

## 附錄 B 以遊戲探索有趣又有效的數位設計過程

### Exploring Playful and Effective Digital Design Process with Games: A Framework for Digital Design Studio Teaching and Learning

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#### Abstract

The idea of developing a framework, which integrates design studios and computer graphics, is derived from the nature of architectural design, which has always combined creativity and technology. Furthermore, as computers are being increasingly used in design studios, a systematic digital pedagogy, which can take advantage of the strengths of computers in all stages of design, should be developed simultaneously to facilitate learning.

This paper attempts to propose a playful and effective digital design process that can be flexibly applied to computer-based design studios and design-based computer graphics courses. The pedagogical framework is based on a set of digital design games that follows a general design process presented by the author. First, the components of digital design games will be defined and the relations of those game components will be clearly depicted. Then, a framework will be proposed, followed by the use of an example demonstrating applications of the framework.

Continual advancements in digital technology have created generation gaps amongst teachers of architectural schools. A structured digital design process can help teachers, with varying levels of computer-capabilities, know how, when and what needs to be adjusted in order to achieve the goal of digital design education.

Keywords: digital design process, playful and effective, digital design games

#### 1 Introduction

The scope of computing in Architecture has been broadened tremendously since the introduction of *Computer Aided Architectural Design* written by William J. Mitchell in

1977. The development of digital media not only provides new production methods such as computer rendering and modeling, but expands our abilities to create, see, express, compose space, and understand design in new ways (Neiman and Do 1999). Architectural schools have increasingly incorporated computer-aided design into design studio over the past twenty years. Although a greater number of teachers are now skilled at applying digital media to design, rapid integration of computing technology has created communication and generation gaps within the profession (Loy 2001). It is difficult for experienced studio instructors with limited computer capabilities to take advantage of digital media. “As the software embodying knowledge becomes more user-friendly, it will give architects new power to bring together a multitude of issues in a holistic way without themselves being specialists.” (Seebohm 2001) This is certainly a wonderful idea, which I look forward to, as this ideal software should empower the design potential. However, before it is realized, how can instructors with limited computer capabilities bring together issues of a digital design process? The structured format of digital design process and the pedagogical model presented in this paper will attempt to clarify and systematize a digital design process so that instructors have a clear idea of how it works. Consequently, even inexperienced computer-capable instructors should be able to include digital media in the design process by incorporating technical teaching assistants in collaboration with other computer-based courses. The integration of a design studio with computer graphics would allow computers to explore new architectural design possibilities rather than leaving students themselves to bring coherence to the two fields (Wu 2002).

In conventional computer graphics courses for entry-level students, a great deal of attention is placed on acquiring software skills. However, working too much on the level of operating technological skills in an instrumental way tends to be boring and ineffective. So, how can beginners of architecture learn technological skills playfully and effectively? The approach proposed here is to learn computer skills through the process of operating a series of digital design games, which, at the same time, can be a potential new means of understanding aspects of design and digital technologies. Therefore, creating games that are intrinsically interesting and relevant to learning about design is one of the purposes this paper tries to achieve.

## 2 Analytical Review

### 2.1 Design Metaphors

Game, play and puzzle are three powerful metaphors to interpret the nature of design. Archea (1987) suggested that the best description for architects' uncommon mode of action is puzzle-making. *Puzzle* aligns itself with experimentation, testing of procedures, and challenging representation or abstractions. *Play* and design are both states of being absorbed in action for its own sake. Woodbury (2001) proposed that play and design can be put into metaphorical relation, and to do so is to let each inform the other. Play is often aligned with phrases like playing around, speculation, ability, and performance. Play is

generally an open-ended activity with unique and ephemeral results.

*Game* possesses many different characteristics that can be classified in numerous ways. Whether it be a bet, lottery, roulette or baccarat, it is clear that the player's attitude remains the same. They do nothing but await the outcomes. On the other hand, a boxer, runner, and chess player, must work as hard as they can in order to win (Caillois 1961). However, Game is not always associated with winning or losing. The essence of a game lies in a person's immersion in the process, subject to rules, and immersion implies a complete absorption in the activity (Radford 1997). Game is aligned with strategies and tactics or procedures with potential, known, or desired outcomes. Games have a predictable outcome because they involve well-defined systems, and they also capture attention by providing an unfolding understanding of the rules of a system (Cheng 1999).

