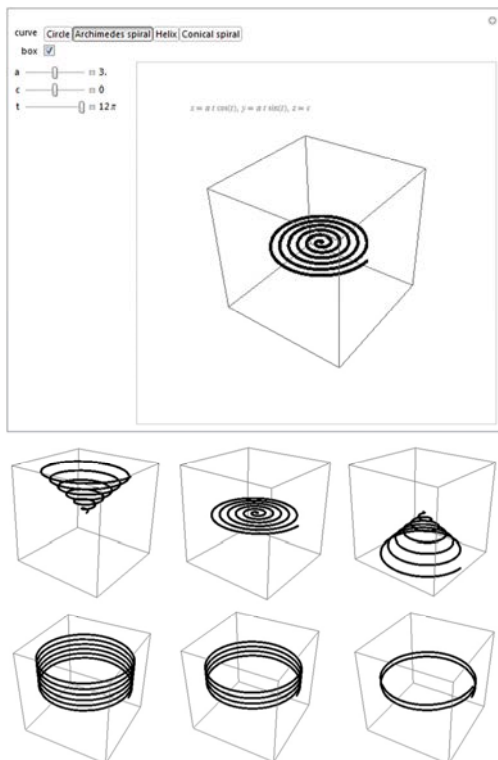


Figure 3 - Demonstration "Four Space Curves"

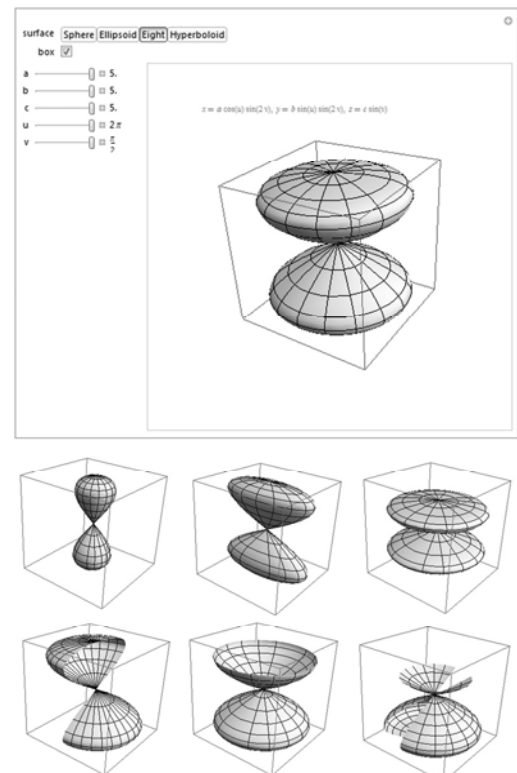


Figure 4 - Demonstration "Four Surfaces"

```
"Eight",
Pane[
Column[{
Text@Row[{Style[Row[{
TraditionalForm[x == a*Cos[u]*Sin[2 v]],", ",
TraditionalForm[y ==b*Sin[u]*Sin[2 v]],",",
TraditionalForm[ z ==c*Sin[v]]}]]}],
ParametricPlot3D[
{aa*Cos[u]*Sin[2 v], bb*Sin[u]*Sin[2 v],cc*Sin[v]},
{u,0,U},{v,-Pi/2,V},
PlotRange→{{-5,5},{-5,5},{-5,5}},
Boxed→ax,Axes→False,ImageSize→300,ImagePadding→20]],
{400,400},Alignment→{Center,Center}],
```

