
TrackKenzan: Digital Flower Arrangement using Trackpad and Stylus Pen

Abstract

We propose “TrackKenzan”, a training system for *Ikebana* (Japanese flower arrangement) in a 3D-CG space using a trackpad and a stylus pen. In an actual *Ikebana*, a *Kenzan*, a flat metal base with hundreds of upward pointing pins, is used to hold flowers in place. In our training system, a trackpad represents a *Kenzan* in 3D-CG space, and a stylus pen equipped with a 3D tracker represents a flower stem. Users perform flower arrangement by selecting a CG flower to be represented by the pen, adjusting its length, its direction, its angle, and placing it on the trackpad. As a trackpad and a pen resemble a real *Kenzan* and its virtual flowers look like real world flowers, TrackKenzan provides an intuitive and an easy to use interface to the users. This paper describes the implementation of the system, its evaluation tests on actual users, and discusses future uses of the TrackKenzan.

Author Keywords

Ikebana, Flower Arrangement, Tangible Device

ACM Classification Keywords

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Introduction

Ikebana is a traditional Japanese art in which flowers and plants are specifically arranged in a vase for appreciation. It is enjoyed all over the world in decoration of rooms. Many studies are being done in order to hand down traditional *Ikebana* skills, using computer technologies such as virtual reality [2, 10] and 3D-CG simulations [5, 6]. In *Ikebana* lessons, practicing a lot of combinations of flowers and layouts repeatedly is important in order to have a sense of beauty [8, 9, 7]. Learning tools using virtual reality and CG simulation are effective, because learners can try as many flowers and layouts arrangements as they want without spending money on actual flowers. In a digital practice world, a learner can even restore a flower stem that has been trimmed too short, and can try another arrangement with the longer flower stem [3]. However, we think that we should carefully design a user experience in VR and CG based learning tools, because difference between a user's experience in the virtual world and that in the real world may hinder effective learning.

In this paper, we propose and implement “TracKenzan”, a training system for *Ikebana* in 3D-CG space using a trackpad and a stylus pen. A user manipulates a trackpad and a stylus pen that represents a virtual *Ikebana* and flower stem. The similarity of their shape provides continuous user experience between manipulation in the real world and CG presented in the virtual world. The system has been evaluated on 11 beginners, 7 experienced learners and one *Ikebana* teacher. They evaluated that it is easy to use and useful for practicing *Ikebana*.

TracKenzan

In an actual *Ikebana*, a *Kenzan* is often placed at the bottom of a vase to hold flower materials such as flowers, branches and leaves in places, as shown in Fig. 1. A

Kenzan is a metal object consisting of hundreds of upward-pointing pins set on a flat weight. People usually hold a *Kenzan* with their non-dominant hand, and hold flower materials with their dominant hand to arrange them. Pins on a *Kenzan* pick the edges of flower materials and hold them in place.

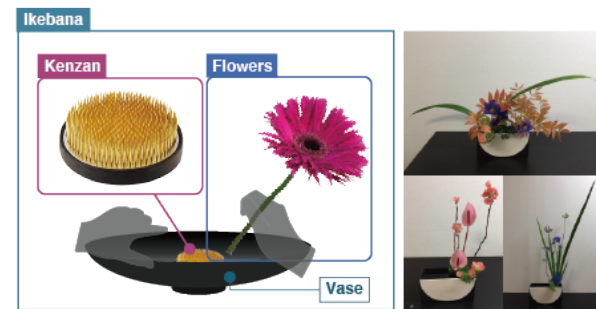


Figure 1: In *Ikebana*, flower materials are pierced on a *Kenzan*.

TracKenzan is a 3D-CG based *Ikebana* practice system. The overview of the system is shown in Fig. 2. A user manipulates a trackpad and a stylus pen with a VR tracker attaches at the end (Fig. 3). The trackpad represents the *Kenzan* placed in the CG vase, and the stylus pen represents a flower material displayed in the CG world. The flower material show in the LCD moves as a user changes the position and rotation angle of the tracker equipped stylus pen, hereinafter referred to “flower stem device”.

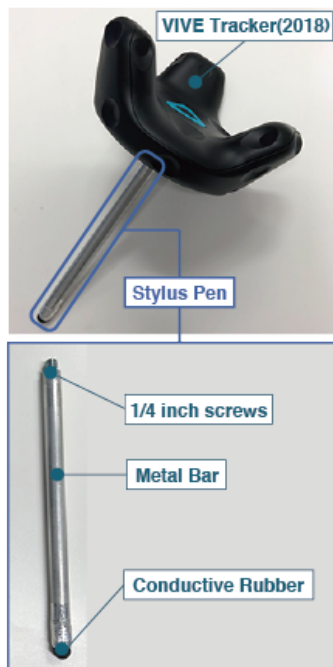


Figure 3: Flower stem device: stylus pen equipped with VR tracker.

