Reconfiguring Course Design in Virtual Learning Environments

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Although many administrators and educators are familiar with e-learning programs, learning management systems and portals, fewer may have experience with virtual distributed learning environments and their academic relevance. The blended learning experience of the VIP A e-learning project for architectural students offers some innovative insights into experientially oriented educational interfaces. A comparative analysis of VIPA courses and project results are presented in the paper. Special attention in the discussion is devoted to the improvements of e-learning solutions in architecture. The criterion of the relation between the actual applicability of selected e-learning solutions and elements of collaborative educational interfaces with VR are taken into account. A system of e-learning applicability levels in program and course development and implementation of architectural tectonics in courseware is developed from the evaluation process and which contributes to the discussion of future trends in architectural education.

Keywords: Architectural education; e-learning; virtual space.

Virtual tectonic

The emergence of virtual learning environments challenges notions of physicality inherent in traditional architecture. For example, tectonics is traditionally defined in terms of the physical and structural nature of building; a theory of tectonic architecture given by Kenneth Frampton calls for “architectural qualities, which are expressive of a relation of form to force” (Frampton et al., 1995). Putting aside software representation and simulation of physical force, such definitions are more difficult to apply if virtual architecture is to have its own integrity.

Although laws of physical force are suspended in virtual environments, there are nevertheless other rules, laws and limitations which provide design context for what may be called a ‘virtual tectonic’. That is to say, virtual environments are real in other ways to their designers if they build, work, and communicate in them; while there is no gravity, climate, nor materiality, the design form in virtual environments can be specific to other forces. For example, the perpetual flux of data in virtual space as exemplified by Marcos Novak’s work with variable data forms (Novak, 2003): from virtual space, untouched by human hand so to speak, form results from the extraction
of algorithms, manipulated by adjusting the mathematical formulae behind them, until physical models are produced using a rapid prototyping process. On closer reflection, the tangible models thus produced are essentially (physical) representations of virtual-world, virtually-tectonic forms, a remarkable inversion of the more accustomed virtual representation (VR) or simulation of physical reality. In this sense, virtual environments provide a new context for architectural design and the future careers of today’s design students – that of design in virtual space. In this scenario, virtual form may be designed specifically for virtually inhabitable buildings and thus seek to respond to its context tectonically.

There remains a real challenge for architects and educators in bridging these opposing thrusts and design contradictions of virtual and physical; it is as architecturally dishonest to apply physical tectonics in the virtual world, as it is to attempt to apply virtual tectonics in the physical. As Toyo Ito has written: “as with the dead end that hi-tech got into, the final modernist statement of the glass and steel box … we are in danger of computer-generated architecture going that way too if there was not some kind of twinning with the structure in a fundamental way” (Ito and Balmond, 2002). By attempting a re-understanding of tectonics as the forces of interaction between physical and virtual worlds, we may come to think of virtual worlds rather than just instrumental simulations of physical buildings with its predominantly fixed laws; in an age of increased electronic and mediated design it makes no sense to think of building design solely within this stasis. Rather the communities provided by information technology and virtual environments reconfigure the task of building design in a networked space of multiple possibilities, which may contribute to a fluid production of architectural tectonics.

These arguments offer a framework to consider the recently completed ‘blended learning experience’ of the VIPA e-learning project for architectural students (Mullins et al., 2006). Based on a comparative analysis and evaluation of the implemented VIPA courses and project results, a system of e-learning applicability in course development is developed in the paper. The criterion of the relation between the actual applicability of selected e-learning solutions and elements of collaborative educational interfaces with VR are taken into account.

**Blended learning experience**

Several courses of the VIPA project are evaluated (VIPA platform, 2006). They are firstly ordered from the most abstract to the most concrete, on the basis of their programmatic aims, and linkage between virtual and actual physical context.