One of the reasons that this paper chooses to use *game* as the analogy to design is that game has a predictable outcome and well-defined systems. For architectural students who just enter this complicated domain, a more systematic pedagogy with less serious atmosphere can better help them to acquire design knowledge and skills. Psychologists have confirmed that a playful attitude gives a person the chance to experiment by reducing associated penalties (Lieberman 1977). Moreover, for studio instructors who have limited computer abilities, a well-defined system provides them the opportunity to plan out necessary technical assistances in advance and incorporate digital technologies in their design studios.

## 2.2 Design Methods

The pedagogical doctrines evolved in the studios of the Ecole des *Beaux-Arts* in Paris during the 18<sup>th</sup> and 19<sup>th</sup> centuries have a rigidly formalized staging of work process (Carlhian 1979; Egber 1980; Middleton 1982). Sequential teaching phases were directed toward elaboration and detailed presentation in plan, section, and elevation. Throughout each stage, the activity was carefully monitored (Rowe 1987). The first American professional school of Architecture was founded at MIT in 1865. *Beaux-Arts* and Gothic revival approaches dominated American schools for their first half-century. *Beaux-Arts* education stressed ornamental details, specific proportions, and the composite settings (Wright and Parks 1990). The systematic approach to design and its veneration of the classical tradition implied the tendency of more hierarchical teaching methods.

A number of significant contributions were made during the late 1950s and 1960s, which regarded design as a series of stages characterized by dominant forms of activity, such as the phases of analysis and synthesis in *Notes on the Synthesis of Form* written by Alexander in 1964. Besides, Asimow (1962) distinguished two structures in the design process: a vertical structure involving a sequential phasing of activities from a definition of need through feasibility study, preliminary design, detailed design production planning and production itself; and a horizontal structure in the form of a decision-making cycle from analysis to synthesis, evaluation and communication. Other celebrated methods include Jones' (1970) factors, Archer's sub-problems, Cross' (1977) automated architect,

and Rittle's (1972) issue based information systems. However, only a few design methods theories retreated to a small number of courses in architectural schools, and were survived to become the foundation for some of the first commercial CAD (computer-aided design) system.

The preferred media underwent a change through time from delicate watercolors and metal-point pencil to photographs, quick sketches with a soft #2 pencil (Wright and Parks 1990) and then digital media today. The computers have the potential to radically change three fundamental ingredients in the classroom: students, instructions, and instructors. It is obvious that changes of this kind spell out a commensurate change in design pedagogy (Akin 1990). For the past twenty years, the application of computers has changed the design method (Liu 2001). Many famous architects such as, Frank Gehry, Peter Eisenman, Daniel Libeskind, Greg Lynn, Tom Mayne, Eric Owen Moss and so on, have created amazing spaces through the assistance of computer technology. Those methods are changing the way that buildings will be designed in the future.

To sum up, although design methods might be changed through time, media trends and designer's personal perspective towards the project, the dominant design thinking underneath can be integrated into the sequence of analysis and synthesis. Therefore, I propose a general and fixed design process for the discussion in this paper, which are: information collection, data analysis, concept generation, design development, detail design and design representation.

### **3 Digital Design Process**

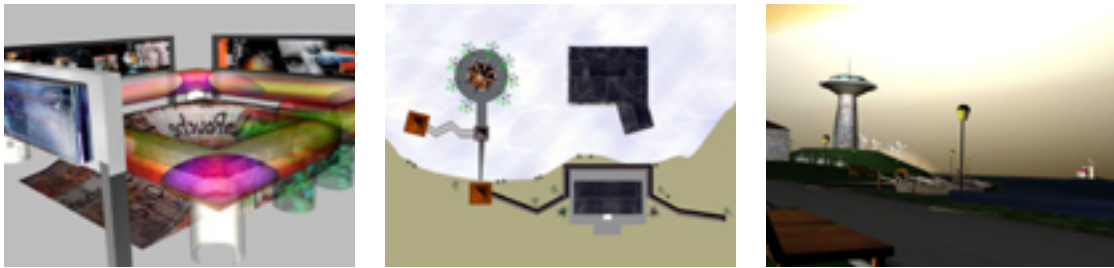
#### **3.1 The Components of Digital Design Games**

Game and design can be put into analogies in many ways as stated above. The study here has analyzed and characterized six elements that are derived from both game and design. At the same time, it has the potential to encourage students to become more creative and imaginative by studying the components of the game.