Figure 5 - Demonstration "Four Surfaces" – part of source code, functions for surface visualization

```
{surface,{ "Sphere", "Ellipsoid", "Eight", "Hyperboloid" },
ControlPlacement→Top},
{{aa,3,"a"},1,5,
Appearance→"Labeled",ImageSize→Tiny},
{{bb,1,"b"},1,5,
Enabled→
(surface□"Ellipsoid" | surface□"Eight" | surface□"Hyperboloid"),
Appearance→"Labeled",ImageSize→Tiny},
{{cc,3,"c"},1,5,
Enabled→
(surface□"Ellipsoid" | surface□"Eight" | surface□"Hyperboloid"),
Appearance→"Labeled",ImageSize→Tiny},
{{U,2 Pi,"u"},Pi/32,2Pi,Pi/32,
Appearance→"Labeled",ImageSize→Tiny},
{{V,Pi/2,"v"},Pi/2+Pi/32,Pi/2,Pi/32,
Appearance→"Labeled",ImageSize→Tiny},
{{ax,True,"box"},{True,False},ControlPlacement→Top},
```

Figure 6 - Demonstration "Four Surfaces" – part of source code, functions for surface visualization

In Figure 5, a part of source code of the demonstration "Four Surfaces" is shown. That part of code implements tab which represents surface *Eight* (Figure 4). In *Traditional Form*, parametric equations are displayed, and with the function *ParametricPlot3D*, surface *Eight* is visualized. The arguments of function *ParametricPlot3D* are parametric equations, boundaries of intervals within parameters take values and some optional settings for surface visualization.

In Figure 6, some of the functions for creating demonstrations are shown. Part of the source code of the demonstration "Four Surfaces" given in Figure 6, implements tabs *Sphere*, *Ellipsoid*, *Eight*, *Hyperboloid* (Figure 4), and shows implementation of sliders which allow change of parameter values a , b , c , U , V . There is one check box denoted with *box* (Figure 4, and source code in Figure 6). If it's checked, then box around object is displayed. Code also includes some optional functions for sliders and tab placement (*ControlPlacement*), possibility of using them (*Enabled*), their size and appearance...

Before uploading⁸, demonstrations are sent for reviewing process. Experts in relevant field check its accuracy and quality, and automated software-quality-assurance methods check its operation. In case of theoretical or technical irregularity, demonstrations are sent back for correction. Therefore, available demonstrations are theoretically correct, they could be counted as academic publications and could be used in educational purposes. Demonstration Project made possible for everyone to use Mathematica visualization and to learn about Mathematica code. With accuracy check and great number of contributors, Project became reliable and extensive source of knowledge.

The Wolfram Demonstration Project continues to grow, because number of contributors and published demonstrations increases daily. Demonstrations are developed in many areas – mathematics, physics, mechanics, biology, art, etc. Although demonstrations mentioned in this paper are developed for architecture generic explorations, Wolfram's team also related them to other areas: 3D graphics, high school mathematics and analytic geometry.

APPLICATION IN THE PROCESS OF ARCHITECTURAL DESIGN

At the Faculty of Architecture, University of

⁸ Wolfram Demonstrations Project, Op.cit.

Belgrade, within the series of elective courses named Generic Explorations⁹ the authors of this paper made experimental part of architectural form exploration based on plane and space curves and surfaces. Two groups of 20 senior students took part in the experimental design.

The exploration was organized weekly in the following phases: Plane curve study, Generic potential of plane curve, Curve discretization, Space curve study, Space curve materialization, Architectural interpretation of space curve in a given context, Surface study, Curves on surfaces and Final works. Curves and surfaces are defined by parametric equations.

The participants in this experiment easily adopted the presented Demonstration as an explorative tool and stimulated further development of Mathematica demonstrations for exploring curves and surfaces.

These Demonstrations made possible for architecture students to see spatial representation of curves and surfaces, which depends of larger number of parameters. Also, they contributed to examination of generic potential and to application in architectural form exploration. Some of the results of curve studies are shown in Figure 7, and some of the resulted architectural form based on curves and surfaces exploration are shown in Figure 8. Explorations of architecture form are realized in CAAD software, while Mathematica demonstration projects have been considered as a tools for basic precedent explorations.

The functionality of the Demonstration projects in the process of generic explorations is easy to follow on the example of curve (10) within demonstration project "Looped Curves". Even with systematic mathematical analysis, which include variation of parameters k_1 and k_2 for fixed values of remaining parameter a and b , one could not predict appearance of curves obtained from some combination of parameter values (Figure 9).