- development of algorithmic architecture – fig. 1
- virtual city concept & scale changes (scale independency game) – fig. 2
- virtual city-part design & ‘responsive architecture’ (‘responsive architect’- to abstract and concrete project conditions)- fig. 3
- redesign of physical micro-urban environment – fig. 4
- construction concept – fig. 5

‘VIPA’ environment has offered the following functionalities for the test-run:

*Figure 1
‘Algoritmic Architecture’, T. Grasl, C. Falkner, C. Kühn / TU Vienna*
Figure 2
'Skipping Dimensions',
mentor P. Gabrijelčič, co-
mentors: S. Hudnik and M.
Juvačič (example: 'Green
city': A. Jelen, K. Skarlovnik,
B. Krese, K. Toplak, P. Bečan,
A Zumer, 2006/07) / all
UL-FA
• administrative-organisational support of course implementation [Moodle, 2007] with curricular models and supportive courseware for selected topics (as developed and adapted within VIPA),

• bilateral data-exchange (Moodle),

• multilateral data-exchange (software, developed within VIPA),

• detailed user-manual for open-source 3D modeller [Blender - UniVerse, 2007],

Figure 3
‘Responsive Architecture/Responsive Architect’, mentor: T. Zupancic, co-mentor M. Juvancic / both UL-FA; example: M. Kaufman, Erasmus student from Gdansk 2006/07

Figure 4

Figure 5
‘Bridge – Otocec’, mentor: V. Kilar / UL-FA, example: C. Cal, Erasmus student from Lisbon 2006/07
detailed user-manual for simultaneous multi-user experiential VR laboratory [Open Croquet, 2007] and
detailed user-manual for combination of 3D modeller and simultaneous multi-user VR laboratory.

Key e-learning functions can thus be summarized into:
a. course management,
b. bilateral data-exchange,
c. multilateral data-exchange,
d. use of modeller (support to conceptual design approach) and
e. simultaneous collaboration in ‘VR’ laboratory (support to experiential design approach).

**Applicability of e-learning solutions and virtual tectonic**

The main criterion used for comparative analysis of the VIPA courses is the interrelation of virtual and physical tectonics together with the applicability of e-learning to the given task. This criterion includes thus the interrelation between abstract – concrete; conceptual – experiential; and general – local. The chosen e-learning solutions for a shared platform between the universities in a ‘VR lab’ are outlined in the previous section. A system of e-learning applicability levels in programme and course development and implementation of architectural tectonics in courseware is developed from this evaluation process.

The applicability of the VIPA components in course development and implementation of architectural tectonics in courseware can be identified from the levels of their actual use in relation to the chosen topics: in some cases due to the suggestion of mentors, in other cases based on individual student explorations. The results derive from the test run and the evaluation loop, the last with approx. 57% contribution from the Faculty of Architecture in Ljubljana.

There are three applicability levels of chosen e-learning elements/systems defined for the purpose of the present analysis: high, intermediate and low.

The applicability of course management system (a) is ‘high’ regardless of the course topic, except in the case of physical micro-urban environment redesign (4). This is due to the field work, which predominates over all the analytical part of the exercise (case studies). Individual or group field work itself simply cannot be replaced by any digital replacement interface. It is effective more or less regardless of management support. In this case course management system applicability is ‘intermediate’.

Bilateral data-exchange (b) applicability is ‘high’ in all the cases.

Multilateral data-exchange (c), then key technical-innovation of the VIPA project, is ‘intermediately’ applicable in the cases of algorithmic architecture (1) and within the ‘skipping-dimensions’ game-like exercise (2). Its applicability is low in the cases of dealing with experiential urban-environmental design, showing the idea of ‘responsive architecture’ (3), micro-urban re-design (4) and the development of construction concepts (5), where physical tectonic most predominates over any virtual tectonic. A general problem of all the cases involved is the technical limitation of the tool to extend or vary the possible exchange topics and formats. The specific reason of a low applicability level (4, 5) is related to time-management problems: higher level of complexity due to higher physical tectonic level gives less time for complex data exchange, technically separate from ‘VR’ laboratory (e).

The actual application and general applicability levels of the chosen modeller (d) depends predominantly on different traditions of study at the different universities. In the case of algorithmic (1) and scale-related discoveries (2) the functionality mentioned is obligatory, and thus is fully applied. The definition of obligatory use in the first case derives from the expected outcomes for the programme. Obligation in the second case is, on first inspection, more questionable, because of the availability of comparable solutions at the institution. Nevertheless there are some advantages of the prescribed methods for the exercise, which are identifiable only in the case of
obligatory use, especially when students are used to other methods for solving comparable design problems. For example: in the case of virtual urban explorations, focused to show the idea of a responsible architect (3), use of this tool may result in innovative design results in comparison with established tools, especially because of its applicability in combination with experiential virtual lab (e). On the other side, the prescription of such a tool is pointless when similar or even better results might be expected with the use of well established 3D modelling tools; when the student focus is ‘place’ but not ‘technology’; the use of tools is more effective (4, 5).

