

A Web-based Interaction Design Tool: Pattern Language Toolkit

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Abstract—Interactive installation and new media are new developing areas with great potential in art and design. In these new art domains, artists use various types of media through different ways of interactions to create and present their artworks. However, due to the multimedia and cross domain features of this type of art, traditional design principles and tools may not cover the theoretical and practical needs of the artists in this domain. In this research we attempt to create a new design guideline aiming for interactive installation and new media art design. We found that the pattern language, proposed by Alexander in 1977, can perfectly fit the requirements of these new forms of art design. In order to illustrate how to apply the pattern language to interactive installation design, we have developed a set of patterns from the analysis of several related artworks and articles in the literature. We have developed a Web-based visualization system, in which one can share and communicate their ideas and experience with other experts during artwork design through the common language patterns. This system allows the users to clarify and consolidate their ideas by decomposing them into pieces of related patterns that can be re-built to form a more constructive pattern diagram. Moreover, this tool can also be used to stimulate the imagination of user through related works of similar pattern. In a preliminary evaluation of our system, we have interviewed three artists in this area about the feedback of using this system and their responses are rather positive. We believe that this type of tool utilizing pattern language can effectively help the artists realize their ideas in interactive installation and new media art designs.

Keywords: *Interaction design, Interactive Installation Art, Pattern Language, New Media Arts*

I. INTRODUCTION

In recent years, due to the development of digital interaction technologies and the rise of New Media Arts [7], interaction installation and art creation have become a new subject in the domain of art and design. Artists begin to use various media in diversified ways to create and present their artworks. Through a good variety of sensing and detection technologies, an entirely new form of art, interactive installation, has been created. Interactive installation allows viewers to join the work and thus become part of

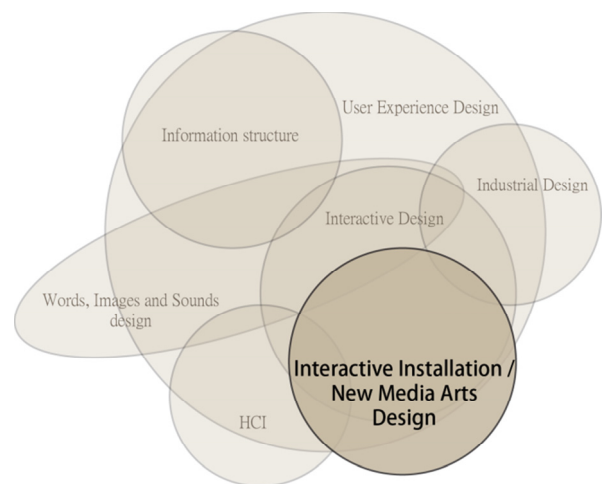


Figure 1. Positioning of interactive design among related domains

the installation. For different viewers, the feedback of the installation may be very different and unique. A new kind of association between viewers and installations has been created.

Although a large number of interactive installations or artifacts have been created, there are still two major problems on the design of interactive installation. First, compared with traditional arts, which have clear style classification and design principles, interactive installation design lacks a comprehensive design guideline. This creates a barrier for those designers who want to enter this area. Second, interactive installation design is an interdisciplinary subject [1], often requiring experts from different domains, such as engineers, HCI designers, and artists, to collaboratively create an artwork. The position of interaction design or New Media Arts among other related domains is shown in Figure 1 [7]. The designers in this field may possess knowledge from different domains and have their own backgrounds and professional languages, thus it is crucial to have a good facility for them to share and communicate their ideas when creating an artwork effi-

ciently [2][3]. The main purpose of this research is to create a computer-assisted system for the design of interactive installation. We propose to use the concept of pattern language to design a system that can solve the two abovementioned issues on interactive installation design. With such a system, we hope that the artists can have a design guideline to follow and share and communicate their ideas and experience in artwork creation [6].

