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Using visual language to represent interdisciplinary content in urban development: Selected findings

This article addresses visual language in architecture and spatial disciplines, using it as a means of communicating and conveying information, knowledge and ideas about space that are permeated by their interdisciplinary character. We focus in particular on the transmission of messages between professionals and the general public, arguing that this process aids the long-term formation of a responsible and critical public, which is then able to take an active part in sustainable planning and design practices. The article highlights some findings of an empirical study of 245 people that tested the effectiveness of selected presentation techniques in communicating spatial messages to the general public and placing them in the framework of existing knowledge.

Keywords: visual language, presentation techniques, general public, public participation, urban space

1 Introduction

When developing presentation techniques in architecture to effectively convey spatial topics, information and ideas, we are unavoidably faced with the issue of visual language. Essentially, we want to apply and use visual presentations, which can transmit complex messages in a clear, understandable and intuitive form. To a certain extent, such presentations follow the logic and nature of the message or content that needs to be conveyed, but at the same time their choice is also determined by the intended recipient. This article focuses on conveying spatial content and topics between professionals and the general public, and on research on approaches and techniques that best support this communication.

The empirical study is part of a wider study that was conducted in several stages (see Verovšek, 2012) and helped develop a model and tools for interpreting urban spaces. The model and tools help convey complex spatial relationships to the general public, improving their understanding and interpretation of such places. The research was guided (and its aims set accordingly) by the assumption that when the general public has a better understanding of urban spatial realities it is possible to have more constructive discussion within the spatial decision-making process. Above all, it also extends communication to earlier stages in the process. Such efforts are of great importance, especially for issues related to public urban spaces that are subject to constant change and powerful dynamics. In addition, these spaces are also extensively used by the public and are a constant concern, making the public a legitimate partner in decision-making. This article focuses on selected presentation techniques and their effectiveness in transferring complex messages about public spaces. It examines techniques for conveying spatial information in a format that combines both experiential and conceptual levels of expression (Casey, 1997; Bosselmann, 1998). Each such presentation technique, supporting one of these levels of expression, has advantages and limitations with respect to message-carrying capacity.[1] We tried to determine at what point and under what conditions these prove to be crucial for the general public's understanding, and when and how they can be applied. Our findings fill some gaps in existing knowledge and create a basis for further research.

2 Background

Efforts to involve the public in architectural and urban planning often face the problem of the general public's incomplete understanding of professional arguments (Al-Kodmany, 1999). Presenting and integrating ideas – and, due to the nature of the subject, the inevitable interdisciplinary approach to spatial problems – raises the issue of coordinating views and proposals by professionals and various public groups such as investors, the general public, governmental actors and so on. There is a relatively artificial but important distinction between participants with professional knowledge and the general public's knowledge of a specific spatial problem.

The dichotomy between professionals and the general public has various causes. Some issues are due to differing interests and priorities, which vary greatly even within different public groups. Much divergence is the result of a failure to communicate (Ogorelec, 1995; Bizjak, 2012). According to Tadeja Zupančič and Matevž Juvančič (2003), communication barriers between parties in urban planning are often due to different communication methods and different visual language by both sides, leading to different interpretations of visual messages. The architectural community is used to conceptual visual language, abstracting and skipping over scale dimensions (Zupančič et al., 2009), which are skills acquired through professional education and practical experience, as well as research. The general public, on the other hand, is rarely capable of decoding such visual messages or expressing spatially related ideas in a concise visual manner. Adding to the communication gap is the difficulty level of the spatial content being conveyed. Spatial urban architectural issues seldom have unambiguous or straightforward solutions, but are more often complex problems with many factors, requiring deeper understanding and an interdisciplinary approach. Although spatial issues are perceived in a specific temporal and spatial framework, and are thus traceable, the processes that led to them are not always recognisable in space. They may extend beyond the locations examined or manifest themselves later, requiring a systematic analysis with methodological support, as well as suitable communication and representation methods, taking into account their complexity and the ultimate recipient. Hence, the communication gap between professionals and the general public can roughly be divided into a lack of understanding spatial content/topics and a lack of understanding the visual language used to transmit the content (or a lack of skills to decode the messages themselves). To overcome the gaps in the communication process, these issues need to be addressed at two levels: studying visualisation methods and their effectiveness, and studying the message's carrying capacity while regulating the complexity of the contents (i.e., condensing, simplification, generalisation etc.). We seek to extract the essence of a message and condense the content such that it still has solid information value but can be conveyed in experiential form. Users of specific urban places understand them and their quality based on their own experience, the places' comfort level, and attractiveness in terms of the space's potential to satisfy users' needs (Bradshaw, 1972; Carr et al., 1992; Alfonzo, 2005; Methorst et al., 2010), such as social interaction, freedom of movement and accessibility, supply, play, entertainment, edu-

Table 1: Levers for modifying experience- or concept-based perceptions in visual presentations.

Approach/leverage for modifying visual depiction	Approaching experience-based perceptions	Moving away from experience-based perceptions
Standpoint and perspective	Pedestrian perspective	Elevated view, bird's-eye view, ground plan, axonometric, cross-sections
Extent of view (part-whole)	Pedestrian extent of view (fractional)	Reduced/enlarged scale, panoramic view, distant view
Sequentiality	Sequences of views	Non-sequential view
Feasibility of view	Accessible/common views	Rare, false, infeasible views
Depiction of the visible	Realistic/detailed depiction	Abstract[2]/generalised, non-realistic depiction
Capture of spatial content	Only visible, tangible contents represented	Invisible, intangible, conceptual relations/ connections represented
Dynamics	Dynamic	Static
Engagements[3]	Perception of self as part of the scene	Not tended to sensually engage the viewer with the scene
Navigation	Own navigation options	Not navigable

cation, and so on. These are the vital qualities of any urban space, which define the quality of living in the broadest sense because they represent the stage for human activities and are an important factor in decision-making, and also crucial in terms of representation for the general public. Moreover, discussing and dealing with spatial issues based on visual language at the experiential level is considerably easier for the general public, better suits their skills and represents an illusion of reality (Tuan, 1975) that people encounter in their daily lives (it is determined by representation techniques that rely on similarity with experience). At the same time, this reduces opportunities for summarising, condensing and generalising the characteristics of the space or presenting information not directly traceable in space. We are therefore forced in part to resort to more concise and conceptual forms of communication, even if the recipients are the general public. From this perspective, interpreting space at the conceptual level is more challenging for the general public. In addition to understanding abstract spatial content, it requires the ability to recognise the professional code that transfers such content from ideas into images (schemes, plans, maps, ground plans, process presentations, diagrams, etc.). Such an approach is reasonable and necessary among professionals because it allows quick and precise exchange of ideas, and questions about content-related quantity, meaning, relationships and connections.