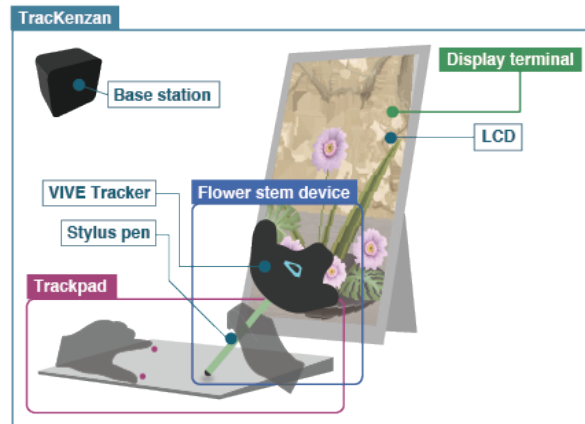


Figure 2: Overview of TracKenzan system.

Implementation

We implemented TracKenzan on a MacBook Pro with macOS 10.13.5 and Unity environment. To enable a flexible arrangement of the computer display (e.g. switching portrait/landscape view), an external LCD (ASUS MB 169C+, a 15.6 inch full HD liquid crystal display) is connected to the PC.

We used Apple's Magic Trackpad 2 [1] to represent CG *Kenzan* on the display. By using XY position data on the trackpad besides 3D tracker, a user can place CG flower materials more precisely. In addition, thanks to the built-in pressure sensor and vibration actuator, it is possible to give a tactile feed back to the users when a CG flower stem is inserted into CG *Kenzan*. By using the trackpad device, the user can easily recognize the position and action of flower material insertion. It is expected that this makes learning *Kenzan* usage effective.

The flower stem device is made of a metal rod, a

conductive rubber, and an HTC's VIVE Tracker [4], as shown in Fig. 3. We installed one VIVE Base Station above the user to detect the position and rotation angles of the VIVE tracker. The detected data is reflected to the movement of a CG flower material shown on the display. When a user hold and move the rod, the corresponding CG flower material changes its position and angle. This feels as if the user is holding the flower stem inside the CG world. This device functions as a stylus touch pen on the trackpad. When the user touches or press the rod onto the trackpad, the touch and position is detected through the conductive rubber tip.

Operation

This section explains the usage of TracKenzan. As the position of the conductive rubber of the flower stem device is detected when the device touches or presses the trackpad, the tracker position is calibrated on the fly while the user performs *Ikebana* tasks. Once the initial calibration is finished, the user can perform *Ikebana* activities such as selecting, cutting, restoring, inserting, and extracting flower materials.

Selection Fig. 4 shows flower materials and vases that can be used by TracKenzan. Users can select one of the flower materials using a one finger left or right swipe on the trackpad. The vase is selected using a three finger flick. They then appear on the 3D-CG world, and the selected flower materials become controllable by the flower stem device, that is, it moves according to the movement of the device.

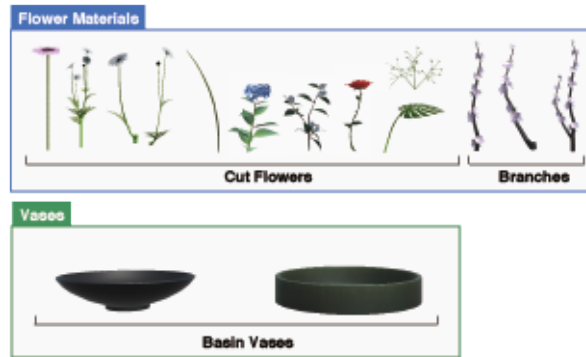


Figure 4: Flower materials and vases used in TracKenzan.



Figure 5: Horizontal flick selects flower materials.

Cut and Restore Pinching in by two fingers on the trackpad allows user to cut and shorten the stem of the flower device, as shown in Fig. 6. Cutting a stem is a basic *Ikebana* step to affect the flower layout significantly. Cutting is usually one of the difficult steps because the action is irreversible. In our system, pinching out by two fingers allows users to restore the part of the stem that is trimmed in the previous cut action.

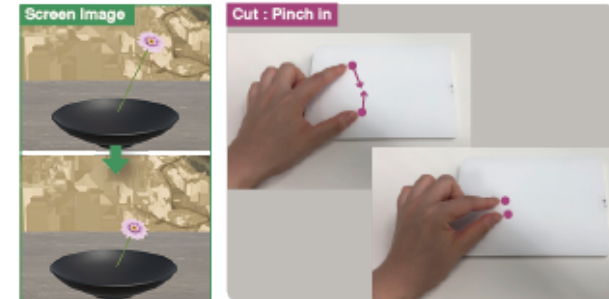


Figure 6: Pinching in and out adjusts stem length.