II. NEW MEDIA ARTS AND PATTERN LANGUAGE

According to Crosbie [4], new media is not only a tool of communication but also a new model of many-to-many communication. In this communication model, people can receive similar, yet different, messages at the same time, and have direct influence or partial control over the messages. New media art emerges as a new form of art emphasizing on the modalities of interaction [5]. As shown in the book of Manovich [6], the characteristics of New Media Art includes: Numerical representation, Modularity, Automation, Variability/Liquidity and Transcoding. The first three characteristics nicely correspond to the deconstruction and reconstruction processes of pattern language as described in later sections.

Pattern language was proposed by Alexander in 1977 [1], in a community build case. Pattern language is designed for communication between architects and residents in the building phase of architecture. Due to the property of the pattern language on communication with cross domain crew, in this research we found it can be well adopted in New Media Arts design, where there is also an urgent need for cross-domain experts to work together. In Figure 2, we show a typical group collaboration in New Media Arts design without pattern language, where the design task is divided into three parts (content, engineering, and HCI design) and the final product is from the intersection of their separate expertise in different domains. In contrast, with the help of pattern language, if we can express the main design idea through a common tool as shown in Figure 3, it would be easier for the participants to understand every domain more easily and accurately.

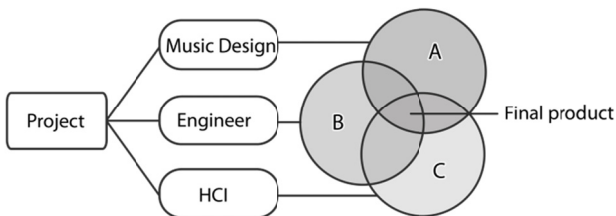


Figure 2. Cross domains collaboration without pattern language

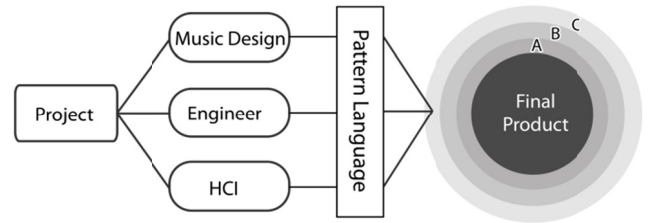


Figure 3. Cross domains collaboration with pattern language.

III. INTERACTION DESIGN IN PATTERN LANGUAGE

In this research we use pattern language to analyze existing interactive artifacts, focusing on interactive technologies and hardware supports in order to draw a graph diagram to guide interaction design. This graph contains hierarchical concepts of the design, including the ways the artwork interacting with viewers, the required techniques, and the implicit meaning that the artwork conveyed. This graph provides a graphical representation of an interactive design and can serve as a design guideline as well as a communication tool for other interaction designers and experts from other domains.

Our pattern language is derived from the definition of Alexander's format [1]. Important properties in this definition are kept and several new properties related to interaction design are added. Each pattern contains six properties as described below:

- **Name:** The identification of a pattern representing its meaning. This property is used for discussions in different domain workgroups.
- **Problem:** A short description of the problem that this pattern attempts to solve.
- **Motivation:** A description of the scenario and its contexts where the problem may arise and the pattern can be applied.
- **Solution:** The techniques that can be used to solve the problem for the given interactive design. Multiple solutions may be available for the designers to choose from.
- **Related works:** Other interactive installations that are related to this pattern. The references could be presented as text or video link.
- **Related patterns:** Other patterns related to this pattern. This reference may provide alternative solutions for the designer.

To verify that the design of our pattern language can satisfy the needs of physical applications, we have used this pattern language to analyze a number of artifacts and design new installations. This pattern language consists of patterns in a hierarchy of four layers as depicted in Figure 4. The hierarchy starts from a central idea of *interaction design* at the first level of our pattern language. We classify all artworks according to how they detect user behaviors when they interact with viewers. Our pattern language at the second level, *interaction method*, is constructed based

on these five senses that a human has. However, since few artworks were designed from the points of smell and taste, currently our patterns only focus on vision, touch, and hearing. At the third level, the patterns are mainly for *interaction events* while the lowest level is aiming at *interaction technologies*. In order to illustrate how the design patterns can be placed at appropriate level of this hierarchy, we have created a list of patterns in Figure 5 as examples.

