Anamorphicons: An extended display with a cylindrical mirror

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ABSTRACT
We developed an interactive system which takes the technique of Anamorphosis, with a 2D display and a cylindrical mirror. In this system, a distorted image is shown on a flat panel display or tabletop surface, and the original image will appear on the cylindrical mirror when a user puts it on the display. By detecting the position and rotation of the cylinder, the system provides interaction between the user and the image on the cylinder. In our current prototype, an iPad screen and its multi-touch display is used to detect the cylinder.

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General terms: Design, Human Factors

Keywords: Anamorphosis, anamorphicon, tangible, phicon.

INTRODUCTION

Anamorphosis is a painting technique of drawing distorted images. The viewers are required to use special devices or to take a specific perspective to recognize the undistorted image. Specifically, anamorphosis that uses a cylindrical mirror is called cylindrical mirror anamorphosis. The technique of anamorphosis was introduced in modern media art, such as "The silhouette of a shadow" [1] , which shows a distorted movie on a 2D display and viewers look into a cylindrical mirror to enjoy the original image.

In our study, we have implemented an interactive cylindrical mirror anamorphosis using a flatpanel display and a cylindrical mirror placed on the display. We named our cylindrical mirror device "Anamorphicons" by combining anamorphosis and phicons (physical icons)[2]. By detecting IDs, position, rotation of the Anamorphicons that is placed and manipulated by users, and by changing images on the underlying display, various interactive methods could be possible.

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[1] http://www.iamas.ac.jp/ exhibit09/research_maekawa.html

Figure 1: An traditional anamorphosis with a cylindrical mirror.

IMPLEMENTATION

We have implemented an Anamorphicon system using an iPad as a display and detector for our cylindrical mirror. Interactive content to browse a 360 degrees view of an item was also developed.

In this section we explain the system implementation in two parts; detecting method and display method.

Detecting Method

To detect the coordinates and rotation of the cylindrical mirror placed on the iPad, we used two touch pens which are commercially available for the iPod. These kinds of touch pens have conductive rubber on their tip to change the capacitance on the iPad surface. We placed two touch pens inside a reflective cylinder, on opposite sides and touching the bottom, as illustrated in Fig.2. Also, the top side of the cylindrical mirror is an aluminium board. The touch pens and the aluminium board is connected by electric leads to detect the users' manipulation . By this structure, the iPad application is able to detect the coordinates of two points from the touch pens, when the user touches the aluminum board. By computing the middle point of the coordinates of the two touch pens, the software can determine the position of the cylinder. The software can also detect the rotation of the cylinder from the position of the two touch pens. Depending on this information, the software displays interactive content.

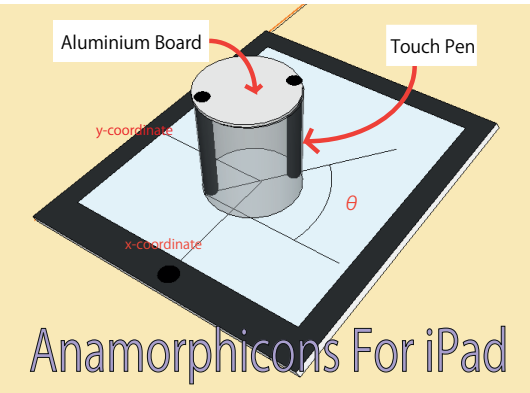

Figure 2: Anamorphicon detection by iPad.

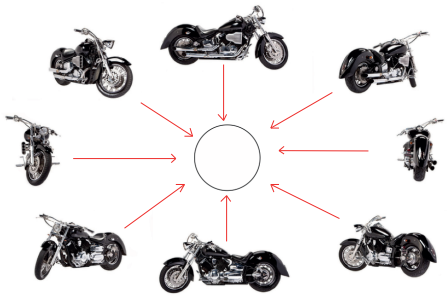

Figure 3: The example images for 360 degrees view. ©J Collingridge Photography 2010

Display Method

As an application of this system, we developed a 360 degrees viewer, which displays images of an item on the cylindrical mirror surface. When a user rotates the cylinder, a picture depending on the rotation angle appears on the mirror. This will create an illusion, as if the user is rotating the item by his/her hand.

We prepared about 70 pictures of an item taken from various angles. The examples of them are shown in Fig.3. And we converted them to anamorphic images using Photoshop's polar coordinates filter.

The application changes the image shown on the iPad display according to the rotation of the cylinder. Fig.4 is a snapshot of the application when a user is rotating the physical cylindrical mirror by her hand. An image of a motorcycle from a certain angle is shown on the surface of the cylinder. The user experience is as if she is rotating the miniature motorcycle by her hand, and is able to examine the item though 360 degrees by intuitive direct manipulation.

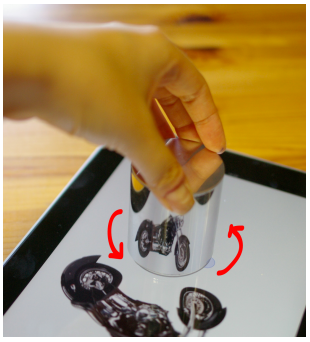

Figure 4: System Usage. Rotating the object on the mirror.

RELATED WORK

Battery-less passive display devices used on a flatpanel or tabletop display have been developed in previous work. Data Tiles[4] are clear acrylic tiles, and Lumino [1] is a block of glass fiber bundles, which are designed to be used as passive displays. When a user puts them on a flatpanel display, the system displays images just under these tiles or blocks. Tablescape plus[3] uses free-standing miniature projection screens on a tabletop display with a special optical sheet to control light path. A user arranges these screens to play with interactive content.

Anamorphicons realizes a simpler and lower-cost method of displaying semi-3D images on a vertical surface over a flatpanel display.

CONCLUSION AND FUTURE WORK

We developed the Anamorphicon system which provides interaction between the user and the image on the cylinder by detecting the position and rotation of it. Since our method shows interactive pictures on a simple object without expensive parts like batteries and electric circuits, we believe that various potential applications are available for Anamorphicons.

In a further study, we are planning to apply Anamorphicons to video conferencing, in which each remote participant appears on a cylindrical mirror, and a user can interact with them by moving and rotating the mirror.

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