The most important criterion is that the game has to be relevant to learning about design using digital media. The content of the game can be changeable according to the course objectives, but the components of the game have to be fixed by the following six elements: context, digital tool, clue, exploration, interaction and reward.

- Context: theme of the game relates to learning about design.
- Digital Tool: various kinds of digital media that can be used in different stages of the game, including both hardware and software. For example, in the concept generation stage of a course titled Digital Design Studio instructed by the author, students are encouraged to engage in all kinds of digital media that can best inspire and represent their ideas, as shown on figure 1.
- Clue: instructions, hints or rules of the game.

- Exploration: possible paths of the game that need to be traced out.
- Interaction: a platform or forums for multiple players to receive and make comments and communicate with colleagues and juries to improve their performances.
- Reward: the self-fulfilling intrinsic playfulness derived from the game.

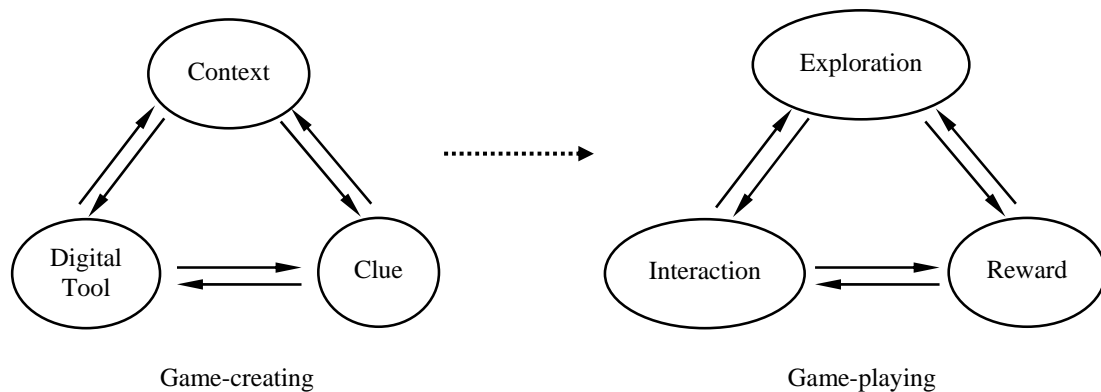


**Figure 1. Images of Concept Generation Stage Using Different Media (From the Left to the Right: 3d Max, Photoshop, and Digital Camera)**

### 3.2 The Relations of Components

The six components of digital design games are all related. However, some of them are more relevant than others according to their individual characteristics. I propose to organize them to two groups: game-creating and game-playing.

