

# TOWARDS BUILDING SOCIAL CONSENSUS USING GIS

## Virtual Time-Space of Kyoto

The post-war construction of tall, modern buildings in Kyoto has generated heated debate on issues such as what kind of landscape is most beneficial for the city and how can economic progress and environmental protection go hand in hand. The author shows how the use of GIS and Virtual Reality makes it easier to communicate to stakeholders proposed changes to landscape than by 2D-maps alone. Such 4D-GIS are becoming an essential tool in building social consensus.

The present-day Kyoto cityscape is characterised by medium to tall high-rise buildings of the post-war era, such as the Kyoto Tower, Kyoto Hotel and, more recently, the Kyoto Station Building. These structures stand out particularly against the backdrop of streets and alleys that have existed in the Kyoto basin since the Heian period, and some pre-war herit-age buildings and structures such as shrines (about 350), temples (about 1,300), distinctive townhouses called Kyo-machiya (about 24,000) and modern buildings (about 2,000). Over the past five years the number of Kyo-machiya has fallen by 13% to 16%. Continuation of this trend may completely erase Kyo-machiya from the cityscape of Kyoto. The question is how to arrive at a timely understanding of the consequences of planned changes such as the construction of high-rise buildings, and how to communicate these plans to the stakeholders and build social consensus. For this we have developed a Virtual Time-Space approach based on GIS and Virtual Reality (VR) technology and applying Prof. Steinitz's framework for GIS-based landscape planning.

### City Surroundings

The three mountains of Kitayama, Higashiyama and Nishiyama surround Kyoto. Mt. Hiezan is on its north-east side and the Kamogawa and Katsuragawa Rivers flow through the city. The mountains of Kyoto reflect strikingly the four seasons, with cherry blossom in spring, dense greenery in summer, vibrant red foliage in autumn and pure white snow in winter. The area surrounding Kamogawa River is luxuriously vast and open, whilst yet close to central Kyoto. The natural surroundings and changing seasons seen in Kyoto have always been an important part of the overall beauty of Japanese landscapes. Tourists to Kyoto thoroughly enjoy the four seasons, visiting the various shrines and temples the city has to offer, roaming the narrow alleys and streets adjoining Kyoto's distinctive townhouses and tasting the variety of the city's cuisine. In 2004 Kyoto had over 4.5 million tourists, the highest number so far recorded.

### Theoretical Framework

For a long time, the study of landscape and cityscape has been an important component of the subject of Geography. To understand the complexity of landscape patterns, geographers narrowed down the various natural and socio-cultural elements creating landscapes and presented them in two-dimensional (2D) maps. By combining the various elements describing a landscape, overall landscape systems could be successfully understood and interpreted. Since the GIS revolution of the late 1980s there has been remarkable progress in the area of landscape research using maps. The pioneering research of Prof. Carl Steinitz of Harvard University is a good example of this. Since the launch of GIS in the 1960s he has investigated landscape planning through the use of maps. The framework for landscape planning which he developed involves six models:

- representation model: which answers the question how to describe landscape
- process model: how to use landscape
- evaluation model: to evaluate the functioning of the current landscape
- change model: to explore how landscape can be changed
- impact model: for understanding expected differences implicated in any proposed change
- intent model: understanding how the future landscape should be changed.

These models consist of factors such as recognising the context, specifying the research methodology, and initiating research and repetition. Most importantly, all six models use maps. For example, several scenarios are firstly planned, and for each scenario the future of the concerned region is projected. Upon each scenario a visual representation (map) is generated of the appearance of the future landscape. These maps finally turn out to be very useful resources in the decision-making process undertaken by stakeholders.

### Virtual Time-Space

Representing landscape through 2D-maps does not ensure that the majority of the general public will understand the implications of any change; not everybody can read maps or reconstruct mentally a 3D landscape from a 2D-map image (see sidebar). There is thus a need to use Information Technology (IT) as a tool for visualising the landscape in the full three dimensions of space, as well as time, within a virtual space, and to view that virtual landscape from various points of view. The advantage of such a VR system is that one can see simulations of non-existing, planned landscapes, which can be viewed by several users simultaneously. We developed a Virtual Time-Space of today's Kyoto by generating a database of the cityscape using 2D-GIS, in addition to applying the elaborate 3D-city model of



Kyoto by Map Cube. We also generated a virtual space of Kyoto as it was in the past using geo-data resources such as old topographic maps, aerial photographs and residential maps from the beginning of the Taisho period. Finally, we reconstructed the changes in Kyoto's cityscape on a 4D platform by introducing a time dimension into the 3D-model.

#### Final Remarks

In his fine artwork Heisei no Rakuchō Rakugai (In and out of Kyoto), Ikuo Hirayama depicts the complexity of the city and streets through paintings. In a similar way, it is now possible to recreate these complex details by computer using GIS and VR technology. 4D-GIS enables the transformation of 2D-maps into models for sharing information on planned landscape changes. Such Virtual Time-Space is becoming an essential tool in building social consensus.

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#### Further Reading

- Steinitz, C. (ed.), et al. 1996 Landscape Planning for Biodiversity; Alternative Futures for the Region of Camp Pendleton, CA. Graduate School of Design, Harvard University.
- Steinitz, C., et al. 2002 Alternative Futures for Changing Landscapes: The San Pedro River Basin in Arizona and Sonora, Washington, DC, Island Press.

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