Submission No. : C000009
Affective Education

Effects of Idea Sketching and Storyboards on the Design o...
Keywords: Sketching, Storyboards, Display Techniques, Des...

ISASE 2019

# Effects of Idea Sketching and Storyboards on the Design of Playground Equipment

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**Abstract:** Design spans a wide range from the design of things, which targets color and form of products, to the design of experiences, which targets user experience in systems and services in recent year. In the design of things, many display techniques such as sketching and prototyping have been utilized to obtain optimal designs. Although the importance of display techniques is also recognized in the design of experiences, the techniques used in the design of experiences are often considered as applications of techniques used in the design of things. This study aims to help development of effective display techniques by clarifying the role and impact of the display techniques in the design of experiences. Specifically, the effect of design sketching, which is often used for product design, is compared to the effect of storyboarding, which is often used for animation production, in design exercises for college students with the theme of playground equipment.

**Keywords:** *Sketching, Storyboards, Display Techniques, Design of Experiences, Design of Things*

## 1. INTRODUCTION

Recently, the word "design" has encompassed broad concepts ranging from commercial design such as the color and form of products to area-integrated systems and service solutions. The former is classified as the design of things, while the latter is the design of experiences in response to diversity in design. One reason that the design of experiences is widely known is that IDEO, a US design office, developed design thinking that systematizes problem-solving methods by designers. IDEO's process consists of the following stages: empathize, define, ideation, prototype, and test.

Many books have been published about practicing design thinking [1-3]. These books describe methods for the empathy and definition stages, but detailed explanations and methods for display techniques in the ideation and prototype stages are limited. Additionally, the descriptions of the display techniques depend on the book. In design thinking, which is used in both business and citizens' workshops, utilization of display techniques is difficult for many people. Thus, display techniques are often avoided.

Design of experiences, which is represented by design thinking, has attracted attention as a new trend in design. However, to date, there are no scientific studies on the effect or role of important display techniques in ideation. Thus, if a display technique suitable for the design of

experiences is developed and its acquisition method are subsequently developed, workshop participants with diverse backgrounds may be able to visualize and propose ideas. Based on this background, this research aims to make clear the role and impact of display technique in the design of experiences toward realizing an effective display technique in the design of experiences. Specifically, I examine the effects of utilizing idea sketching and storyboards in university student design classes with the theme of designing children's playground equipment for a park.

## 2. SKETCH AND STORYBOARD

Sketches are available to any designer because they can be produced anywhere using paper and pen in a short time. Sketches can be used appropriately depending on the ideation of design and the presentation in the product design [4]. Sketches can effectively indicate the idea in the designer's mind by visualizing the image and connecting it to the next step [5].

On the other hand, designs accompanying movement such as animation and digital signage are attracting attention in recent years. A storyboard, which is filled with scenes and conversations, is used to reflect various sketches where the object changes over time [2]. A storyboard corresponds to design drawing specifically showing the change in movement and the state of the

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**Table 1:** Evaluation results for group A

| | Sketch(1st) | | | | Storyboard(2nd) | | | |
|---|---|---|---|---|---|---|---|---|
| | Character Drawing | How to Play | Detailed Drawing | Supplementary Explanation | Situation Description | Conversation (serif) | Detailed Drawing | Overall View |
| 1 | 1 | 1 | 1 | 1 | 5 | 5 | 1 | 1 |
| 2 | 0 | 1 | 1 | 1 | 1 | 5 | 1 | 1 |
| 3 | 0 | 1 | 1 | 1 | 1 | 5 | 1 | 1 |
| 4 | 0 | 1 | 1 | 1 | 5 | 5 | 1 | 1 |
| 5 | 0 | 1 | 1 | 1 | 0 | 5 | 1 | 0 |
| 6 | 0 | 0 | 0 | 1 | 5 | 5 | 1 | 1 |
| 7 | 0 | 1 | 1 | 1 | 0 | 5 | 1 | 0 |
| 8 | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 0 |
| 9 | 0 | 1 | 1 | 1 | 5 | 2 | 0 | 0 |
| 10 | 0 | 1 | 1 | 1 | 5 | 5 | 0 | 1 |
| 11 | 0 | 1 | 1 | 1 | 5 | 5 | 1 | 0 |
| 12 | 0 | 1 | 1 | 1 | 2 | 5 | 1 | 0 |
| 13 | 1 | 1 | 1 | 1 | 0 | 5 | 1 | 0 |
| 14 | 0 | 1 | 1 | 1 | 3 | 5 | 0 | 0 |
| 15 | 0 | 1 | 1 | 0 | 0 | 5 | 0 | 0 |
| 16 | 0 | 1 | 1 | 1 | 1 | 5 | 1 | 1 |
| 17 | 1 | 1 | 1 | 1 | 0 | 5 | 1 | 1 |
| 18 | 1 | 1 | 1 | 1 | 5 | 5 | 1 | 1 |
| 19 | 0 | 1 | 1 | 1 | 2 | 5 | 1 | 0 |
| 20 | 1 | 0 | 1 | 1 | 4 | 5 | 0 | 0 |
| Ave. | 0.25 | 0.85 | 0.95 | 0.90 | 2.45 | 4.85 | 0.70 | 0.45 |

