

# Interior Design Tool for Common Users

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## Abstract

*Until recently, computer simulation of interior decoration was reserved to architects and other highly skilled professionals, because existing tools require technical knowledge on computer aided design. During the last years, several easy-to-use tools for home planning and interior design have been released. These tools intend to allow users, without specific skills, to create their virtual house, decorate it and navigate in the resulting scenery. In this paper we present three of these applications and describe task analysis using them. As a result of this experiment, we identify user requirements for this kind of tools, along with positive and negative aspects, providing good insights and directions for future work.*

## Keywords

*Computer-Aided Design, Sketch-Based Interfaces, User Interfaces, Task Analysis, Evaluation*

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## 1 Introduction

There are several software tools for interior design. However, most of them are directed for architects, interior designers or for users with a good knowledge in CAD applications. These type of tools are very hard to use by common users, because they require a long learning time and because they force users to acquire specific skills on interior design and/or in CAD applications.

To understand the motivations, skills and limitations of potential users, and also to identify the main features that this kind of applications should have, we carried out task analysis. It was not our intent to perform an exhaustive evaluation of existing applications, but only to identify user requirements in order to establish guidelines for future development of this kind of tools. Since there are several applications, in the market and in research laboratories, to do interior decoration, we decide to perform task analysis using only a small set. We selected the *Punch! Professional Home Design Suite* [PUN], the *IKEA Office Planner* [IKE] and the *DecoSketch* [Brito 05] prototype. During task analysis we asked users to perform a set of tasks in the three applications, while we videotaped everything and took note of their comments and suggestions. The main conclusion from task analysis was that existing systems

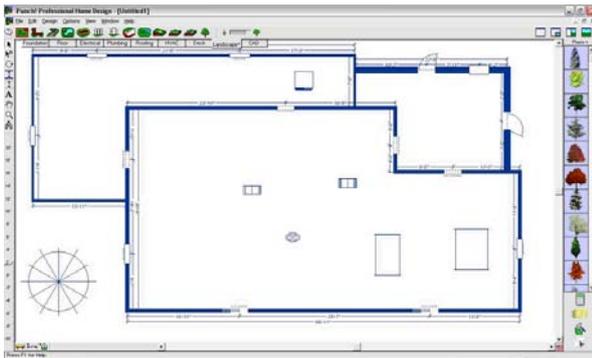
were not designed for common users. They were created for professionals with, at least, some knowledge of architecture or interior decoration in conjunction with some experience of computer assisted drawing.

To overcome these limitations, we plan to develop an interior design tool based on calligraphic interfaces, recognition techniques and 3D retrieval mechanisms. Our solution will offer common users an easy, simple and expedite way to create the floor plan and decorate the divisions of their houses, by inserting decorative elements stored in a database of furniture.

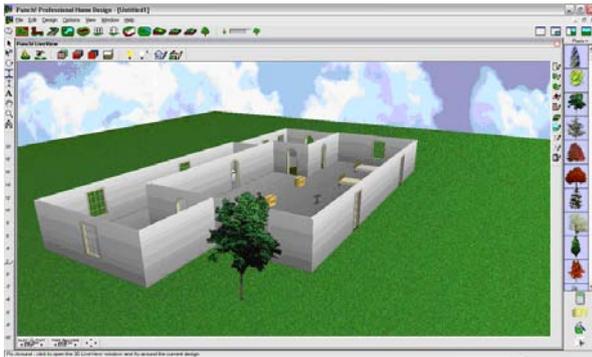
The rest of this paper is organized as follows: next section provides an overview of three tools for interior design. In section 3 we describe the task analysis and present the main results achieved. Finally, we discuss our conclusions and present directions for further development.

## 2 Interior Design Tools

Currently, several tools for interior design are available as commercial applications or research prototypes. Most of these tools were created for expert users, namely architects or other highly qualified professionals. However, some recent applications have been developed to allow users without specific skills to design their own home plan. From



2D editor



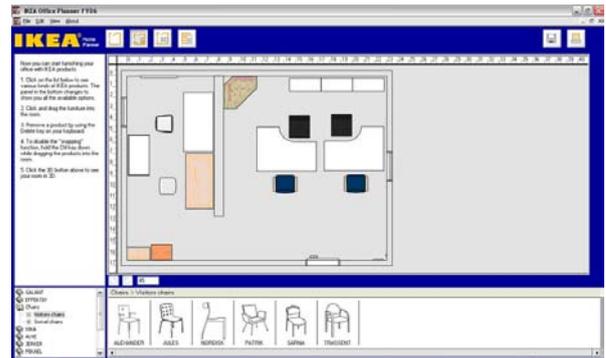
3D viewer

**Figure 1. Punch! Professional Home Design**

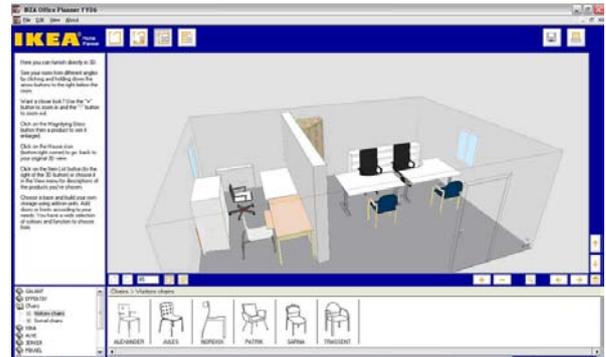
these tools we selected a small set to experiment with final users. With such experiments we intended to identify user requirements for this kind of tool and identify the positive and negative points of selected tools, and not to perform user evaluation.