However, this issue does not arise only in connection with the two extreme sides of the spectrum, nor does it only refer to one aspect of representation (Table 1). Between the experiential and the conceptual, there is a range of representation approaches. They enable professionals to approach either side of the spectrum. Moreover, this should not be understood in a narrow sense (as simply modifying the graphic mode of represented spatial realities) but should be regarded as a search for the optimal delivery methods, taking into account the volume and accuracy of the information, the scale of the area presented, the height and width of the view, the degree of information compression, the relationship between directly visible and indirectly traceable content, the level of generalisation of shapes in the experiential perspective, the level of sequentiality in delivery (within the experiential perspective) and so on. Different techniques allow a set of information about the specific space to be represented in an attempt to improve possibilities for the target audience to identify and interpret them. We also try to extend options for conveying complex spatial content to the general public or transfer it into an experience-based framework.

The study described below limited the examination of representation techniques to three basic sets of conditions because it would be difficult or impossible to examine a larger number of variables (while systematically maintaining the constants) in one study. This is due to implementation limitations such as the length of the survey, the time allowed to complete it, the influence of tasks already completed, and technical limitations. Other studies and resources closely related to the variables examined are included in the discussion of the findings.

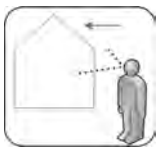
3 Survey

3.1 Description of the variables and conditions of inquiry

An online image-based survey was conducted to examine the carrying capacity of information conveyed by different visualisation techniques (Figure 1). The questionnaire was based on visual materials at three locations (urban places) and we created two different versions: a basic version (A) and a control version (B). The primary objective was to identify, explain and substantiate the reasoning behind the representation techniques that enable the general public to decode the initial

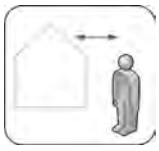
G	GRAPHIC MODE	P	SEQUENTIALITY	I	INFORMATION SUPPLEMENTATION
BACKGROUND LAYER	**G1** line drawing **G1a** manual mode **G1b** quick/app mode	**P1**	concise manner (two or fewer images)	**I1**	basis = experiential depiction (pedestrian perspective)
	G2 colour shaded line drawing **G2a** manual mode **G2b** quick/app mode			**I2**	systematic supplementation of semantic information in experiential form
	G3 photo post-processing			**I3**	systematic supplementation of semantic info by conceptual ground plan technique
INPUT / OUTPUT ELEMENTS	**G4** vector silhouette	**P2**	sequential manner (series of images, narration)	**I4**	systematic supplementation of semantic info by conceptual cross-section technique
	G5 shaded silhouette				
	G6 cartographical technique			**I5**	systematic supplementation of semantic info by conceptual chart technique
	G7 cross-section technique				
	G8 diagram technique				

Figure 1: Three basic categories of the variables/conditions examined.

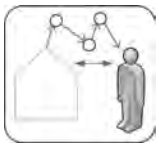


Identification or representation of visually traceable elements within the experience-based depiction (elements and characteristics of place from the experiential perspective)

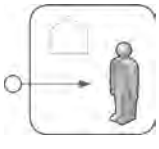
Identification or representation of visually traceable elements with the characteristics of a sign within the experience-based depiction (traffic signs, signposts, iconic labels present in the space, etc.)



Identification, interpretation and attention to indirect meaning of the visually traceable elements within the experience-based depiction (bus stop = presence of public transport; traffic lights = the possibility of crossing, etc.)



Representation and identification of indirectly traceable factors with their origins within the frames of the place depicted (e.g. linking the effects of noise, sunshine, traffic safety, etc. with the primary factors)



Representation and identification of indirectly traceable factors with their origins beyond the frames of the place depicted (e.g. the impact of a P+R system, the impact of bypass roads, the effect of a new public transport line, etc.)

Figure 2: Categories of messages as clearly presented or intelligibly interpreted.

message in a comprehensive, clear and accurate way. The tasks were related to selected micro-locations and particular issues, followed by five different difficulty categories (Figure 2). More specifically, the study examined the impact of visual presentation variables on the level of message effectiveness. The individual presentation variables were grouped into three categories (see Figure 1), depending on the main properties of changing conditions: changing the graphics mode, the level of sequentiality in the presentation and the format in which information was added.

The tasks referred to the cause-and-effect relationships between various elements within the selected urban spaces. In addition, the tasks also referred to the elements' contribution to enhancing accessibility, movement and living for users of the place. These relations were divided into five categories ac-

cording to the level of their traceability and recognition in a particular urban space. By posing indirect questions, we assessed the comprehensibility of the information provided, consistency of respondents' interpretations with the information provided, attractiveness of the representation modes and in some cases also the ability to recognise the locations.

The selection of urban sites for the tasks in the questionnaire were limited to central Ljubljana, which was optimal due to its complex structure. This also provided opportunities to address issues applicable to other Slovenian towns. The final locations of the tasks were selected arbitrarily, taking into account the planned schedule of tasks and potential responses. The goal was to avoid responses based on opinions and attitudes towards the specific locations. The survey questionnaire was not designed to seek out existing opinions on specific urban locations and any issues associated with them, but was an experiment-based approach to test assumptions about the effectiveness of visualisation techniques in the absence of other factors that might influence the responses. Although these cannot be completely eliminated or controlled except in complete isolation (Neuman, 2011), careful selection of the locations and tasks can minimise their impact. We therefore concealed the identities of the locations, used a dual-structure questionnaire and prevented respondents from returning to completed tasks.

