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TOWARDS EFFECTIVE INTERFACES FOR GENERAL ARCHITECTURAL LEARNING.

Eco-spatial educational interface for pupils

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Introduction: motives for lifelong architectural education of general public

Architecture as profession has (been) recently been dealing not only with planning but more and more frequently engaging in awareness-raising and education about spatial values and sustainable practices as well. In these processes different participants that act in existing natural and cultural contexts are addressed. The problems of wider public and user participation have been on the eCAADe agenda for several years. The participation always brings to the surface the proverbial questions of who the participants are and what, if any, intersection of knowledge, (visual) communication skills, attitudes and values they share.

Many previous studies (i.e. Uccelli, Conti & Klercker (1999); Mullins, Zupancic & Juvancic (2002) etc.) have been researching different technological solutions, understanding of visual messages and presentation techniques for different publics. The communication issues emerge most evidently during the face offs of different publics in the planning process where there is much interference on different levels and differences in understanding of visual messages. This problem is most noticeable in contacts between general and expert public. But the proverbial lack of common visions regarding architecture, eco-spatial values and spatial interventions does not arise merely from misunderstandings and expression disabilities. The national surveys (in Slovenia) indicate (Tos, 2004) that there is a wide overlap of professional and general public values regarding natural and built environmental issues. But as in many similar cases the divide between declarative statements of respondents and their actions and interventions when it comes to materialization becomes painfully obvious as they start solving their everyday living and housing needs.

Lifelong learning process presents an opportunity to address such problems before they emerge (prevention), it presents them to wider audience (who is not always even aware of wrong-doing) at the stage when changing attitudes does not require as much effort as in later years. The audience especially worth addressing is younger generations, still in the process of formal education, engaging in the future sustainable development who will consequentially and most likely take part in shaping the future built environment. Raising awareness in such an audience can also lead to the overspill of conveyed messages to their reference groups (parents, grandparents), the groups who are notoriously much harder to address.

Out of this argument comes the basic pre-assumption that awareness raising and education of general public and the introduction of spatial-sustainable topics into the lifelong learning process can improve the understanding of professional ways of thinking, issues, attitudes, values, and consequentially contribute to more prudent spatial interventions as well as reduction of spatial and environmental problems.

Recently concluded international project R.A.V.E. Space (Demsar Mitrovic et al, 2007) and the results of the survey conducted among teachers in primary and secondary schools have shown the lack of time provided for spatial-sustainable topics, the lack of information, lack of suitable learning tools and last but not the least – teachers are of opinion that they themselves are not “equipped” with adequate knowledge to convey the issues to their students, leading to awkward presentations and unintended omissions.

As a helping hand in transmitting professional values, issues etc. and overcoming the knowledge barriers of teachers, who are already besieged with other equally important topics, the emerging field of architectural educational interfaces presents new opportunities to address younger generations and wider public as early as possible. Such systems are only a part of wider selection of means and tools for teaching and transmitting spatial/architectural topics to non-architects (other efforts include i.e. Arkki school of architecture for children and youth, Finland). As Dierckx, Stellingwerf and Verbeke (2002) suggested the basic structure (“scheme”) of educational database systems – creator-database-user, several field specific questions have emerged, especially about the effectiveness of architectural educational interfaces for general public and respectively the effectiveness of different variations of such systems.

Architectural educational interfaces for general public

Much has been written about different interfaces and educational support systems for architectural education (i.e. VIPA: Mullins et al, 2006). Learning Management Systems (LMS) and Course Management Systems (CMS) are helpful for organizational support, correspondence, management of course activities, contents and participants. Although they allow visual enhancements and presentations, they lack the specialized tools - visual (and spatial) in its core - the “visual” sciences require. Solutions can be found in adaptations of existing tools and systems or in the more time consuming and expensive development of new applications. Graphical user interfaces (GUI) of these tools are considered crucial because they act not only as mediators and communication tools, but according to Carroll (1991), they also create the environment, which broadens human capabilities, enables access to digital tools and supports cognitive interaction. The main role of educational interface is bridging the gulf between the learner and knowledge embodied in the field (Quintana et al., 2002). Dealing with and educating wider public through means of educational interfaces requires modification of the definition of the role of such interfaces. While the interfaces in professional education for future architects help students embrace the knowledge in the field, provide experimentation tools (i.e. VIPA), develop skills needed to practice architecture, the interfaces for general public have to bridge the gap between tacit knowledge and rudimentary field knowledge (values, problematic, etc), raise awareness and thus contribute to better communication between professional and general public.