The results of the analysis of simultaneous collaboration within the experiential ‘VR’ laboratory (e) are similar to the results of the use of the modeller chosen (d), but the applicability level is generally lower. The intermediate level in the first three cases (1, 2, 3) derives from the technical instability of the system. This is due to the didactical focus of the ‘VIPA’ project. Within the last two cases (4, 5) the preoccupation of students with concrete questions about space predominates, thus the motivation to explore the potentials of the interactive experiential ‘VR’ lab is not high enough.

The combination of tools and their functionalities offered (for example (d) and (e)) is – as anticipated – most useful/applicable in the most abstract cases of educational contents.

The results of the test-run demonstrate that all the elements are used/applicable, regardless to the technical difficulties and implementation problems.

The starting points of the exercises can be developed from technical tools directly when educational content is abstract. On the other hand, in the case of concrete content, needless further complications are added. For example: in the case of micro-urban redevelopment synthesis, the tools are offered as self-selected options. When only an additional workload without better course outcomes can be anticipated, no obligation should be prescribed.

The applicability level of e-learning elements/systems within the VIPA project derives from the level of complexity of the contents offered; the applicability of e-learning rises when virtual tectonics outweighs physical tectonics.

**Applicability levels**

The above comparison of VIPA courses leads to the development of a system where applicability levels for course content can be defined for e-learning solutions. These levels themselves are applicable not only in further course implementation, but also in the development of new courses and curricula in the field of architecture. These can be taken as a starting point to reconfigure course design in virtual learning environments (table 1):

- Course management systems (a) are highly relevant, regardless of the level of complexity of the course’s interrelation of physical and virtual tectonics.
- Applicability of bilateral data-exchange (b) is high or intermediate in all the cases.
- Multilateral data-exchange (c) requires further technical improvements focused on higher effectiveness. Some perspectives can be found in the direct connection with the redevelopment of simultaneous collaboration system within the experiential ‘VR’ laboratory (e).
- Use of the chosen modeller (d) depends on the educational conventions within the chosen cultural environments. Improvement of its applicability levels is relevant especially in the connection with the already mentioned experiential ‘VR’ laboratory (e).
- Simultaneous collaboration within the experiential ‘VR’ laboratory (e) represents the lowest level of applicability, but the highest level of expectations in this direction. Alongside the technical questions the ability of translation of concrete contents into abstract visual language is the key question. The answer to this question can contribute essentially to the improvement of the ‘VR’-lab-applicability.
A system of e-learning applicability levels in programme and course development and implementation of architectural tectonics in courseware is developed from the evaluation process. The levels can be seen as indicators of design contradictions of virtual and physical. Higher levels of difficulties using e-learning solutions indicate the complexity of the physical design problems, which are only indirectly transferable from physical to virtual. On the other hand, a very high level of applicability of e-learning solutions show that virtual tectonics is regarded as the key starting point of design endeavours. There are several intermediate levels showing that the intertwinement of physical and virtual cannot be treated as application of virtual to physical or as application of physical to virtual only.

The system of e-learning applicability levels in programme and course development and implementation of architectural tectonics in courseware attempt to contribute to the discussion of future trends in architectural education.

### Trends in architectural education

The field of virtual space design is in constant flux. Its only constant is its flow: several parallel flows in fact. The future of these flows seems unpredictable. Nevertheless, some clear tendencies can be traced: one reflecting the concepts and materializations of the physical world in virtual space – the representation of the physical in the virtual; the second exploring the integral identity of virtuality – in its true form, virtual tectonics; the third trying to inter-relate both worlds – often as simulation of the physical in the virtual.

Virtual space design education derives from a virtual culture, which builds new socio-spatial identities in virtual worlds. Thus new educational profiles and professions emerge. As the variety of these profiles will probably increase, it will be more and more difficult to ensure a common background for accreditation in educational institutions. On the other hand, as in all conventions, the best solutions occur regardless to the quality assurance systems, which may generally be said to ensure minimum levels but cannot guarantee maximum levels.

The developments in the field of virtual space design in education can be seen as elements of the frontiers related to general architectural education; however they are not the only ones. Real architecture is touchable, gravity dependent, and available to all the senses. Virtual tectonics can be seen as experiments whose application to general architectural education requires a critical approach and responsibility towards the people and places architecture contracts with.

### References


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### Table 1

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- Table 1: Applicability levels of e-learning solutions in relation to (the VIPA) course orientation to virtual or physical tectonic

VIPA (platform - 2006); http://vipa3.adm.at/.