3.2 Visual materials and questionnaire

In designing the visualisations, we followed two basic guidelines: maintaining the experiential aspect in depicting urban areas, and providing and maintaining the generic nature of the representation, but preserving the potential for comparative and repeatable applications in different spatial circumstances, as well as the potential for conveying condensed information that can be designed and carried out digitally. We sought a compromise between the authentic and generic nature of the presentations and between a conceptual and experiential level of depiction that would still allow recognition of user activity, age and social characteristics or extraction of factors such as traffic safety, available services, lack of free space, lack of urban infrastructure and social aspects. These demonstrate features relevant for representing and interpreting complex messages, maintain a certain degree of precision, or refer to conditionally traceable elements or interactions that are not always immediately recognised as able to influence quality as perceived by users.

The visualisation templates used photographic material as quickly and easily accessible information. We deliberately used vector generic silhouettes whenever possible. We separately designed a series of concept representations, which were placed in the templates to show the value of certain communication parameters; for example, comparisons between transportation modes, intensity of user activities, and highlighting some information. The key principle used in such representations is an approach that "softens" traditional methods of conceptual data visualisation (graphs, diagrams, tables, etc.). This contributes to more comprehensive information and is more quickly and easily accessible to the general public. The basic version, questionnaire A, had thirty-two questions and tasks referring to twenty-two images. The control version, questionnaire B, contained the same number of questions and eighteen images. The first set of questions was direct identification questions, and the second set was direct and indirect questions about architectural and urban content to verify the study's hypotheses. The third set was control questions referring to familiarity with Ljubljana, frequency of visits and an open question for comments. The task sequence was essential because several images related to the same locations (in some cases, we concealed the identity of a location, and in other instances we chose not to do so). We also wanted to prevent respondents from being influenced by tasks already completed (i.e., clues found when solving previous tasks or instrument error[4]). This was done by carefully planning the order of the tasks and using a control version of the questionnaire with the control group. We mostly used indirect questions, making it difficult to detect the objective of the research hypotheses, thus avoiding the risk of respondents' answers being influenced by social expectations.

In line with the initial survey requirements and questionnaire, we use an online digital interface format for the questionnaire. This was practical for controlling the order for solving the individual tasks and preventing respondents from returning to tasks already completed. It also made it possible to distribute two versions of the questionnaire randomly. The digital format allowed flexible management of the visual material, interactive tasks, application of the survey to a larger sample, and savings in time and resources. Shortcomings of the digital questionnaire included a more limited sample (not all age and social groups are ICT-literate and present on the web) and the sampling limitations (within the framework of subjects available online), described in greater detail in the next section.

3.3 Research framework of the population and sample

The basic framework of the surveyed population was set in broad terms. It consists of members of the general public with an education, a professional orientation or employment outside architecture or urban planning, as well as people motivated to participate in directly spatial issues, not through representatives. However, motivation to participate was not deemed crucial for our research (the survey was experimental and not meant for education, opinion polling about actual

urban spaces or evaluating urban design), and was therefore not considered for sample selection. Voluntary participation in the survey does indicate greater interest in spatial issues; we were aware of this and factored it into the sample composition. The digital nature of the tools used to reach the general public played a significant role in defining the sample. Increasing computer-supported presentations of spatial issues for the general public and internet distribution of the digital material made it reasonable to survey the ICT-literate population. The Statistical Office of the Republic of Slovenia[5] indicates that households have adequate access to ICT, but there are still large differences in ICT use and proficiency between different age and social groups. In 2011, 72% of the population used computers and 69% of people 10 to 74 years old had internet access. Younger people and those with higher educations are more regular computer and internet users. Among 10- to 24-year-olds, 99% are computer users, compared to 33% of 55- to 74-year-olds. Thus, even at an unlikely zero sampling error, the sample would be expected to be younger and more highly educated than the Slovenian average. This hypothetical population range narrows down the sample framework[6] because there is no register of internet or e-mail users for creating a random sample of the target population. The sample was thus shaped based on our e-mail directory[7] used to invite potential survey participants. We also sought potential participants through public social network databases,[8] some enabling random invitations to individuals on the network. This method was also potentially skewed toward a younger population.

The final sample consisted of 245 members of the general public, with an average age of 34 (range: 14 to 65). By education, 58% of the respondents had university degrees, 14% junior college, 27% high school, and less than 2% primary school only. Seventy-three percent were employed, 8% unemployed and the rest (17%) in school. To ensure the validity of the results, which were based on two separate groups (Group A and control Group B), we first tested for their symmetry and comparability according to basic parameters (gender, age, education, status, domicile, familiarity with Ljubljana and frequency of visits). The assumption of no statistically significant difference between the two groups was confirmed, comparability was assured and influencing factors on the survey results were resolved.

