

IroKage: A Townscape Colour Planning Support System Using *Kansei* and Colour Harmony Evaluations

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The problem of how to live in a comfortable environment has attracted attention with the changing expectation of residents, and aesthetics of townscapes is a central factor in urban-development problems. Townscape colours are one of the most influential factors concerning the townscape aesthetics. For townscape colours, keeping colour harmony within the environment is a common goal. In addition to the colour harmony, expressing characteristics and impressions of the town in townscape colours are other meaningful goals. Although several previous colour plans have included characteristics and impressions of towns, most of them have been based on anecdotal reports or experience and have been conducted for individual localities.

This dissertation describes *IroKage*, a townscape colour planning support system. The system offers several improved colour schemes for existing townscapes based on three elements: colour harmony, impressions of the town, and cost for the change of colours. Handling colour harmony and impressions of townscapes requires quantification of psychological responses. The system includes a colour harmony model to evaluate harmony in a target townscape colours, and a *Kansei* evaluation model linking *townscape colours* and *town impressions*.

First, the colour harmony model is constructed based on colour harmony principles. The colour harmony equations by Moon and Spencer are expanded for townscape colours. Takagi-Sugeno type fuzzy reasoning calculates an aesthetic measure for townscape colours. The construction of *Kansei* evaluation model is based on the *Kansei* engineering approach. In order to investigate the relationship between town impressions and townscape colours, evaluation experiments are conducted using Osgood's semantic differential method. The results experiments are applied as the training data of neural networks. The model is constructed using a neural network for each pair of adjectives.

With the constructed evaluation models, the system is implemented using an evolutionary algorithm. The problem on the implementation is the method to select appropriate colour schemes under the evaluation scores with the three different objectives: colour harmony, impression and cost. The evolutionary algorithm searches for Pareto optimal solutions of those three objectives. After the implementation, townscape colour development is conducted using the *IroKage* system. The results of the development show that the system has achieved sufficient ability to propose appropriate colour schemes with minimum colour changes.

The results of this research assuredly contribute to simplify the current colour planning procedure, and help to realize aesthetics in townscapes much more easily.