**Table 2:** Evaluation results for group B

| | Sketch(2nd) | | | | Storyboard(1st) | | | |
|---|---|---|---|---|---|---|---|---|
| | Character Drawing | How to Play | Detailed Drawing | Supplementary Explanation | Situation Description | Conversation (serif) | Detailed Drawing | Overall View |
| 1 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 0 |
| 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| 3 | 1 | 1 | 1 | 1 | 1 | 3 | 0 | 1 |
| 4 | 0 | 1 | 1 | 1 | 0 | 5 | 0 | 0 |
| 5 | 1 | 0 | 0 | 1 | 5 | 5 | 1 | 0 |
| 6 | 1 | 0 | 0 | 1 | 4 | 5 | 0 | 1 |
| 7 | 0 | 1 | 1 | 1 | 4 | 5 | 0 | 1 |
| 8 | 0 | 1 | 0 | 0 | 5 | 5 | 0 | 1 |
| 9 | 1 | 1 | 1 | 1 | 5 | 5 | 1 | 1 |
| 10 | 1 | 1 | 1 | 1 | 2 | 5 | 0 | 0 |
| 11 | 1 | 1 | 1 | 1 | 4 | 4 | 1 | 0 |
| 12 | 1 | 1 | 1 | 1 | 3 | 4 | 1 | 0 |
| 13 | 1 | 1 | 1 | 1 | 0 | 5 | 1 | 0 |
| 14 | 0 | 1 | 1 | 1 | 5 | 0 | 1 | 1 |
| 15 | 1 | 1 | 1 | 0 | 0 | 4 | 0 | 0 |
| 16 | 1 | 1 | 1 | 1 | 0 | 3 | 0 | 1 |
| 17 | 0 | 1 | 1 | 1 | 0 | 5 | 1 | 1 |
| 18 | 1 | 1 | 1 | 1 | 3 | 5 | 1 | 1 |
| 19 | 1 | 0 | 1 | 1 | 5 | 5 | 0 | 1 |
| 20 | 0 | 1 | 1 | 1 | 5 | 5 | 0 | 1 |
| Ave. | 0.7 | 0.9 | 0.8 | 0.9 | 2.8 | 4.15 | 0.45 | 0.55 |

character over a period of time. It is used to accurately convey images to stakeholders in the production of animations.

## 3. PLAYGROUND EQUIPMENT DESIGN

The subjects designed based on the theme of "playground equipment connected with people." The subjects were divided into two groups (A and B). Each group had 20 university students, who were first grade students studying design. Although all students attended a four-month drawing course, none of the subjects had received sketch lectures. Therefore, prior to the design experiment, they took a 90-minute course that included three-dimensional descriptions by perspectives.

Group A: After expressing the design of the playground equipment using a sketch (10 minutes), scenes where children play on the playground equipment are expressed using a storyboard (10 minutes).

Group B: After expressing scenes where children play on playground equipment using a storyboard (10 minutes), the design of the playground equipment is expressed using a sketch (10 minutes).

Depending on the size of the playground equipment and the type of play, sketches are drawn with product or scene onto one A4 paper. The storyboard contains five frames on one A4 paper, where the title is on the upper side of the frame, the situation is explained on the left side, and the conversation (serif) is on the right side.

In the evaluation of sketches and storyboards, the quality of the expressed design and the drawing ability such as the accuracy of the perspective projection method were not evaluated. However, the presence or absence of expressed elements and the number of keywords were

evaluated as follows:

Evaluation of a sketch

(1) Character drawing: Does the drawing include the person who play at the playground equipment as well as how to play?

(2) How to play explanation: Does the drawing include an explanation of how to play on the playground equipment using keywords and sentences?

(3) Detailed drawing: Does the drawing include detailed shapes such as a handle on the playground equipment?

(4) Supplementary explanation: Does the sketch include keywords and sentences to supplement the structure and details of the playground equipment?

Evaluation of a storyboard

(1) Situation description: How many frame descriptions include keywords and sentences?