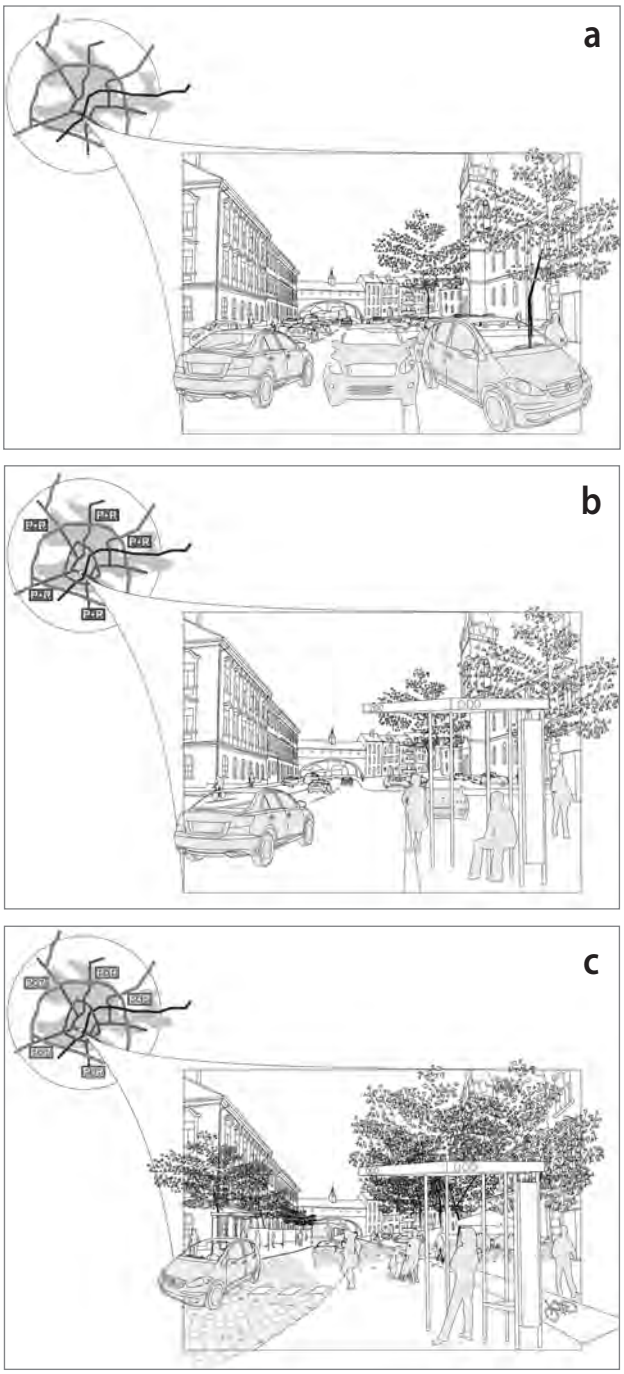


Figure 3: Example of graphic materials in the visual story (a, b, c) used to examine the effectiveness of classic and colour-shaded line drawings (illustration: Matevž Juvančič).

4 Results

4.1 The effect of colour shading

The section on the graphic modes of image backgrounds mostly examines the implied information value, attractiveness and general impression that observers receive from the various graphics used. The distinctions were made with respect to the level of genericity, which determined the technical imaging. Here, we focus on the task verifying the message capacity and effectiveness of the classic line drawing as opposed to a colour-shaded line drawing because there are significant differences in the hypotheses in other studies (e.g., Pinnel et al., 1999; Leggitt, 2002; Ware, 2008).

The effect of colour shading was examined through a series of tasks that followed a three-part narrative composed of im-

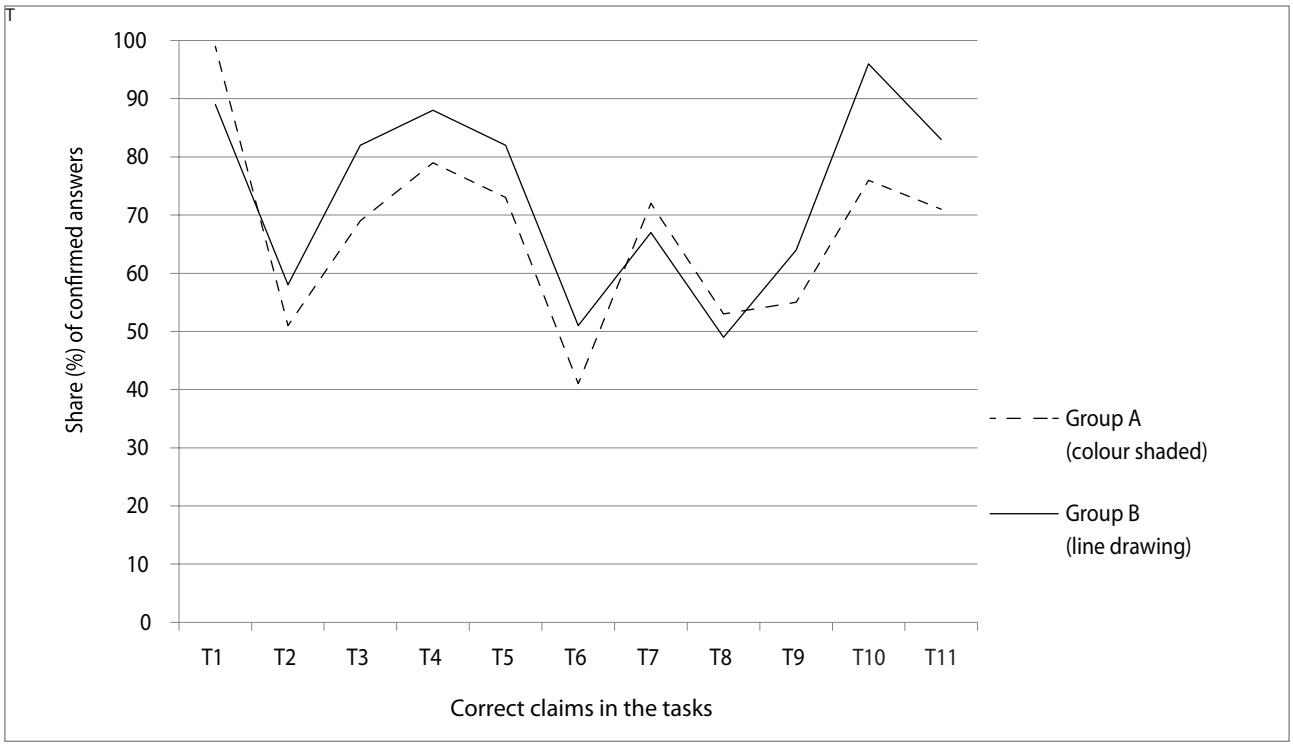


Figure 4: Group A and B performance in validating given statements. Only cases of presumably correct statements are analysed.
Note: T = statement (e.g., T1 = statement 1, T2 = statement 2, etc.)

ages (Figure 3). Group A was given colour-shaded pictorial material, whereas Group B solved the tasks based on line drawings. The tasks were designed as a set of statements[9] and the participants confirmed their validity based on the images provided. We were mainly interested in identifying the options that enabled participants to read and interpret the images, and in evaluating the accuracy of their interpretations or any common errors when the images were being interpreted. In analysing the results, we first determined the hypothetically correct and incorrect statements as guidelines and then evaluated respondents' results based on how they deviated from the predetermined correct answers. We also included misleading statements in the task in order to determine the subtlest differences in interpretations of the material between the two groups. The results were additionally substantiated with open questions at the end of each task directly related to respondents' views on problems encountered while interpreting the materials.

