DECISION TREE TEMPLATES FOR INTERACTIVE EVIDENCE-BASED DESIGN OF SITE-SPECIFIC USE-SPECIFIC PEDESTRIAN ENVIRONMENTS

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1. Methodology

This article demonstrates the use of decision tree learning algorithm (Quinlan, 1993) in generating site-specific use-specific landscape design evidence. The domain knowledge was captured using intercept surveys at six sites in Texas. Fifty cognitive, physical and social attributes related to walking environments in Texas were used to generate the grass roots data (fifty-four intercept surveys were conducted querying responses to the identified attributes). The decision-tree learning algorithm used the domain knowledge generated by interviews to learn what constitutes good pedestrian landscape design. The PED-Learner is an adapted version of ID3 decision tree algorithm with one modification made to suit generation of specific design hypotheses. The PED-Learner allows fixing desired number of variables at the top (higher hierarchical levels i.e. near the root) of the decision tree with constraint attributes to allow generation of more specific hypotheses. For example setting the root of the decision tree to the attribute *motive of walk* allows generation of hypotheses for identifying physical attributes contributing to good health walking environment. This allows testing of programmatic design parameters and generation of multiple design options.

2. Results

Motive is very important cognitive feature that provides contextual information for evaluation. *Edge of Space* has been considered as one of the important spatial features for evaluation of landscapes (Lynch, 1960). Hence decision trees were generated using them as root attributes (see Figure 1).
Design Hypothesis 1: *A good walking environment must have a well-defined edge of the space, with adequate view and vistas, and separated from traffic.*

Design Hypothesis 2: *For encouraging health walkers, if adequate water feature is not available then an adequate number of trees is required to make a good walking environment.*

The design hypotheses generated by decision-tree were used to formulate simulated pedestrian worlds (shown in Figure 2). The simulated worlds were operated with the Driving Simulator at Texas Transportation Institute. Twenty-seven volunteers participated in the pedestrian simulation experiments. The regression analysis of the simulated pre-trials showed a direct correlation between the presence of curb-side landscape and a sense of overall safety on the part of the participant walker. The perception of safety was correlated positively with the presence of a well-defined edge and increased lateral distance from traffic. This result was consistent with Decision Hypothesis 1. The results from the simulator trials validate the appropriateness of the use of decision tree rules as guideline for pedestrian landscapes design.

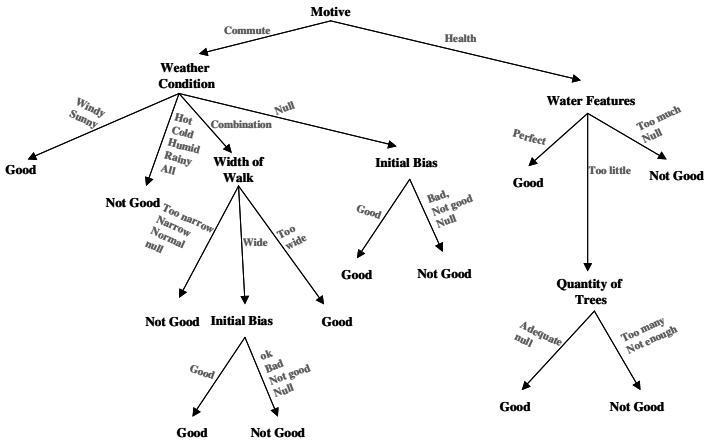

Figure 1. Decision trees rules with Motive as the root attribute

Figure 2. Simulated pedestrian worlds: a) with trees b) without trees c) ill-defined edge

References

Quinlan, JR: 1993, *C4.5: Programs for Machine Learning,* Morgan Kaufmann, San Mateo, CA.

Lynch, K: 1960, *Images of a City*, MIT Press.