Approach to Systematization of 3D Gesture Design Pattern for 
UI Operation

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1. Background

In recent years, Natural User Interface (NUI) have 
received a lot of attention as the next interface of GUI. 
Especially, 3D gesture operation is just beginning to be 
implemented on PC like Intel RealSense technology [1]. 
As of now, 3D gesture operation doesn’t have common 
and general definitions in the world and each vendor 
assigns her own gestures in an original way. However, 
this causes inconsistent operations which confuse users 
even though the consistency is one of the most important 
matter for better user experience.

2. Approach and objective of this study

We aimed to build common design policy for 3D 
gestures of UI operation. In this design policy, we try to 
provide both design guidelines and design patterns. 
Fig.1 shows the relationship between design principles 
and design patterns as a basic structure of the design 
policy. Guidelines provide basic principles for 3D 
gestures. But, it is difficult to design each gesture by 
each developer with keeping consistency. To provide 
design pattern as catalog, developers can select proper 
gestures for each application. In similar context, 
consistent experience can be provided for users to assign 
same pattern. Therefore, this paper shows about 
building 3D gesture design pattern. This design policy is 
espected to provide consistent experience for users and 
help to enable new applications by developers.

3. What is design pattern? [2-3]

3.1. General outline

Design patterns are formalized several phronesis to 
each pattern and share patterns catalog generally. 
Patterns provide a set of common challenges and 
solutions as common vocabulary of design. Developers 
select patterns based on own situation and apply it. This 
idea which share phronesis like catalog is said to be able 
to apply to other area. Especially, design pattern approach is used for GUI design frequently [4-5]. So, we 
think this approach can be also applied for NUI design.
Primary advantages of pattern are said as below:

1. Provide solutions for repeated problems in specific context as assistant of existing guidelines and specifications
2. Support communications among co-workers, users, stakeholders by provided solutions and the background
3. Anyone can apply each solution easily and reduce the development effort

3. 3D gesture design pattern

3D gesture design pattern was built by reference to previous study [6].

4.1. Collection of patterns

Patterns were collected from existing gestures of Intel, Microsoft Kinect, each business unit of Lenovo, NECPC hand power and so on. Then, each gestures are categorized to 7 types through KJ method. These 7 types, are summarized by pattern name, context, problems which are addressed by these gestures, detail gestures. Fig.2 shows “Global function” as an example.

4.2. Systematization of patterns

To systematize gesture design pattern, Formal Concept Analysis (FCA) was used. FCA is the method which clarifies the inclusive relation. From context table which consists of “attribute” and “object”, concept lattice which visualizes inclusive relation is made (Fig.3). In concept lattice, upper position attribute is more general and under position object has more attributes. “A” is the most general attribute in Fig.3 and includes attributes of “C”, “D” and objects of “4”, “3” and “1”. In this study, FCA was used to consider the class structure of 3D gesture.

Fig.4 shows the FCA result (Attribute: 3D gesture, Object: Use case). This means “Global” gesture is most general. Other gestures excepting “Menu control” have the same number of objects. But, the user of “table” and “3D CAD” will be fewer and more specific. In reference to this result, we proposed the 3 class structure of 3D gesture pattern as Fig.5. We think a global gestural scheme should run across all apps, and the more specific functions should be supplemented where possible and appropriate.

5. Future outlook

This paper shows the possibility to build 3D gesture design patterns. To build more valuable pattern, further discussion is necessary for the following items: Default on & off, Feasibility, On-screen help, Cultural / Geographic differences in each region.

References