The analysis of the statistical significance of the results (we used Levene's Test for Equality of Variances and a *t*-test to compare independent samples) showed that in 86% of the statements there were statistically significant differences in the responses from Group A (colour-shaded drawings) and Group B (line drawings). Colour-shaded drawings did not significantly improve the information value of the message compared to line drawings. The differences between the groups, in terms of message effectiveness, favoured traditional line drawings, but these differences were not equally pronounced throughout all the tasks. A more evident advantage of line drawings over colour-shaded drawings appeared in more nuanced (misleading and incorrect) statements (in fact, more an issue of less incorrect interpretation than more correct interpretation). In other words, in absolute terms both groups responded relatively inaccurately, with the answers of the line-drawing group Being less inaccurate.

These results support the assumption that more visual information does not always contribute to greater message effectiveness, as confirmed by previous research on architectural representations (Ucelli et al., 1999; Zupančič et al., 2009, Svetina et al., 2011). In our case, the latter cannot be confirmed entirely. In specific situations and superficially, both line and colour-shaded drawings were sometimes misleading, particularly when accompanied by misleading statements. For line drawings, this could be subject to errors in intuitive reading, associated with lower depth perception, difficulty in distinguishing between specific elements and reduced ability to quickly perceive the Figure and the background. For colour-shaded drawings, errors are associated with the picture being perceived as "busier," elements appearing more plastic, the place being intuitively perceived as more picturesque than the actual place and problems with imprecise "reading" of individual segments due to information saturation. The respondents' answers implicitly confirm these findings.

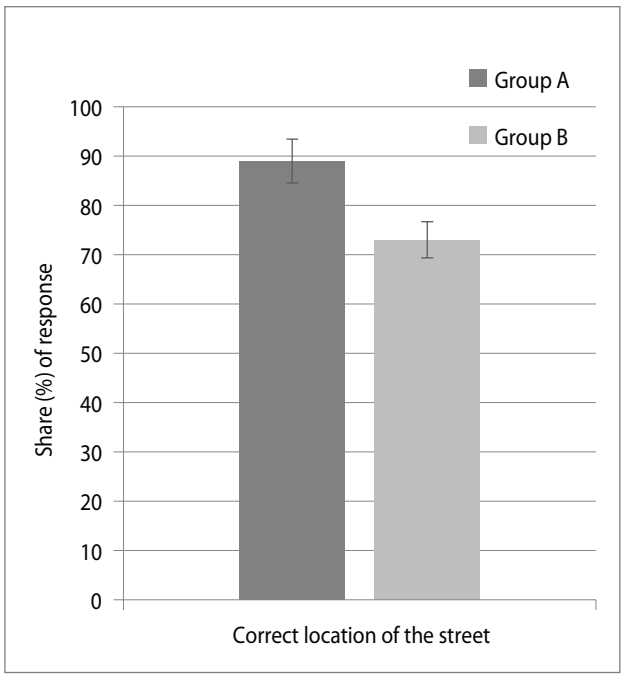


Figure 5: Proportion of correct answers in placing the street in the wider urban context.

4.2 Reading clues in the experiential representation of space

The task described above focused on the background layers of the images. This section focuses on the added figures and their information effect or added value. The background templates remained unchanged as a constant in the test. The first part of this segment examined the message effects of the information, which was included in the basic template as clues at the experiential level. This task included a visible church tower and traffic sign for a non-motorised traffic zone in the view of the street given to Group B. All of the participants in Groups A and B were asked to assess the trafficability of the street, its cultural and historical significance and its approximate location within the city – and, if possible, to identify the street. Each of the tasks included an open-ended question asking participants to substantiate their answers. These could not be numerically analysed, but provide useful information and help in interpreting the main results. When analysing tasks referring to the dissimilar segments of the graphic material between the groups, we searched for significant differences in answers (using Levene's Test for Equality of Variances and a *t*-test for comparison of independent samples). The tasks referring to representation segments that the two groups had in common were grouped and analysed together.

The results showed that elements purposely selected and added to the basic template of space representation may add information value or be recognised by the viewer as a clue that contributed to interpreting the place depicted. As predicted, by merely adding a church tower (as an element of the central function), we limited potential viewers' ability to place the street in the broader spatial context *t*-test: ($t(195) = -2.317$; $p = 0.022 < 0.05$) and to a lesser extent to recognise the geographical identity of the space. To a lesser extent, added information value was achieved by a clearly marked traffic sign. The added element contributed to a more definitive and unambiguous interpretation of the street traffic arrangements, but did not represent a decisive factor (*t*-test: $t(195) = -0.878$; $p = 0.381 > 0.05$) because the control Group B (without the added traffic sign) was not far behind the average of Group A. Group B's responses were largely explained by other indicators of the traffic arrangements in the area. There were no differences between groups A and B on assessing the cultural and historical importance of the street. Further detailed analysis of additional descriptive answers (an open-ended question) found that, regardless of which group they belonged to, the participants explained their answers based on the motorised traffic ban[10] and the appearance of the facades and roofs on the street; this information was available to both groups. Descriptive answers also showed a relatively diverse set of spatial elements, based on which the participants interpreted the street and through which they further substantiated their assessment of the cultural and historical significance or the street's character within the wider urban context. The answers demonstrated a surprising level of cause-and-effect thinking by the participants. However, the answers were from open-ended questions and the results could only be analysed descriptively. Due to the length limitations of the questionnaire, we were only able to test a small number of variables. Therefore the findings cannot be accepted without reservations or be generalised in terms of the information value of other spatial elements that may be added to the visual material. Further research in this direction is warranted because adding visually traceable elements to the experiential representation of a space may influence the information value in various ways, and the exact limits and capabilities of recipients to interpret information correctly in any particular case is unknown.