Insert and Extract When the user press the tip of the flower stem device onto the trackpad surface, the corresponding CG flower material is inserted onto the CG *Kenzan* inside the CG vase. This operation causes the trackpad to vibrate, and the user obtains haptic feedback at the pen tip. Position and angle of the flower material are fixed and are not affected by the movement of the flower stem device anymore. The user can extract the flower to retry different layout. When the user clicks at the position of the target flower by the flower stem device, while touching with 3 fingers on the trackpad as shown in Fig. 7, the flower material is detached from the CG *Kenzan* and become controllable by the flower stem device again. The use of 3 fingers touch mimics the real-world action of fixing *Kenzan* so that the flower is extracted successfully. Note that the unlimited trial and error mentioned here is only available in the digital world, because a flower stem is easily damaged by pins of a *Kenzan* in actual *Ikebana*.

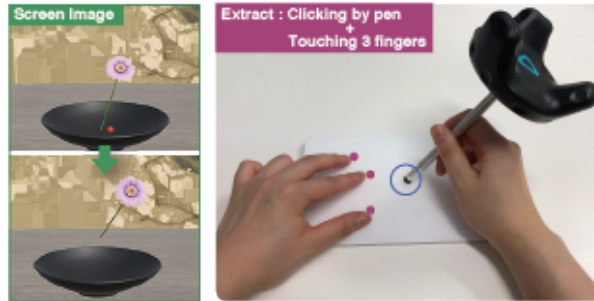


Figure 7: Clicking by pen while touching with 3 fingers extracts a flower from *Kenzan*.

Viewer The user can confirm the finished work(s) of *Ikebana* by TracKenzan's viewer. The finished works is outputted to XML files. The output file has seven kinds of information, i.e. the vase name, the flower's name, the position of flower materials in space(X-Y-Z coordinate), the insert position on trackpad (X-Y coordinate), the rotation of flower materials, the scale of flower materials, the sequence inserted in trackpad. The user can show this viewer when press the Enter key.

Demonstration and User Study

TracKenzan has demonstrated *Ikebana* training in 3D-CG world. Comparing TracKenzan's *Ikebana* training with real *Ikebana* training, they are the same to intuitive handling. However, some function e.g. add flower materials etc. is still scarce in our system. Nonetheless, our system shows that *Ikebana* trainers' desires for a demand of *Ikebana*'s training system different in beginners and teacher and experience learners. We now discuss the implications of these findings for training system for *Ikebana*.

TracKenzan's UI, that is a combination a trackpad and a stylus pen itself had no issues to be criticized, but a problem occurred during making the *Ikebana* works using our system by beginners. Some beginners were confused how they could make the *Ikebana* works by themselves. Therefore, our training system requires to provide some samples of *Ikebana* work that serves as a useful reference for beginners. TracKenzan's viewer implementing the processes of producing *Ikebana* work (Fig. 8). By determining the flowers position on *Kenzan* by a procedure like this, the beginner can easily and speedily perform operation without hesitation.

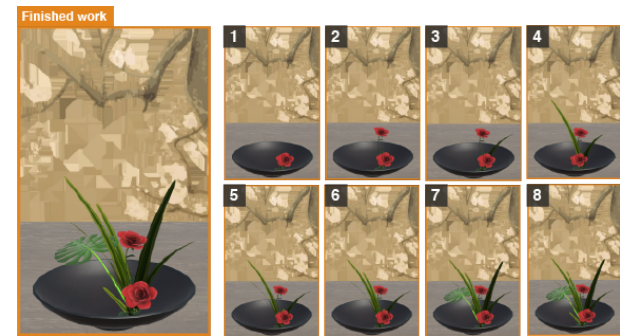


Figure 8: TracKenzan's users are able to see the processes of producing *Ikebana* work.

The *Ikebana*'s teacher and the experienced learners had an expected completion image of an *Ikebana* work. Therefore, the primary use of TracKenzan was simulation of an *Ikebana* work. To increase the number of flower materials in order that TracKenzan can be easier to use and frequently used.

Conclusion

We propose TracKenzan, a digital training system for *Ikebana* flower arrangement in 3D-CG space using a trackpad and a stylus pen. In the system, the trackpad is assigned to a CG *Kenzan* and a stylus pen to a CG flower stem. The similarity of their shape provides user experiences closer to that of an actual *Ikebana* for effective learning. We have evaluated the usability through user experiments. The SUS scores and comments given by the subjects suggests that this system is useful and effective for *Ikebana* training. In the future, based on our discussion, we intend to improve our training system for beginners and teacher and experienced learners.

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