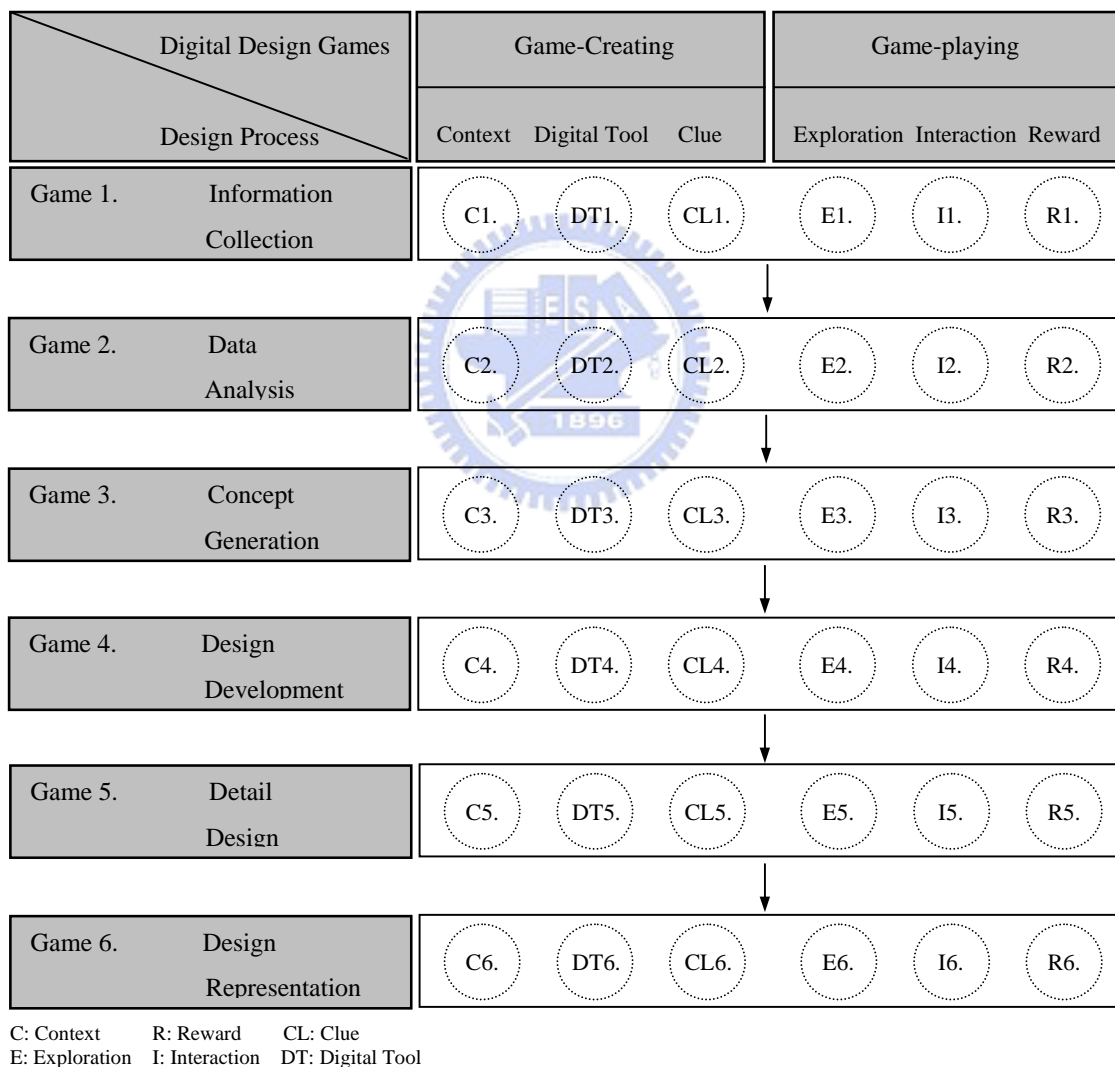
To apply the game-creating and game-playing process, instructors have to be as much involved as students, but in different ways. Instructors are the main game-creators and partial game-players, while students are the main game-players and partial game-creators.