Educational interfaces presented in the paper can act as educational tools in the educational process or act on the behalf of the professionals or suitably trained specialists when they are not at hand. They can also narrow the divide of interests, improve understanding of problematic among different participants and bridge the gap between declared values and actual interventions of individuals when it comes to building in existing cultural fabric.

The research outline: elements and characteristics of architectural educational interfaces

The research builds on the idea that general public should be approached by the professional public with the following: adaptation to their communicative abilities and knowledge as well as with additional teaching to improve these abilities.

In this endeavour to improve the communication between different participants and develop specific tools that could bridge the divide of attitudes value systems and actions with architectural interfaces for educating general (often referred to as lay-) public, we can follow Lasswell’s rudimentary model of communication (Severin & Thankard, 1992): who - says what - in which channel - to whom – with what effect?

In attempt to apply the questions to specific field of architecture and sustainability in combination with general public, the research has tried to answer the questions about who the participants are, what the target group characteristics are, what topics need to be communicated and how, and finally what effect they all add up to on preparation, testing and use of educational interfaces. In order to answer these questions some elements and

characteristics concerning two aspects of interfaces - content (“what”) and communication-technical (“how”) set have been isolated.

“How the elements and architectural interfaces characteristics influence interface effectiveness in the process of increasing the public awareness and education of general public?” - was the basic research question of research presented.

With the substantial emphasis on the interfaces (as promised in the title) the report on findings about the suitable contents of such interfaces is going to be brief and stick to the basics. The questions of what to transmit or base the messages upon should, according to the research, be grouped around the following points (later referred to as “contents characteristics”): all sustainability is local, focusing the concept of spatial sustainability around living, an equal treatment of all three sustainability columns are to be considered, the absence of interference and non-materialization are the interventions that should also to be taken into consideration. Among the (contents) elements that need to be included are: burning (architectural) spatial problems, similar problems indicated by the existent development trends, specific indicators of sustainable development as identified by Abel (1997).

In the field of architectural educational interfaces:

a. The “elements” represent the “building blocks” that previous studies about interfaces in general or presentation techniques have already looked into: system/interaction management elements (menus, entering fields, slides, buttons, indicators, etc), visual formulation elements (presentations, icons, windows, descriptions, addresses).

b. The “characteristics” that can influence effectiveness of interfaces have been isolated and are the following:

- ways of navigation – how the user “moves” through the system;
- ways of content presentation/narration – how the content is transmitted (on demand, automatically, combination of narration and presentation techniques used, etc);
- ways of interaction with elements – how the user interacts with the systems (manipulation of objects/contents, reversibility of actions, visual feedback, etc);
- system openness rate – how the user can modify the system (openness of systems to modifications);
- rate and manner of user immersion.

The Experiment: Eco-spatial educational interface

In the experiment the elements of interfaces (the contents included) were tested through their use in educational settings in primary schools and the independent variables of interface characteristics – ways of navigation, ways of narration and ways of interaction with elements – were experimentally tested with the help of prototypical eco-spatial educational interface that combined the findings mentioned above (adjective eco-spatial was coined from two adjectives: ecological and spatial to emphasize the interrelation between the two). The system openness rate and rate of immersion were presumed constant (closed system and non-immersive interface) as was the already mentioned eco-spatial contents (identical in all cases).

Methods and Materials

The interface was designed as a collection of five selected tasks - each presented within one screen size. The screen was divided into several parts: two larger parts were dedicated to education, passing of information and task at hand, the bottom part of the screen was reserved for the title, the top for navigation. The contents of educational part (light-green) – texts and small pictures for reference were visible most of the time, while other multimedia presentations opened on the same page (either automatically or on demand, depending on the variation of interface) and played in bigger quadrant to the right. The same quadrant was also used for presentation of the task solving instructions and tests themselves (Fig. 1).

