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An Interactive Agent for Multi-attribute Preferential Interior Design

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1. Introduction

When arranging many pieces of furniture in a large space, a considerable amount of time and effort is required in the process of trial and error. In order to achieve efficient interior design planning, this study creates a tool to support the design of living and living spaces. The system learns the user's preferences from their evaluations and improves the design in the process of extracting the user's preferences. The purpose of writing this paper is to document the results obtained in the process of optimizing the placement of multiple pieces of furniture considering their dependencies. In Chapter 2, we will give an overview of the system to be created. In Chapter 3, we will provide an explanation of the utility space, and in Chapter 4, we describe the method of evaluation experiments.

Keywords:
Algorithms, Interface Agent, Parametric design, Interior design, Generation, Supervision, Preference

2. System overview

In this study, Blender, a 3DCG production software, is used. The operation procedure consists of six steps: inputting the dimensions of the room, specifying the number of each piece of furniture, specifying the dependencies, evaluating the size of the furniture, evaluating the position, and generating an optimal design proposal.

2-1. Operation Procedure

(1) Create a room

Create a rectangular room based on the room dimension information entered by the user.

(2) Input the number of pieces of furniture

There are three types of furniture: desks, chairs, and beds. Users enter the number of each furniture item to be placed in the created room.

(3) Specifying dependencies

Specify the dependencies of the furniture to be placed in the room. For example, if a desk and a piece of furniture are considered to be dependent on each other for learning preferences, the user can set them to be a single set.

(4) Size evaluation

For each piece of furniture or set of furniture, we evaluate the size. There are three sizes available. For a set of dependent furniture, all the furniture in the set is displayed at once and evaluated.

(5) position evaluation

Evaluate the position of each piece of furniture or set of furniture. The furniture is randomly placed, and preferences are learned by entering ratings for each piece. If a set contains multiple pieces of furniture, all the pieces in the set are evaluated at the same time, as in the size evaluation. When evaluating a single piece of furniture, the goal is to reduce the number of evaluations by limiting the candidate areas for placement using the method: The evaluation value of the design is used as a parameter to update the placement candidate area. The placement candidate area is narrowed by repeating the

process of making the convex hull of the set of coordinates with a certain score the placement candidate area for the next and subsequent placement.

(6) Generation of an optimal design proposal

The best proposal is presented based on the input information.

3. Utility space

In the following, we try to apply the notion of utility to the space of design outcomes. That is, the utility of a design D, namely U (D), is the sum of the utilities related to the size of the furniture and the utilities related to the position of the furniture, U (S) and U (P), and its formula is expressed as in equation.

$$U(D) = U(S) + U(P) = \sum_{o \in D} U_S(o) + \sum_{o \in D} U_P(o)$$

4. Evaluation test

We will have several users use the add-on and discuss the final design proposal based on their evaluation of it.

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