**Figure 2. Relations of Digital Design Game Components**

### 3.3 The Framework of Digital Design Process with Games

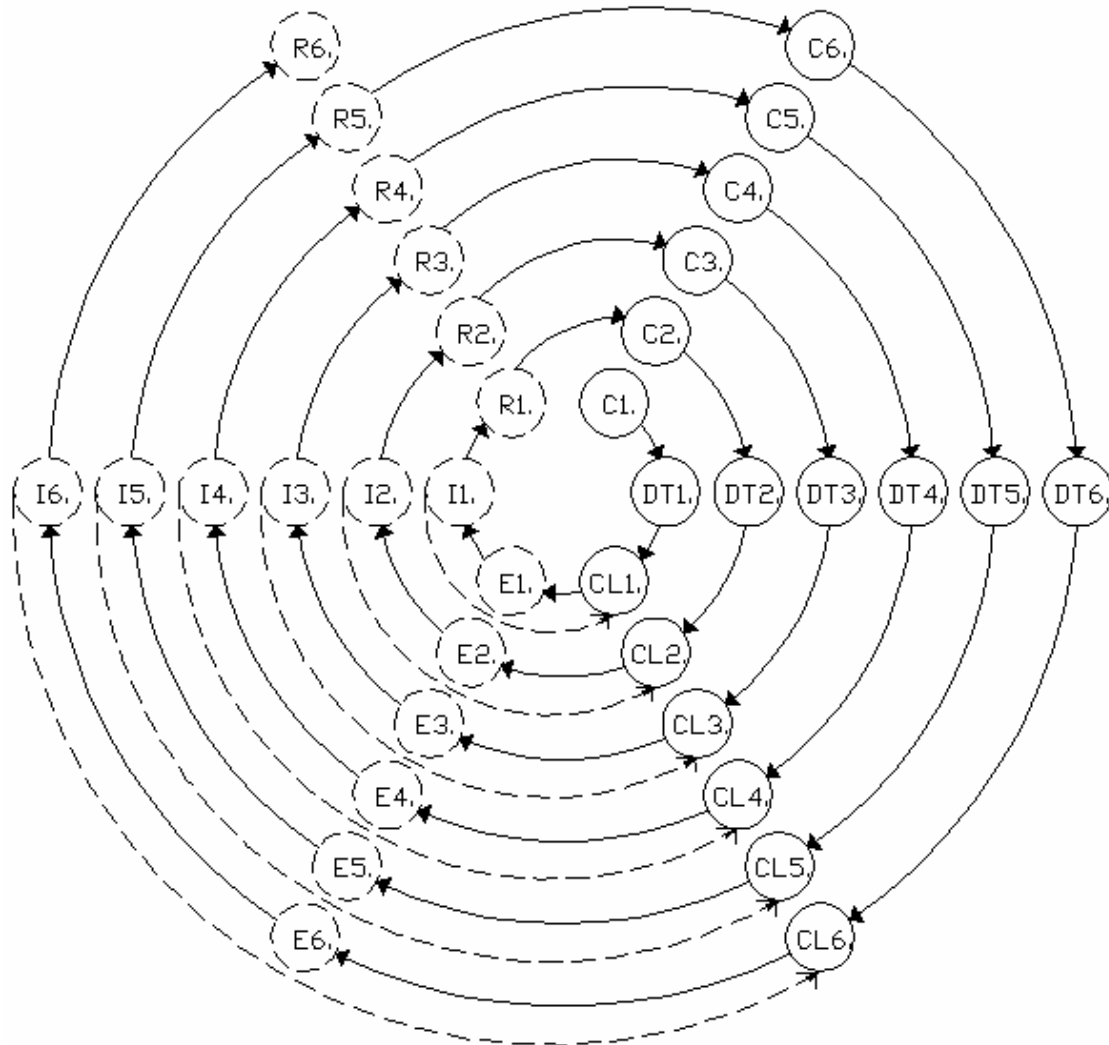
The digital design games proposed in this paper are embedded in general design process to provide an understanding of design operations. To implement the essence of game-creating and game-playing, the general design process and game components are combined and developed into six packages of digital design games. Game components, which are context, digital tool, clue, exploration, interaction and reward, and design process which are information collection, data analysis, concept generation, design development, detail design and design representation, are both fixed. Digital design games form the horizontal structure of the framework and the general design process defines the vertical structure sequentially.



**Figure 3. Framework of Digital Design Process with Games.**

### 3.4 Process of Game-creating and Game-playing

Each of the game package is sequential. Participants have to play the game one after another. Instructors and students create and play games under a pedagogical structure, which will direct all players to achieve the end of the game.



- : Game-creating
- : Game-playing
- C : Context
- DT: Digital Tool
- CL: Clue
- E : Exploration
- I : Interaction
- R : Reward

**Figure 4. Process of Game-creating and Game-playing.**

To further clarify the use of this framework, I would like to emphasize more on how instructors create the games and when students are supposed to join the games. In addition, further explanations will be given on how to run the six packages of the games.