Fig. 1. Eco-spatial Education Interface (task no.3 and classroom setting)

The interface was prepared in 5 different variations, with different levels of interactivity consisting of 3 variables: (i) navigation, (ii) narration/presentation of contents and (iii) interactivity of tasks (visual feedback, reversibility of actions, experimenting). Conditions ranged from maximum to minimum interactivity, from traditional face to face (f2f) education method to the test group (which did not receive any information and educational contents, just the task and basic instructions). Several parameters were automatically recorded (i.e. time, user choices, etc) and results of each task graded. All the elements were put together in the Adobe (Macromedia) Director, where also all the functionalities were added. The technical requirements for running the application and its IT scope were intentionally scaled down to match the IT equipment in schools (no installation required, application runs even on slow computers) (Fig. 2).

Fig. 2. Eco-spatial Education Interface: functionality, feedback (task no.1, maximum & minimum interactivity)

The animation (Video 1) presents the functionality and feel of Eco-spatial Education Interface – the most interactive version*.

The educational contents and tasks dealt with eco-spatial topics and most urgent, common and annoying local problems the experts want to warn future generations of-, call to their attention- or change their attitudes toward- were building on sloped grounds, greenery around habitats, unfinished houses and their surroundings, building in the existing environment, adapting to scale, renovation of residential neighbourhoods, etc.

The test group of final - 9th grade primary school pupils (age 13-15) had 218 units, which were evenly distributed among 5 test settings – 5 variations of interfaces. This population represents the last instant before the whole generation diversifies into different vocational and professional directions, it is mature enough as it has built relatively independent system of abstract, contextual thinking abilities and social responsibility awareness and not last - the architectural awareness of their parents is still reflected in their way of thinking.

Results

The excerpt of results clearly shows the influence of interactivity on the test results (average score). The traditional face to face teaching with the computerized test solving part at the end still yields the best results. It has the smallest range between the lowest and highest grades. It is closely followed by the maximum interactive version of the interface, with middle and minimum versions trailing behind. In all these versions the range between the lowest and the highest scores extends. The results of the test group were unexpected - it has surprisingly good and focused scores. Nevertheless, the average scores are not as good as in traditional f2f approach, they are lower than the maximum interactivity group average, equaling middle and beating minimal interactive interfaces. (Fig. 3)

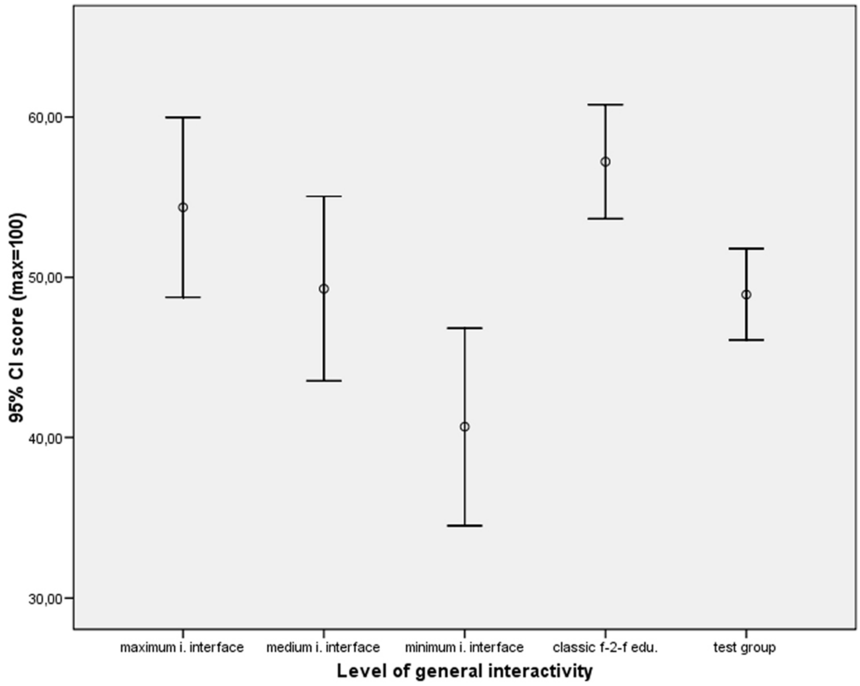

Fig. 3. Average scores in different test situations and interface variations

Results also show that (i) navigation has some effect on the results (moving freely among the tasks contributes to effectiveness), while (ii) narration/presentation of contents (or the lack of it) and (iii) interactivity of the task have considerable influence on the final score, but due to test design their individual effect contribution cannot be isolated.