DISCUSSION – CURVE AS A FORM GENERATOR

The presented Demonstration projects are mostly related to plane curves for a particular reason. Plane curves have important role in generating architectural geometry. Surfaces are often generated as a trace of movement of

a plane curve. That surface contains all those curves, generated by moving the first one, and some of them, often by discretization, could take a role of construction elements. Discretization of surfaces with polygons creates large number of plane curves which could be interpreted like its constructive elements.

Plane curves are very important in generating architecture form. This is justified and proved once more through this experimental work. For this reason the plane curves are at the main focus of this study. Developed Demonstration projects have had an important role in choosing and studying plane curves.

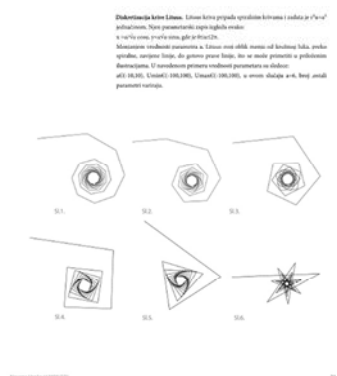
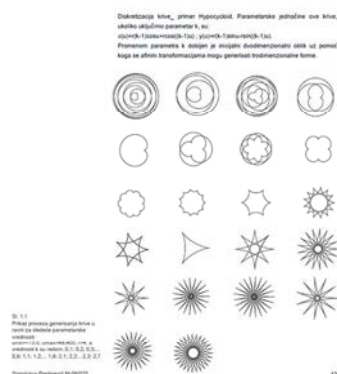


Figure 7 - Plane curve study and Curve discretization
(Student works: Stanislava Predojević, Nevana Urošević)

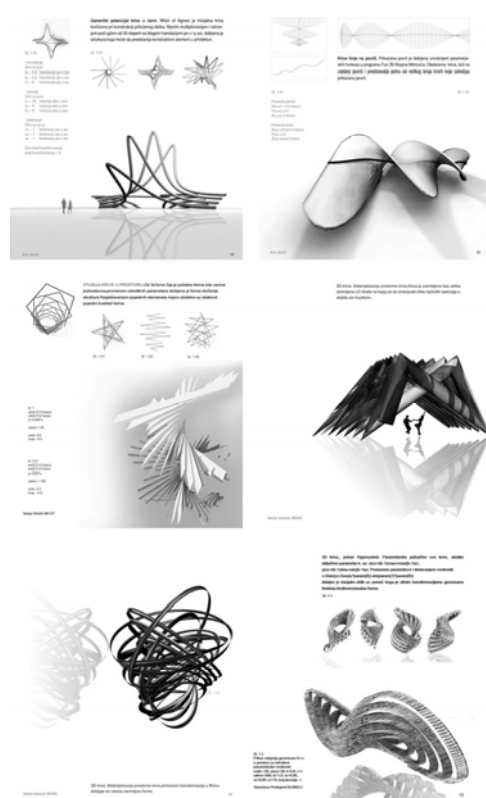


Figure 8 - Generic potential of curves and surfaces –architectural form exploration
(Student works: Ana Jevtić, Sonja Dimčić, Vesna Ivanović, Stanislava Predojević)

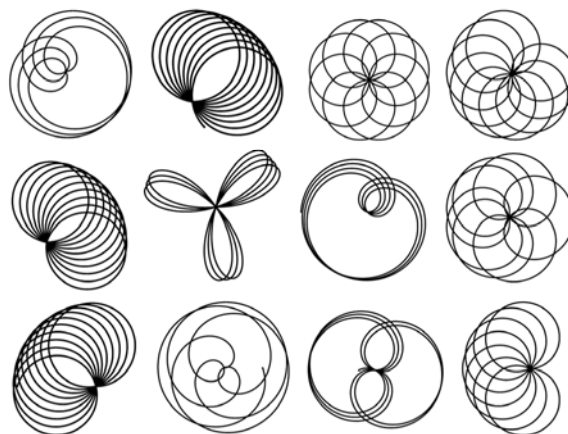


Figure 9 - Study of curve with parametric representation (6)

⁹ Web resource: Generic explorations, elective course, Op.cit.