Before the digital design games start, instructors are required to have the game-creating components ready, which means that the theme of the design, the digital tools that can be applied to the design process, and the game's instructions are made available to all students. However, one of the components of game-playing, interaction should also be prepared beforehand. Because interaction of the game-playing means a virtual or physical platform and may allow players to communicate with colleagues and juries, the preparation for setting up hardware and software may be time consuming. Students are asked to follow the clues to explore possible paths using digital tools. Time limit for each game is restricted. Students have to complete the exploration and interaction of the current stage in order to move on to the next game. If any of them fail, they must spend extra time going over the clues of the stage and study further instructions given by the instructor until they have successfully completed the stage. Players should be aware of the deadline of each game, as the starting point of each game is the same for everyone.

It is important to remember that the reward of the game is the self-fulfilling and intrinsic playfulness of the game itself. No player will be asked to terminate the game for any reason, while the game is still in progress. Students, after completing the game, will all have their own individual interpretations of reward.

#### **4 Example: the Application of the Digital Design Framework**

The digital design framework is developed for integrating design studios and computer graphics courses. The objectives of the framework are stated as following points:

- To use digital media to collect information, to analyze data, to generate concept, to develop design, to design details and to represent design.
- To understand the design process.
- To have playful learning experiences.

A number of design subjects can be explored through the game-creating and game-playing process described in this paper. Based on the digital design framework, many kinds of digital design curricula can be developed. A course titled Digital Design Studio instructed by the author is an example of the application of the framework. Originally, there are three topics in the course and the digital design framework is only applied to the last section called "Playing with Forms in Eisenman's Language" which runs for about six weeks.

All the teaching material and information are placed on a class website before the game-playing starts. The course participants are asked to submit their work on-line to a shared folder on the server. Whenever students feel that they have done enough exploration or need advice and comments from others, they are encouraged to post their work on a



platform called *Playground* on the class website. Otherwise, there are explicit deadlines for each game in which all participants must post the results of their exploration on *Playground* to share with the whole class. The following table shows the gaming-creating work that need to be planned out by the instructor beforehand.

**Table 1: Example of Game-creating.**

Digital Design Process	Context	Digital Tool	Clue
1. Information Collection	Meeting Digital Eisenman	Going online is definitely the most convenient means to gather information.	Make a list of websites related to architects, especially those who have used digital technologies to create amazing spaces. Other manual and notes will be given according to the feedback and interaction with students.
2. Data Analysis	Interpreting Eisenman's Language	Use digital photo processing techniques to decompose images and compose collage.	
3. Concept Generation	Transforming Eisenman's Language	Continue to use digital photo processing techniques and other digital tools such as digital camera, scanner, and so on.	
4. Design Development	Sculpting Your House with the Transformed Language	Experiment with manipulating tools provided by Form Z, 3d Max, Maya or other 3d modeling tools.	
5. Detail Design	Designing the House	Manipulate the model more and apply color, light and texture to it.	
6. Design Representation	Visualizing the Aesthetics	Integrate the design to sophisticated digital presentation including static images and dynamic animations.	

## 5 Conclusions

The applied example provided in this paper is not an thorough experiment designed to verify the framework. It is mainly used to further explain the framework. The Digital Design Studio stated above is a pilot study conducted by the author and some phenomena emerged from it will be the foundations of the future experiment.

Due to the premises of the framework, all participants achieve the goal in the end of the semester, and have their own individual interpretations of rewards after completing the games. This is crucial to the entry level students because this learning framework has given them the confidence to continue and the competence to perform. Effective learning has much to do with taking risks (Lieberman 1977). This paper hypothesizes that the engagement of game elements in digital design processes will not only help students to learn effectively, but also enjoy the playfulness derived from it, particularly when instructors and students are both absorbed in the game-creating and game-playing process. Even the inviting atmosphere can increase students' learning competence.

Furthermore, the framework of digital design process presented in this paper clarifies and systematizes a digital design process so that even inexperienced computer-capable instructors are able to incorporate digital media in the design of curricula, while taking advantage of the great potency of digital technologies.

For further studies, besides the experiment that should be conducted to examine the framework, the performance of each component of the digital design games has not been fully developed. Especially when it comes to the interaction of game-playing, it should be more than just Web-based communications and comments from colleagues and juries. There are potentials for more interactive activities and evaluation systems that can be achieved by technical advances.

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