4.3 Information effectiveness of an added chart or cross-section

We also examined the information effects of the techniques included in the basic representation as elements at the conceptual level. This was done by testing the information added as a cross-section or a chart – two forms with a different intensity of condensing information (Figure 6). For the cross-section, the connection with experiential space is stronger than for the chart because a cross-section, despite its tendency towards abstraction of information, still remains within the framework of actual relationships in the space and preserves the image elements in it. In contrast, a chart can be completely removed

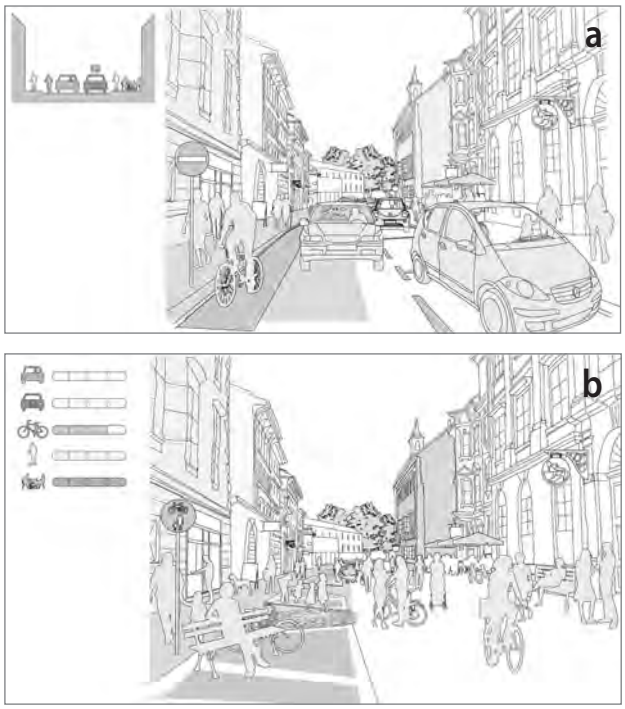


Figure 6: Example of graphic materials for assessing the effectiveness of supplementary information for a) cross-sections and b) charts (illustration: Matevž Juvančič).

from the experiential representation of space (Larkin & Simon, 1987) and can show its related background beyond a visibly traceable form. The information effectiveness of both techniques was examined through tasks and repetitions in slightly modified conditions[11] to achieve a higher degree of reliability of the findings. Most tasks required the participants to identify the characteristics of the street and its suitability for various activities and ways of moving through the place. The tasks alternated between charts and cross-sections, which either confirmed and reinforced or negated the basic message. As in similar cases, we started the analyses of results by formulating an initial hypothesis containing the most relevant (correct) estimation for each rating category. This was used as a reference to define deviations from the correct interpretations and thus assess the differences between Groups A and B. Levene's Test for Equality of Variances and a *t*-test of independent samples were used to confirm the significance of the differences.

Analysis of the results for the effectiveness of the added cross-section showed that in 81% of cases a more precise interpretation of the messages was achieved by Group A, which had added information in the form of a street cross-section. Differences in the results between the two groups were statistically significant in two-thirds of all cases tested, reasonably confirming that the added cross-section did have an effect on the information value of the images. The discrepancy between the two groups was most evident in tasks in which the cross-section demonstrated the use of space more explicitly compared to the solely experiential space representation. In these types of tasks and in terms of accuracy in interpreting the images, Group B (without the added cross-section) performed significantly worse than Group A, sometimes up to 45% more poorly. However, the added cross-section did not play a major role in the tasks in which correct interpretation of the message depended more on indirectly accessible information (which was the same for both groups). In such cases, the added cross-sections were not sufficient to ensure correct interpretation for detecting the presence of street users, their activities and proportions of space used. In these cases, adding such information is inconsequential for the information value because recipients are forced to base their assumptions almost entirely on the basic experiential representation. This finding is confirmed by the relatively small differences between the two groups in their interpretations for this particular task type (e.g., assessing the adequacy of the street for socialising).

In the case of the added chart, the level of perceptional connection with the real place is even lower than in the case of the cross-section, which is why the general public has a smaller chance of finding parallels with the real place and a greater chance of incorrect interpretation. As the results show, the chart has a relatively high potential to demonstrate causal factors originating outside the space depicted and the potential for more uniform or standardised communication increases, although it is not necessarily more successful in terms of information value. In typical examples,[12] where most participants correctly decoded the added chart (also by empirically verifying the chart in the experiential representation), the added chart showed the potential for a more accurate interpretation than was possible only with the experiential representation or with the added cross-section technique. This was the case in more than two-thirds of the tasks (72% of the tasks with the addition of the chart). The results were expected based on preliminary findings (see Keller et al., 2006). We were more interested in determining when the message effectiveness of such presentations was limited or even led to misleading[13] interpretations. Here, particular attention should be given to situations in which, for various reasons, conceptual techniques are likely to affect the recipient's interpretation in a way that it deviates from the intended message. Here, we partially agree with the findings of some authors (Jingling & Zhaoping, 2008) that the accuracy of decisions made at the instinctive or intuitive level is sometimes higher than the accuracy of decisions involving higher levels of reasoning in the decision-making process, as confirmed at least in part by Zupančič and Juvančič (2003). The respondent data indicated that the risk of "reading" a chart incorrectly was relatively large in specific cases, especially when the participants were not able to verify their interpretations in an experience-based representation. This also applies to cases in which a message in a different form could not be

adequately represented due to its specific nature. These messages referred to spatial features and phenomena that are only indirectly traceable in a given space because their origin or direct manifestation is beyond the reach of the space represented (experientially). Also relevant is the fact that our survey never individually assessed the conceptual methods for any of the tasks, but always in conjunction with the experiential base material as a constant common to both groups, which means that what was actually considered was merely the added value that a specific conceptual format was able to contribute. In addition, the results indicate that, in cases of duplicating information by experiential and conceptual representation techniques (cross-section or graph), the viewer adopts the first as the primary source of information, and the second is only used to help the interpretation process. In such cases, errors in interpretation were less likely. Both were tested and demonstrated in the task of non-identical messages between the experiential representation and the conceptual technique added (cross-section or graph), which means that, in this task, the intentionally added information did not support the "narrative" of the experiential view of the street.

