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Sun and Time in the Built Environment

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At a time when requirements on the quality of the built environment are increasingly becoming explicit and specific, computer technology promises the ability to analyse and evaluate buildings during the design process. The computer can extract the necessary information from conventional geometric representations, generate comprehensive descriptions of the aspects to be analysed and use these to arrive at precise and accurate results that can be represented visually. Visual representations facilitate comprehension of the analyses and of their results because of their agreement with our predominantly visual perception of the built environment. The consequent close correspondences between geometric design representations and the visual representation of analyses and evaluations allow direct correlation of the results with the design as a whole. Such correlation is instrumental for imposing explicit and justifiable constraints on the further development of a design.

One good example of visual analyses is daylighting. In many drafting and modelling programs a viewing point can be set on the basis the sun's height and azimuth. The projection returned reveals the surfaces that are directly lit by the sun. In other programs the sun's height and azimuth can be used to position a light source with parallel rays. This source gives rise to shading and shadows that correspond to the ones produced by the sun. In addition, several programs can calculate the position of the sun and hence the viewing point or the light source on the basis of the date, the time and the geographic coordinates of the place. The availability of computer-aided daylighting analysis has obvious advantages for practice. Efficiency and reliability of the analysis increase, while flexibility is superior to analog simulations. Unfortunately automation of daylighting analysis may also impede understanding of underlying principles, that is, of the issues at the focus of architectural education. Explaining how the analysis is performed and why becomes thus a necessity for computer-aided design education.

Exercises that aim at more than just learning and using a computer program can enrich the student's understanding of the analysis and its results. The efficiency and flexibility of the computer facilitate the study of aspects such as the comparison of local apparent time, local mean time, standard time and daylight saving time and their significance for daylighting, solar heating and cooling patterns and possibilities. Sundials with their explicit correspondence to solar movement can be instrumental in this respect. The efficiency and flexibility of the computer also support the investigation of the techniques by which the daylighting analysis is performed and explain the relationships between projective theory, sciagraphy and computer graphics. A better understanding of the principles and techniques for daylighting analysis has a generally positive influence on the students' learning of the daylighting analysis software and more significantly on their correlation of daylighting constraints with their designs. This leads in turn to increased flexibility and adaptability of the designs with respect to daylighting and to a conscious and meaningful exploration of variations and alternative solutions.

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