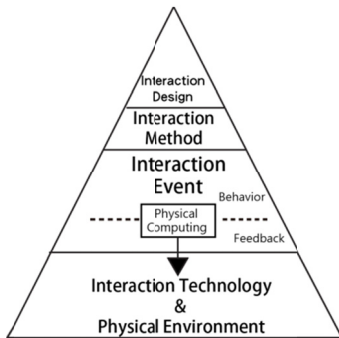


Figure 4. The hierarchical design patterns in our pattern language

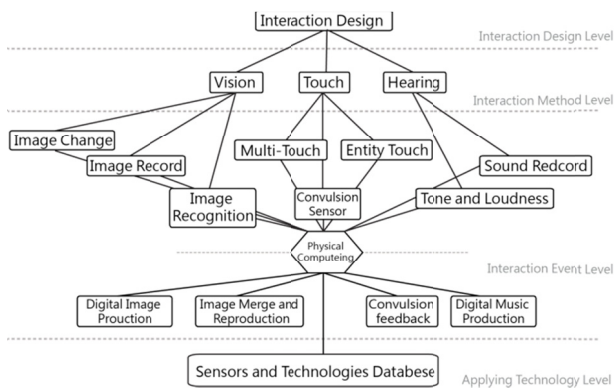


Figure 5. Examples of patterns in various concept levels in our pattern language

IV. THE PATTERN LANGUAGE TOOLKIT

To make the pattern language a good design tool for interactive installation, it is crucial to have a good collection of patterns containing sufficient coverage of designs. In our system, we have adopted a Web 2.0 approach, where create a web-based system allowing the users to share their designs through the toolkit. This toolkit allows the user to include new patterns and create links with other patterns on the system. Meanwhile, the user can also use this tool as a design guideline to create their interactive installation. By this web-based pattern language toolkit, we hope that creating an interactive installation will become easier, and the self-development feature of the system can lead itself to a more complete pattern language tool for interactive installation design.

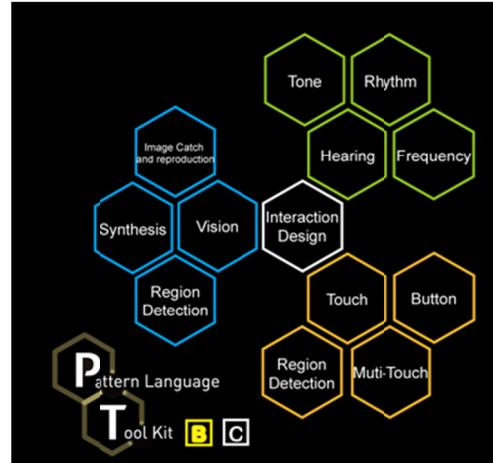


Figure 6. Pattern language web toolkit: An overview of patterns and their relations in the browse mode.

Our pattern language toolkit contains two operation modes: the *browse* mode and the *creation* mode. In the browse mode, the names of all patterns are shown on the browser by an associated graph as shown in Figure 6. A user can unfold a pattern (a hexagon) to view its details, including ‘Name’, ‘Problem’, ‘Motivation’, ‘Solution’, ‘Related works’, and ‘Related patterns,’ as shown in Figure 7. Except text description, the ‘Related works’ also contains visual information about the patterns such as the image or video of related interactive installation to make the understanding of the pattern easier.