Analyzing the results of the experiments, within Plane curve study phase and Generic potential of plane curve phase it was concluded that curve is often interpreted as architectural element, outlining base geometry of future architectural precedent design (Figure 10). Mathematically defined curve becomes architectural sketch. Advantage of this sketch is that architect can control project much more precisely. Experiments from this study deal mostly with early design stages.

In most cases, as an architect is getting closer to a real architecture form, he deals with project construction. Because of technology that is available today, architects discretize curves and surfaces, according to material performances, project scenario, etc. Students at these courses recognized this potential of discretized curves and surfaces and they used it in the early design. Moving plane curves in discrete steps, with simultaneous affine transformations, students used them as a generator of initial architectural geometry design (Figure 10).

As mentioned before, plane curve has the main role in generative processes. Also, comparing the results of plane curve exploration and space curve exploration, it turns out that the plane curve has more significant potential in

terms of future construction (Figure 8 and Figure 10).

CONCLUSIONS

Presented demonstration projects, have multiple impacts on architectural form exploration. With their help, it is possible to clarify mathematical representations of geometric objects and connection between formulae and graphical interpretation. Also, projects made possible for one to explore collections of curves and surfaces by adding additional parameters in parametric representation. Although demonstrations use Mathematica's programming language which differs from other programming languages, authors of this paper believe that the results are worth the efforts of learning it.

Featuring of these demonstrations¹⁰ shows their mathematical (educational) importance. Their importance as a tool in exploration of architectural form is confirmed within the experimental work on the Faculty of Architecture, University of Belgrade.

The presented demonstration projects had essential part in choice and Study of plane curve, Space curve study and Surface study. They facilitate the understanding of generic potential of curves and surfaces. Demonstrations are developed in an intensive interaction with participants of the experiment as a response to their high criteria and demands. Most of the demonstrations are related to Plane curves because they are significant as architectural form generators.

Demonstrations presented in this paper are included in Wolfram Demonstration Project collection. Although they are developed for the purpose of generic exploration in architecture, they illuminate concept of parametric representation of curves and surfaces and are available within Wolfram Demonstration Project's categories of analytic geometry, high school mathematics and 3D graphics.

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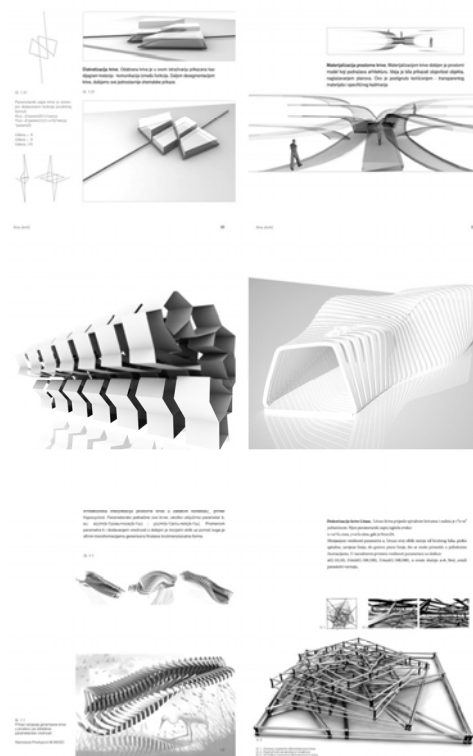


Figure 10 - Curves and surfaces – architectural interpretation (Student works: Ana Jevtić, Stanislava Predojević, Nevena Urošević)

¹⁰ Demonstration projects by Milana Dabić, Op. cit.

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