(2) Conversation (serif): Number of frames with conversations that correspond to the sketch in the frame?

(3) Detailed drawing: Are detailed shape descriptions such as a handle part on the equipment present?

(4) Overall view drawing: Is there an overall picture of the playground equipment?

Tables 1 and 2 show the evaluation results for Group A and Group B, respectively. Group A, which initially sketched the equipment and then developed a storyboard, displayed the following results. In the sketch, only a few subjects drew a scene that included a character drawing (5 people: 25%). However, many subjects wrote an explanation of how to play (17 people: 85%) and supplementary explanations (18 people: 90%). Additionally, most subjects (19 people: 95%) provided detailed drawing. In the storyboard, more than half of the subjects provided detailed drawing (14 people: 70%), but
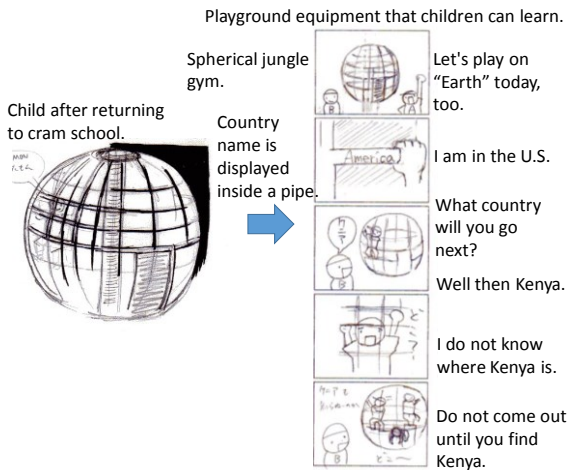
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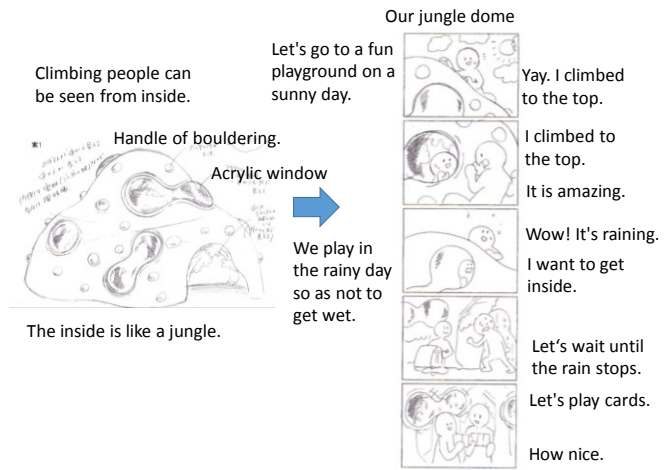**Figure 1:** Sketch and storyboard of A-3



**Figure 2:** Sketch and storyboard of A-12

less than half drew the overall view (9 people: 45%). Situation descriptions were confirmed in 2.45 frames, while conversations (serif) were confirmed for almost all the frames (4.85).

Group B, which developed the storyboard before drawing the sketch, displayed the following results. In the storyboard, less than half of the subjects provided detailed drawing (9 people: 45%), but more than half drew the overall view of the playground equipment (11: 55%). Situation descriptions were confirmed for 2.8 frames, but the majority of the frames (4.15) contained conversations (serif). In the sketch, many subjects drew scenes that included a character drawing (14 people: 70%). Additionally, almost all subjects explained how to play (18 people: 90%) and included supplementary explanations (18 people: 90%).

Comparing Table 1 and Table 2, more subjects in group A (14 people: 70%) provided detailed drawings in the storyboard compared to group B (9 people: 45%). However, group B (14 people: 70%) has a higher ratio of character drawings in the sketch than that of Group A (5 people: 25%).

## 4. DISCUSSION

Changing the drawing order of the storyboard and the sketch affects the design of the playground equipment. If the sketch is drawn first, the proportion of drawing detailed drawings in the storyboard increases. However, the situation descriptions, conversations (serif), and overall views are similar regardless of the order. These observations suggest that the presence or absence of detailed drawings in the storyboard depends on whether or not the sketch is drawn first.

Figures 1 and 2 show examples of Group A where the sketch is drawn before the storyboard (in these figures Japanese is translated into English). The storyboard effectively depicts the relationships between design objects and users and how to use the equipment. In the jungle gym in Figure 1, the sketch shows a spherical shape, but it is explained that the world map is expressed in the globe using a sentence instead of in the detailed drawing. In contrast, the subsequently drawn storyboard shows that the country name is displayed inside a pipe that children can touch. Thus, the drawing depicts two children engaged in cooperative play. In the playground equipment named "our jungle dome" in Figure 2, the sketch contains a detailed design and many written explanations, while the subsequent storyboard proposes a more attractive design by drawing the state of the inside of the dome with user's interactions.