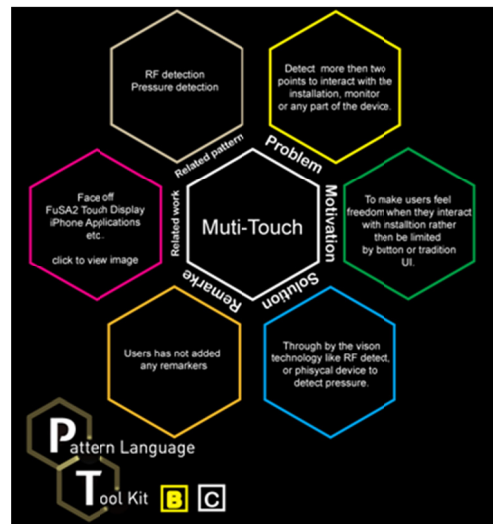


Figure 7. A snapshot of the user interface of the pattern language web toolkit showing the details of a pattern in the browse mode

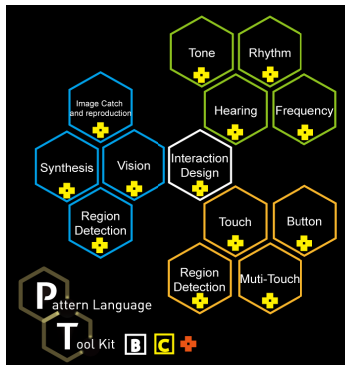


Figure 8. A snapshot of the creation mode in the pattern language web toolkit

The creation mode of the pattern language toolkit is intended to be used by artists who have only a rough creation idea or have limited knowledge about the technologies that can be employed. When a user switches to the creation mode, a little cross is shown on each pattern as depicted in Figure 8. The creators can select the patterns according to the techniques they would like to use or their underlying art meanings. When a cross is clicked, the system will create a new pattern graph with these selected patterns as revealed in Figure 9. This new graph is created with hierarchical layers from the design idea (layer 1) to the employed technologies (layer 4) selected the artist. For the user's viewing convenience, the system sorts out and set aside the properties of selected patterns such as "related work", "related technologies" and "reference" for the users. This can help the users to understand how they can use these patterns and what had been used in the existing interactive installations. The new graph can be used to consolidate the imagination of the artist and can be used as a fundamental tool for further creation.

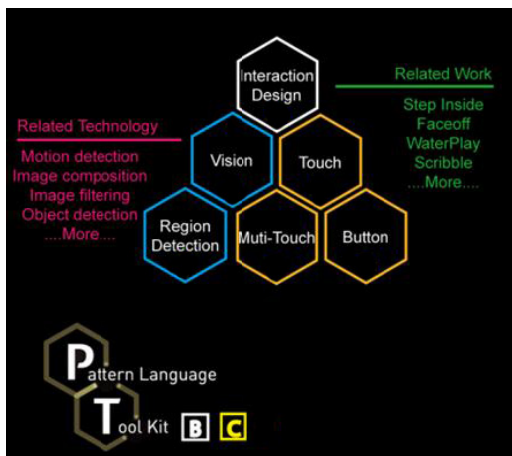


Figure 9. Pattern language web tool: Customized pattern map.

In addition to the graphical user interface shown above, the toolkit also provides a text interface for searching for a specific pattern or entering the detail description of a new

pattern. An example of the interface for inputting pattern attributes (Section III) is shown in Figure 10.

Pattern ID : 18 (AUTO)			
名稱 NAME		層級 Class	
問題描述 Problem		動機 Motivation	
解決辦法 Solution		相關模式 Reference	互動設計 流覽 圖形辨識 觸覺 聽覺 影像變化 影像紀錄 音訊響應變化 聲音紀錄 多點觸控 實體觸控 高動感應 影像合成與遮罩 數位影像生成 觸控生成 觸控回饋
所屬領域 Domain			
相關創作 Relatedwork		備註 Ps.	

Figure 10. Pattern language web tool: Including a new pattern

V. EXPERIMENT AND EVALUATION

The pattern language toolkit has been implemented as a web-based system where PHP has been used for the server to retrieve pattern description from the database and the Adobe Flash technique has been used for the graphical user interface at the client side.