Interior design applications can be classified in three distinct categories: commercial tools for professional or semi-professional use; commercial applications provided by furniture manufacturers or suppliers to their customers; and laboratory prototypes that generally feature novel approaches and methodologies. For our experiment, we selected three different applications, one from each of these categories. The *Punch! Professional Home Design Suite (Puch-HD)* is a commercial application. The *IKEA Office Planner (Ikea-OP)* is a free tool that customers of a furniture manufacturer can download and use. Finally, the *DecoSketch* is a research prototype of a calligraphic tool for home decoration. In the following paragraphs we will shortly describe each one of these applications.

The *Punch-HD* (see Figure 1) is a very complete and professional program, with a complex and not so obvious interface for beginners. It integrates a wide range of functionalities besides interior design, such as realistic 3D rendering or furniture creation. This application can satisfy both home design professionals and common users. We choose this tool, because it has a relative success in the market, so we can get some good ideas from it, and also because we wanted to see how fast a common user would learn how to use it.



2D editor



3D viewer

**Figure 2. Ikea Office Planner**

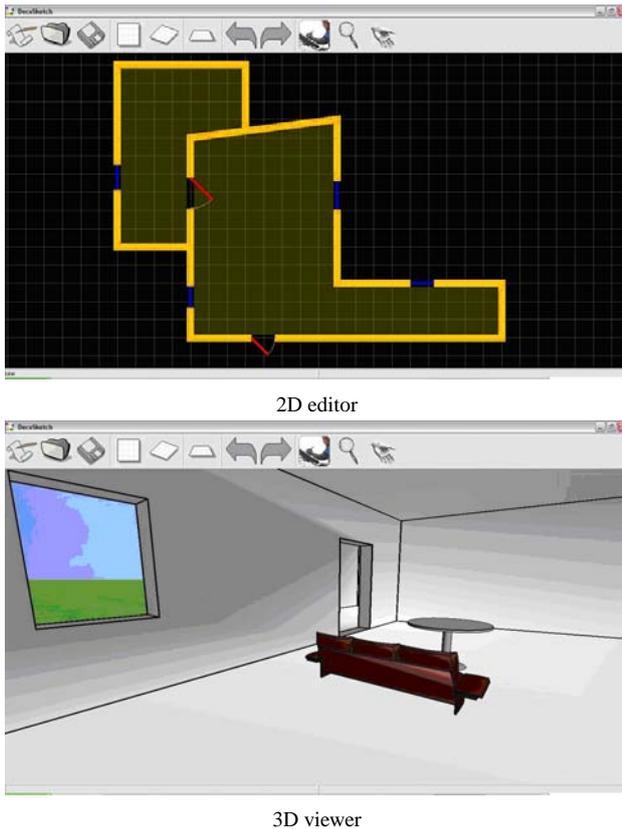
The main objective of *Ikea-OP* (see Figure 2) is to allow easy and quick creation of a house plan, and to put furniture inside to see the resulting scenery. Additionally, the user can know the overall cost of his configuration (users can only include furniture from the manufacturer catalogue). We chose this system because we want to identify its limitations and check its easy of use, since this application was not designed for professionals.

Finally, *DecoSketch* (see Figure 3) is an academic prototype that uses mechanisms we want to include in our solution, such as calligraphic interfaces and sketch recognition methods. We selected *DecoSketch* because we want to validate these ideas and also because we want to see how well users deal with the pen-based interaction in such system.

This task analysis with users, using the three applications allowed us to identify a path for future work in sketch-based interior design research. The experiment with final users, the collected results and its contribution for our work will be described in the following sections.

### 3 Task Analysis

The main goal of the task analysis was to collect a set of user and functional requirements in order to establish guidelines for the development of novel applications for interior decoration. To that end, we asked seven potential users to perform a set of tasks in the three selected applications. None of these users had previous experience with architectural design tools. We videotaped users in action, as depicted in Figure 4, and annotated comments and suggestions. Additionally, users answered two questionnaires,



**Figure 3. DecoSketch**

one at the beginning, to collect information about their profile, and another at the end to measure their satisfaction about the systems.