Both the first and second conceptual techniques of inquiry confirmed the initial findings in terms of the high potential of experiential visual methods in providing a perceptible image of a space (Zupančič & Juvančič, 2003). However, in representing topics that are more complex or difficult to trace, the added value of conceptual (condensed) representation methods proved to be 1) economical in terms of the amount of graphic materials needed for the purpose and 2) sensible given the nature of the information conveyed. In conclusion, we can highlight another interesting observation. The survey data as a whole and in general showed a strong pattern that relates to the power of comparison and indicates a significant improvement in the recipient's ability to interpret the material correctly, given the right conditions for comparison. Although we did not systematically verify the effect of comparisons between different presentation techniques, it can still be identified with a high degree of certainty. This is a typical example of the advantages of comparative analysis, based on better conditions for constructing a referential frame for the evaluation (Neuman, 2011). It is also relevant for calibrating the viewer's perception (as the instrument used for evaluation), which was also confirmed by the results of the survey. In all the cases in which the participants had the opportunity to make their interpretations based on two or more comparable depictions of the street – or where this was an option due to the nature of the task – their interpretations were more accurate and consistent with our initial message. This was true regardless of the techniques used and deserves additional consideration, especially because it represents a small investment towards better results.

5 Limitations of the results

This article selected and presented some aspects of the results of our empirical study; however, we were also forced to adopt a selective and highly targeted approach when designing the entire survey. We tried to eliminate as many confounding factors as possible when testing each variable or condition, and so the possibility of verifying a large number of variables in one study was significantly reduced. Using the survey questions that were initially formulated, we examined some aspects of the effectiveness of visualisation techniques already discussed but insufficiently explained. In other cases, we opened new areas for empirical research. Regardless of the unambiguous nature of certain results of the study and their contribution to overall knowledge in representation techniques in architecture and urbanism, they do not allow for a broader generalisation to the general public. Despite efforts for consistency, the results could deviate from the results for a larger share of the elderly population, which is less computer-literate, or by including a larger portion of participants with a below-average education level. These limitations of the results are therefore due to the characteristics of the sample population and were expected with fair accuracy even before carrying out the survey based on statistical indicators of internet access and use and ICT literacy in Slovenia. Such deviation could not be entirely avoided due to the specifics of the inquiry. However, considering the population most frequently and widely involved in architectural and urban decision-making (Hill, 2003), we reflected a similar age structure in the sample and, to a lesser extent, a similar educational structure. Despite the methodological deliberation used in the survey design, there are critical reservations regarding generalisation of the content of the messages conveyed. The presentation techniques are always somewhat tied to the specifics of the space being presented or the level of traceability of the phenomenon being outlined in a particular location. Thus, the level of the message depends somewhat on the specific elements of the location and the issues examined in the tasks, which is why the findings are not always directly and fully applicable to other situations or require additional critical examination. This issue is also present in similar studies, and so any comparisons between them always warrant additional caution.

6 Conclusion

Recognising the pros and cons of presentation techniques for the general public in topics related to urban space is surely one of the keys to successful communication between professionals and the general public. In addition to factors such as time, technical and software requirements, resources or necessary knowledge and skills, designers of presentation materials

intended for the general public must take into account the characteristics of the target population, their ability to read and interpret messages, and associated limitations on the complexity of the spatial topics or limitations on the abstraction of the presentation materials. There are different approaches to attain a suitable balance between experiential and conceptual expression in a particular presentation of space (e.g., selection of the standpoint and drawing perspective, extent of view, level of sequentiality, level of realistic graphics used, use of shading, use of colour, level of dynamics in depiction, amount of mental connections depicted, etc.). However, when applying one approach in particular circumstances, its effect on the initial message may not always be entirely defined or it may lack professional arguments. Our research efforts complement existing knowledge in this area in a systematic and methodologically coordinated way. The contribution of this study is not merely relevant in a theoretical sense but, based on its findings, one can also more effectively manage the development and preparation of visualisation segments that are part of the digital tools intended for education, awareness raising, informing, or following more proactive forms of public participation in urban planning. As noted, tendencies towards more experience-based representations of space in communication with the general public are based on solid research-based arguments. However, many deviations allow us to seek compromises with less experiential and more condensed forms of communication, or those that are more affordable in terms of financial and time resources. Moreover, even within experiential representations one can always look for spatial features that have higher information value than others (e.g., the information value of the church tower, roof colour, facade details, traffic signs, road markings, activities, etc.). As ascertained in the study, a higher level of genericity in representation neutralises the experiential value of the material, but also offers better opportunities for repeatable, comparable and generalised representation of information, and especially easier and faster transmission of spatial elements into the perspective of the photographic template. This study has added to existing knowledge by ascertaining which elements in space are stronger information carriers than others, how generic they may be, when it makes sense to guide the viewer's attention sequentially (e.g., through a series of images), and when and where is it suitable to add to the experiential expression or even replace it with a more compact, abstract form of communication. These are important aspects of the pragmatic value and contribution of the study. Although it reveals only a small portion of the unknowns in the entire set of equations, it will assist in preparing visual materials in a more effective and economical way under specific circumstances.

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Notes

[1] The message-carrying capacity of visual representation material is understood here as its property determining its higher or lower ability to transmit messages in a form and way that maintain the essence of the message and achieve the interpretation intent at the receiver level, and, additionally, minimise the time and effort for decoding messages. It refers to the information effectiveness of the visual technique that conveys a particular spatial message.

[2] Abstractness extends between the extremes of concrete and abstract, and is also often measured in levels of imaginable. Determining levels of abstractness is easiest in the reverse process of simplifying or abstracting information (selectively reducing details) while checking the comprehensibility of the message during this process (Marentič Požarnik, 2003). By some definitions, the concrete stems from direct sensual experience (Piaget, 1969).

[3] The perception of the self as a beholder, as being part of the scene depicted.

[4] Measuring instrument error – in our case, the questionnaire is the instrument – occurs when the questionnaire text or order of questions influence the quality of the responses.

[5] Seventy-four percent of households possessed a computer (PC, notebook or palm/tablet computer) in the first quarter of 2011, according to the Statistical Office of the Republic of Slovenia (2011). At this time, 73% of households had internet access. The majority of households (92% of those with internet access) had broadband access.

[6] In more traditional survey methods, telephone directories and (voter) registries are used for this purpose (Lozar Manfreda, 2001).