In order to verify the appropriateness of our pattern language design for interactive installations, we had tried to use the toolkit to design an installation about hand shadow interaction for illustration. In this installation, we allow the users to interact with a virtual creator made by their hand shadow. The user of the system is asked to stand in front of the screen, face a red block on the screen, and then make a gesture, as shown Figure 11. A virtual creator will be cast onto a specific area, and then interacts with users according to the recognized gesture shadow.

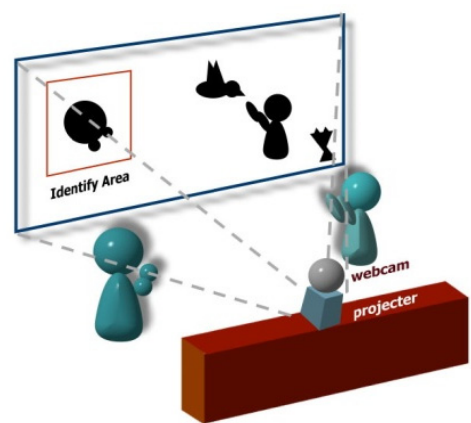


Figure 11. Interactive installation layout

We used the pattern language toolkit to facilitate the creation of this installation. First, in the creation mode, we can choose any related patterns from each domain. In this

example, the involved detection and interactive method belong to the vision domain. Therefore, we can click on the vision pattern to see all related patterns, such as vision, region detection, and image recognition. When we finish choosing patterns, clicking the little cross at the bottom of the page will bring us the final pattern map as shown in Figure 12.

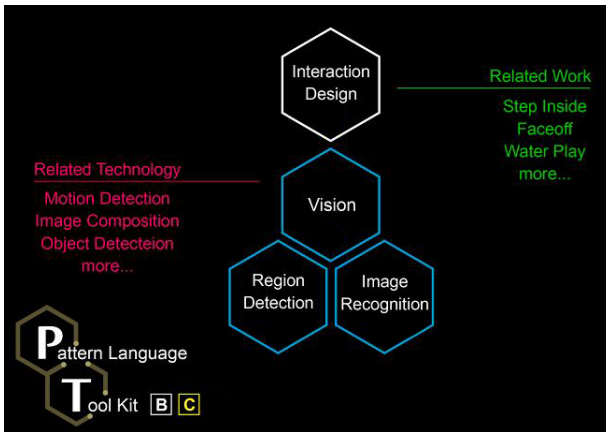


Figure 12. Pattern map for hand shadow interactive installation

Once we have got a pattern map such as the one shown in Figure 12, we can use it as a guideline to construct our creation. From the information provided in this pattern language toolkit, we can find a list of all technologies that we need in designing an interactive installation. We can also research the related interactive installation designs to revise our own. The final interactive installation, as shown in Figure 13, was realized with the help of our pattern language toolkit.



Figure 13. Pictures of the hand shadow interactive installation

In order to evaluate our system, we have asked three interactive installation artists to try our system. They were asked to analyze their past designs in the creation process through our system as if they were designing a new one.

Their feedbacks showed that the pattern language toolkit is helpful in analyzing an existing interactive installations as well as constructing a new design. They pointed out that through the graphical interface showing the details of interactive design, the designers are more likely to be inspired for an creative design. The use of pattern language can also facilitate the communication between the collaborators.

VI. CONCLUSIONS AND FUTURE WORK

As indicated in the beginning of this paper, interactive installation and new media art has become a trend in these years. However, there are relatively few design methods can be followed systematically. The pattern language toolkit has been created to facilitate the design of interactive installations or New Media Art creations. The pattern language toolkit can reduce the technical barrier for artists who are not familiar with programming and technologies. With our system, we believe that process of interactive installation design can be made more creative and diversified.

The current work is just a beginning of a long-term investigation and further experiments. With the increasing number of patterns in interaction design, this approach can help a user gradually accumulate and make use of good design patterns. We hope that this system can used as a good source of references for artists to design interactive installations. In the future, we hope that the system can be further evaluated with objective criteria and revised with feedbacks from more design cases.

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