These examples may indicate that drawing the sketch first led subjects to consider the interaction between the design object and the user by drawing detailed drawings in storyboard.

On the other hand, if the storyboard drawn first, the proportion of character drawings in the sketch increase. However, the how to play explanations, detailed drawings, and supplementary explanations are similar regardless of the order. These observations suggest that the presence or absence of character drawings in the sketch depends on whether or not the storyboard is drawn first.

Figures 3 and 4 show examples of Group B where the storyboard is drawn before the sketch (in these figures Japanese is translated into English). The sketch effectively depicts the relationship between the design object and the target user. In the mushroom-type playground equipment shown in Figure 3, the title of the
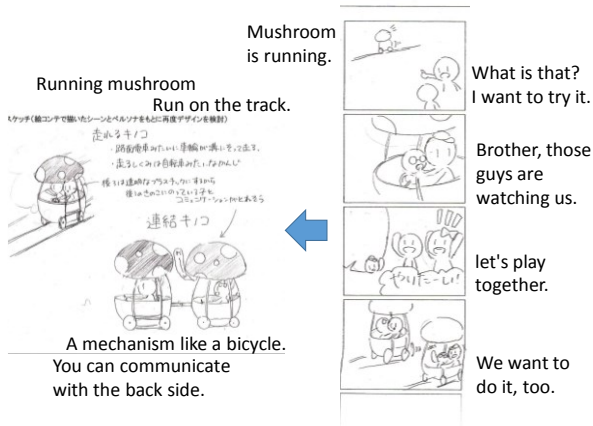
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**Figure 3:** Sketch and storyboard of B-3



**Figure 4:** Sketch and storyboard of B-18

storyboard is omitted, and the scene, which uses four of the five frames, does not consider how users interact with other people. On the other hand, the subsequent sketch has a detailed design that includes the structure of the playground equipment and scenes where children playing and enjoying the equipment are envisioned. In the playground equipment named "Let's fix the dislike of vegetables!" shown in Figure 4, the idea that a child will like vegetables by playing with a vegetable-type playground equipment is studied in the storyboard. The subsequent sketch depicts the relationship between the user and the playground equipment where the equipment can be used as monkey bars. Ideas of paprika-shaped monkey bar and onion shaped jungle gym are conceived and drawn.

These examples may indicate that drawing the storyboard first led subjects to consider the interaction between the design object and the user by drawing character in sketch.

## 4. CONCLUSION

Often in product design, characteristics such as the size, structure, material, and color are considered by drawing a number of sketches. These sketches, along with costs and mass productivity considerations, are used to determine the final design. On the other hand, in the design of experiences as typified by design thinking, design begins by considering the experiences of the target users. Common tools include the persona method and mind maps. However, after the user's experience is directed, display techniques, typified by sketches, are used in the design of objects and environments to realize the experience.

This research compares sketches and storyboards in the design of playground equipment toward realizing
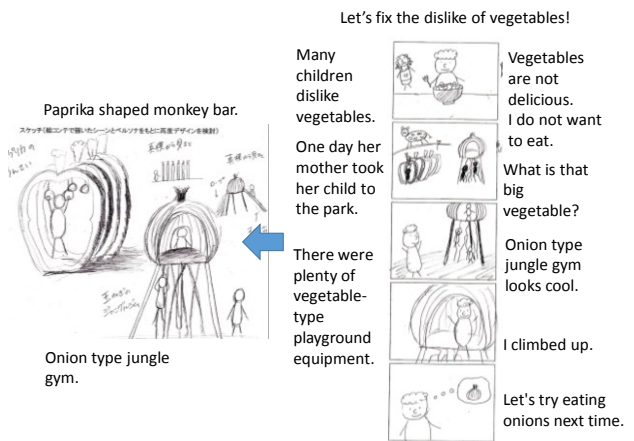
effective display techniques in the design of experiences. An experiment which changed the drawing order of the storyboard and the sketch confirmed that drawing a sketch first increases the detailed drawing in storyboard to examine the user's experience, while drawing the storyboard first increases the character drawing in a sketch to examine the interaction between design object and users. These results suggested that combining sketches and storyboards, which are usually used for different purposes, increases the examination of the user experience in storyboards and increase the examination of the interaction in sketches.

Toward realizing an effective display technique for the design of experiences, I plan to verify more diverse display techniques, identify an optimal display technique, and develop a learning method.

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