Considering (ii) narration: even though the pupils had an opportunity to look at the informative presentations as many times as they wished ("max" version), they mostly did not bother to do that; on the contrary, nobody even looked through the half of all presentations. On the other hand, in the "mid" interface version all were able to interrupt the automatic presentation at the beginning of each task, but only two did so, with many replaying the presentations (despite this fact the average grade in this group is lower than that of the "max" version). The visits to each task (where possible) show similar results – the highest average score is achieved in six visits (which means one visit more than there are tasks).

Considering (iii) interactivity of task: while the possibilities to reverse the actions ("undo") do not play a significant role, visual feedback, possibilities to test different elements or situations, visually evaluate and change selection if needed, and significantly contribute to higher score.

Evaluating the amount of time spent compared with the grade, the best results were achieved by the users who spent approximately 20 minutes in the interface – the score up to this time gradually rises and then gradually falls. The majority of users spent between 5 and 20 minutes within the interface.

The pupils considered task no. 3 the most interesting one. The same task was also the most complex of all five tasks and most game like, with different architectural elements, their "value" and "financial" balance required. The most difficult task was, according to the pupils, task no. 4, which was also the most abstract and the least liked.

Conclusion

The joint results of theoretical analysis and data obtained with the experiment show that the selection of elements and their mutual connections (characteristics) influence the effectiveness of architectural interfaces for the general public in two major sets: the content and communication-technical set. The correlation between the two is difficult to be completely determined. Nevertheless, it can be ascertained that through the experiment tested characteristics (“navigation”, “narrative”, “interaction” – which define the general interactivity of the interface) can influence the achieved result and consequently determine its effectiveness. The results also reveal to what extent the interactivity and effectiveness are related, namely a greater interactivity coincides with the increased awareness raising and general public education.

Further discussion

The results about narration implicate, that non-experts (at the age tested) do not explore the educational contents on their own. This calls for other principles for conveying contents, analogue to game tutorials, which lead the player through series of task learning skills, familiarizing them with the interface itself, goals and means to achieve them – the process one could describe as learning-while-playing.

The importance of interactivity of the task overshadowed the effects of narration, except in f2f learning where narration proved to be crucial for highest scores. Such interactivity supports use of intuition, tacit knowledge, past experiences, constraints and sometimes compensate for factual knowledge, consistent with Norman (1998) suggestions that precise behaviour can emerge from imprecise knowledge. The results also show that complex, game like tasks can be very engaging for younger learners.

Extremely good scores of the test group suggest another aspect of learning through educational interfaces. The lack of scaffolding, interactivity and information, combined with irreversibility of actions, makes the users more cautious, self reflecting and consciously pondering all the options before deciding (the other users approached the tasks in a more relaxed way, knowing the information is at hand if needed and actions reversible). This could be understood as another suggestion that more (information) is not always more effective.

When observing variations of interfaces and comparing results of each task we can speculate about the pupils’ attention and its effect on the results. Teaching f2f achieves the best results in task no.1 (start of the lecture – the highest level of attention) with results of other tasks trailing behind. The same phenomenon can be observed in test group. Contrary to them, the extremes in interface variations do not show such peaks (or extremes).

Although the interface and learning environment described in the paper were used in specific situation, broader implications can be derived from the research that targets wider audience and the transmission of architectural messages and intentions. The results show the applicability of the idea of blended professional architectural learning (tested in mentioned VIPA environment) to the most general target audience.

The results also indicate the possible ways of enhancing the efficiency of GUI-s through a measured mix of elements and characteristics and help GUI developers and designers (to) evaluate and conceptualize their work to be fine- tuned to the target audience in general architectural learning.

While the research addresses some of the characteristics of architectural educational interfaces for general public and tests the prototype in the real teaching environment, proving that such interfaces can actually be used as supporting teaching tools, much is left for further research. Recent research and efforts are focusing on merging immersive computer game play and teaching or merging 2D LMS with persistent 3D worlds (Kemp & Livingstone, 2006), online collaboration of pupils in similar settings, the effect of rate of openness on the teaching outcomes etc. These are all factors that can improve user's GUI experience and contribute to the effectiveness of future educational interfaces when approaching and educating the general public about (architectural) spatial sustainable topics.

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* This video You can see at our site.