Each task analysis session was divided in three parts. First, we gave a brief introduction about the experience (objectives, sequences of tasks, documents to fill, etc.) and asked users to fill out the first questionnaire about general data, background, motivation, etc. Second, we presented and explained each application to users, followed by the realization of a set of pre-defined tasks on each system. By defining the same set of tasks for the three applications, we wanted to know what users like and dislike on each system, what mistakes they make and also try to figure out how easily users perform them. In the first task, users must create from scratch a floor plan of a "L"-shaped room with a door and a window. Next, users must navigate in the newly created room, taking a look at the ceiling, the floor and the six walls. Then, users have to place furniture at specific positions inside the room. Finally, users need to add a second window to that room and move furniture to a different position, with a different orientation. After finishing these tasks, we asked users to fill out another questionnaire about the three applications. The first section of the questionnaire collected information about positive and negative aspects of each application individually, while the last section allowed the comparison between all applications according to specific aspects, such as, easiness to draw a plant, easiness to add furniture, etc.



**Figure 4. User testing session.**

In the next section we present a brief analysis of the answers to our questionnaires, notes taken during the experiment and informal comments produced by users.

### 3.1 Analysis of Results

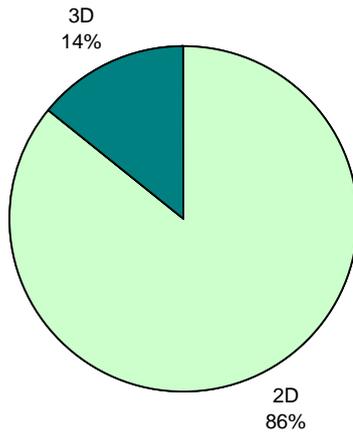
The set of tasks performed during task analysis was defined to analyze the three main features of interior decoration tools: floor plan specification; selecting and placing of furniture; and changing existing models.

In general, users were satisfied with the functionalities related to floor plan design, in all tools. Although, different applications offer distinct alternatives to draw the floor plan, these were equally welcomed by users. They liked the freedom of creation provided by *DecoSketch*, the clear manipulation from *Ikea-OP* and the precision from *Punch-HD*. So, a future application must provide all these features.

However, users were not so satisfied with the applications when they need to change or improve the floor plan. For instance, users were displeased that *Ikea-OP* does not allow them to apply colors or patterns to walls. But, users liked the way this application allows them to change the length and position of walls easily. On the other hand, users generally considered changing the floor plan with *Punch! Professional Home Design* a complex task, mostly because of the numerous options offered by this tool.

During the experiment we noticed that users were always expecting to receive visual feedback of every action, sometimes even while they are performing it. For example, when selecting a color or a texture for the floor, users wish to see immediately the final result while browsing in the palette.

The *Ikea-OP* was pointed by users as the best application, while the *Punch-HD* was commonly criticized by its com-



**Figure 5. Preferences for floor plan editing.**

plexity. Since this last tool is mainly designed for professional users, it is natural that unexperienced users feel uncomfortable using it.

During the tests, *DecoSketch* was often pointed as a second choice tool. Users generally prefer either *Ikea-OP* or *Punch-HD*. However, *DecoSketch* is just a research prototype with very limited functionality, while the other two are commercial, fully functional tools. Nonetheless, according to answers in questionnaires and informal conversations, users were quite pleased with the pen-based interaction and with the navigation mechanisms in both views, 2D and 3D. Thus, we can conclude that the interaction technique proposed by *DecoSketch* should be explored and improved in future work, to produce a fully functional prototype.

It was clear, from the experiments carried out, that most users clearly prefer to edit the plan in 2D rather than in 3D, as depicted in Figure 5. Although, users consider 3D editing useful for some tasks, they are not determinant. Users prefer to edit in two dimensions and then visualize the results in a three dimensional viewer.

After defining the floor plan, users have to place furniture in the created rooms. This task includes the selection of the furniture, its placement and orientation. Commonly, users need to change the displacement of furniture several times during interior design. In this matter, both *IKEA Office Planner* and *Punch! Professional Home Design* satisfies user needs, despite the more complex approach of the latest, mostly caused by the larger number of options. On the other hand, this functionality is not complete in *DecoSketch* prototype. Thus, users cannot fully appreciate the advantages of a sketch-based interface in this task.

When asked if they will use any of these applications again, all users answered positively for *Ikea-OP* and *DecoSketch*. The opinions around *Punch-HD* were not so unanimous. Even though users consider it the more complete and professional tool, less than fifty percent of them consider using it in the future. We believe the main reason for this value is its complexity.

## 4 Conclusions

From this task analysis, we conclude that *IKEA-OP* has the most important features to replicate in novel interior design tools for common users. It is easy to use and easy to learn. Its simplicity and efficiency pleased users more than the complexity of a powerful tool such as *Punch-HD*. Moreover, users liked the calligraphic interface of *DecoSketch* and point it as the best and more natural interaction approach for quick interior design, due to its resemblance to the pen-and-paper metaphor.

The work described in this paper, along with other work we developed recently, namely the comparison with similar applications and informal conversations with architects, designers and common users interested in this kind of tools, allow us to understand and identify users needs and requirements in this area. We believe that the information collected during task analysis provides good insights and directions for the development of a new tool for interior design.

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