[7] For sampling purposes, we used publicly accessible databases of e-mail addresses that we put into a unified framework. It consisted of publicly accessible databases of individuals employed at universities, employees of public and private companies, various social networks and open databases of companies or e-businesses.

[8] General public use of social networks has significantly increased in recent years. In the first quarter of 2011, 35% of people 10 to 74 years old were active in such networks, with participation of regular users equally divided between genders. The share of schoolchildren and college students was 81%, employees 37% and pensioners only 4% (Statistical Office of the Republic of Slovenia, 2011).

[9] Examples of statements: *the number of public transport lines/connections has significantly increased; the new fountain enhances the symbolic significance of the square and makes it more attractive; planting additional trees reduced noise pollution; one can now enjoy drinking a cup of coffee and reading a newspaper in the square in front of the church; the space is now clearly organised and permits easier navigation for all users; one can now access this place with public transport; the place depicted is somewhere near the city centre.*

[10] In Slovenian urban environments, a ban on motorised traffic is a pattern easily associated with the notion of cultural heritage in city centres.

[11] Changing content and spatial situations in pictures.

[12] Example: level of transportability of the street, level of suitability for cyclists and pedestrians; level of suitability for activities evident from the experiential point of view and presentation.

[13] Previous studies did not offer precise answers about the deficiencies of chart or graph presentations within a spatial domain due to specific issues and different research approaches.

References

Alfonzo, M. A. (2005) To walk or not to walk? The hierarchy of walking needs. *Environment and Behaviour*, 37(6), pp. 808–836. DOI: 10.1177/0013916504274016

Al-Kodmany, K. (1999) Using visualization techniques for enhancing public participation in planning and design: Process, implementation and evaluation. *Landscape and Urban Planning*, 45(1), pp. 37–45. DOI: 10.1016/S0169-2046(99)00024-9

Bizjak, I. (2012) Improving public participation in spatial planning with Web 2.0 tools. *Urbani izziv*, 23(1), pp. 112–124. DOI: 10.5379/urbani-izziv-en-2012-23-01-004

Bosselmann, P. (1998) *Representation of places*. Berkeley, University of California Press.

Bradshaw, J. R. (1972) The taxonomy of social need. In: McLachlan, G. (ed.): *Problems and progress in medical care*. Oxford, Oxford University Press.

Carr, S., Francis, M., Rivlin, L. G. & Stone, A. M. (1992) *Public space*. Cambridge, Cambridge University Press.

Casey, E. S. (1997) *The fate of place. A philosophical history.* Berkeley, University of California Press.

Hill, J. (2003) *Actions of architecture: Architects and creative users.* London, Routledge.

Jingling, L. & Zhaoping, L. (2008) Change detection is easier at texture border bars when they are parallel to the border: Evidence for V1 mechanisms of bottom-up salience. *Perception*, 37(2), pp. 197–206. DOI: 10.1068/p5829

Keller, R., Flanagan, T., Eckert, C. M. & Clarkson, P. J. (2006) Two sides of the story: Visualising products and processes in engineering design. In: *Proceedings of the 10th international conference on information visualisation*, pp. 362–367. London, IEEE Computer Society.

Larkin, J. H. & Simon, H. A. (1987) Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science*, 11(1), pp. 65–99. DOI: 10.1111/j.1551-6708.1987.tb00863.x

Leggitt, J. (2002) *Drawing shortcuts: Developing quick drawing skills using today's technology*. New York, Wiley.

Lozar Manfreda, K. (2001) *Web survey errors*. Doctoral thesis. Ljubljana, University of Ljubljana, Faculty for Social Sciences.

Marentič Požarnik, M. (2003) *Psihologija učenja in pouka*. Ljubljana, DZS.

Methorst, R. Monterde, H., Risser R., Sauter D., Tight, M. & Walker, J. (2010) *Pedestrians' quality needs*. Research report. Cheltenham, Walk21.

Neuman, W. L. (2011) *Social research methods. Qualitative and quantitative approaches*. Boston, Pearson Education Inc.

Ogorelec, B. (1995) *Komuniciranje z javnostjo –priročnik za urbaniste*. Ljubljana, Urban Planning Institute of the Republic of Slovenia.

Pinnel, L. D., Dockrey, M. & Borning, A. (1999) *Design and understanding of visualizations for urban modeling*. Research report. Seattle, University of Washington.

Piaget, J. (1969) *The mechanisms of perception*. New York, Basic Books.

Statistical Office of the Republic of Slovenia (2011) *Usage of information-communication technologies in households and by individuals, Slovenia, 2012 – final data*. Available at: http://www.stat.si (accessed 1 Feb. 2012).

Svetina, M., Istenič Starčič, A., Juvančič, M., Novljan, T., Šubic-Kovač, M., Verovšek, Š. & Zupančič, T. (2011) How children come to understand sustainable development. A contribution to educational agenda. *Sustainable Development*, 21(2), pp. 1–10. DOI: 10.1002/sd.519

Tuan, Y. (1975) Place: An experiential perspective. *Geographical Review*, 65(2), pp. 151–165. DOI: 10.2307/213970

Ucelli, G., Conti, G. & Klercker J. A. (1999) Visualisation: The customer's perception. In: Brown, A., Knight, M. & Berridge, P. (eds.): *17th eCAADe conference – architectural computing form Turing to 2000*, pp. 539–544. Liverpool, eCAADe.

Verovšek, Š. (2012) *Development of presentation techniques for communicating interdisciplinary spatial topics to lay public.* Doctoral thesis. Ljubljana, University of Ljubljana, Faculty of Architecture.

Ware, C. (2008) *Visual thinking for design*. Boston, Morgan Kaufmann.

Zupančič, T. & Juvančič, M. (2003) The visual language of spatial presentations – a barrier, or a crossroad? *Urbani izziv*, 14(2), pp. 101–104. DOI: 10.5379/urbani-izziv-en-2003-14-02-005

Zupančič, T., Novljan, T., Juvančič, M., Verovšek, Š., Šubic Kovač, M., Istenič Starčič A. & Svetina, M. (2009) The concretization of the term sustainable spatial development for the assessment of child and juvenile awareness. *Urbani izziv*, 20(1), pp. 153–163. DOI: 10.5379/urbani-izziv-en-2009-20-01-003