Finally, a special potential might result from the idea of a *Model- and Student Work Index resp. Archive*. The volume of digital (re-) construction so far has not been compiled in picture. A group of students analyzing a (famous) piece of architecture may not be able to get hold of possible reconstructions already performed on digital basis. Furthermore, an overview on (extensive) City Models could be of interest. But in what way and how are the findings and materials to be made available to others not directly involved? As already mentioned with regard to CUMINCAD the Internet offers excellent possibilities of making information accessible to a vast public. Provided computer equipment is readily available the expenses accrued particularly result from the actual time consumption.

Conclusions

A fast moving field, such as CAAD, requires responsive indexes of literature in order to allow researchers to „stand on each others' shoulders, instead of stepping on each others' feet". We have proved that using Internet technology and Web-oriented databases allow to create relevant, representative indexes. Because researchers create them themselves and because the effort can be distributed, these indexes may prove more useful to the professional public, than big commercial indexes. A library is an essential infrastructure of any research team. A virtual library, such as CUMINCAD, provides a common library on a global scale. An index, such as CUMINCAD, also provides the basis for further studies about an evolution of a research topic and may influence the future of publishing scientific papers.

References

Y.E. Kalay, *CADLINE: A Bibliographic Database on CAAD-Related Publications*, Buffalo, State University of New York, 1991.

Z. Turk, *WODA - A Slim Web Oriented Database*, IDC99 Conference, City University of Hong Kong, 1999.

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COMMENTS ON LOW-POLYGON MODELING

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The readers of this journal no doubt have a strong understanding of the variety and range of modeling and imaging tools available to architects and designers. Clearly the ability to use these tools often requires a substantial time investment to produce usable results. Modeling, constructing scenes, adjusting lights and materials, setting up camera angles and so forth can often amount to several hundred person-hours. Even with the shift to digital media in professional practice, the time required to model and create scenes for presentation purposes not to mention for design study and analysis is frequently not budgeted.

This issue is expectedly more profound for students, who by definition have limited time and resources. For the last several years, I have been exploring an adjustment to our digital modeling pedagogy with regard to skill building exercises. Specifically, to allow for quick study and analysis of design options without a large up-front time investment or the need for substantial skill. Previously I have had students meticulously build models not as much for the digital model as for the three-dimensional thinking and making skills. This term in particular we have been making use of low-polygon models to test and illustrate formal, material and structural properties of design studies. Using low-polygon models in an iterative process, gradually greater detail and information is added so that the model may eventually be used as a finished product for refined renderings, animations and simulations. The use of a crude model for study is obviously nothing new. Architects have previously made extensive use of cardboard, paper, foam, wood, clay and so forth to study initial formal/spatial ideas principally because the materials are inexpensive and can be manipulated somewhat easily. However, the physical study model is limited in its capacity to test materials, transparency and structure quickly, and it's potential as a final presentation product decreases as it is used to test design options.

The use of low-polygon digital models is similarly inexpensive, requiring relatively little time investment to produce usable results. In addition, material mapping and mesh smoothing tools available in many modeling applications makes it possible to realize a tremendous amount of detail in a digital model without explicitly modeling sub components. The mapping of displacements, materials and bumps, and mesh smoothing at the polygon level, allow localized detail to be placed onto a simple low-polygon model to produce conceptually accurate images for decision making and study. Extending the technique's range is made possible by developing an extensive texture and image map library. This method can transform a simple box into a space with structure, material, openings and fenestration within a few minutes and is often sufficient to provide quick feedback for design decision making and further elaboration and iteration.

In addition, for the last several years we have been making extensive use of morphing tools with mapped low-polygon models. This is being done to test the potential of solutions in

between the extremes defined through static observation (the principles for describing the initial geometry are developed through research and case study). One scenario described in a mapped low-polygon model is combined with one or more scenarios through tools such as 3d Max's Morpher. The morphed results are used to visualize very quickly a tremendous range of alternate scenarios. As well, mapped low-polygon models are being tested and fitted onto sites with the use of space warps and modifiers- testing the impact of context and external influences on resultant geometry. However, in contrast to the paper study model, the digital study model's potential as a final presentation product increases as it is used to test design options. As original geometry can almost always be restored and, each test may be recorded as DV for future presentation.

In my current studio, each student is being allowed to pursue a design typology of their liking but all are required to follow the method described above. Projects range from personal to public spaces. Defining recipes for applying the low polygon modeling method to various typologies was a class activity. For example, the studio defined what elements of each type being considered were essential to the low-polygon model, which elements of a type were inviolate (formally and functionally) and, which elements were flexible (formally and functionally). I also required the class to consider and list localized material properties of types- e.g.- transparent, solid, detailed, bumped. The list of conditions and ingredients was used to guide student decision making while setting up their initial low-polygon models and for controlling modifiers and model manipulations. The potential of writing code to test models and to record tests was also considered but beyond the skill level of most of the students.

A byproduct of the time-savings gained from using low-polygon models has been better defined and tested designs. While subjective decision making has not been eliminated by following the method described, the increased capacity of students for quick testing and feedback has substantially improved their projects and made the results seem less arbitrary. The adjustment in emphasis in digital modeling pedagogy, from complete and accurate to low-polygon approximation, is translatable to the speed and efficiency expectations of practice while not precluding a capacity for serendipity and/or accuracy and completeness.

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