# Tracing Sensation to Fingertip Using a Rotating Disk*


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***Abstract*—This study presents a novel approach for realistic tracing sensation that can present surface texture and friction cues using a fingertip-sized disk that is rotated while the finger is in contact with the center of the disk. This approach provides a realistic tracing sensation continuously and in any direction. with more compact form than previous roller-type methods.**



***Index Terms*—haptics, haptics interface, skin stretch, tracing sensation**


## I. Introduction

The elucidation of tactile perception, particularly the discrimination of texture and frictional forces of objects, depends on the effective presentation of tracing sensations to the fingertip. While several methods have been proposed to emulate realistic tracing motions through the use of plate-like mechanisms [1] [2], these devices often manifest as large or complicated. On the other hand, previous research has highlighted the low-ability of human in accurately perceiving the orientation of the lateral component of fingertip skin deformation [1] [3], thus suggesting that exact replication of horizontal skin motion may not be strictly required. With this in mind, this study presents a novel approach in which a disk of similar dimensions to the fingertip is rotated while the fingertip remains in contact with the center of the disk to present a tracing sensation.

## II. Implementation & Demo Experience

A fingertip-mounted device has been developed which presents a tracing sensation through contact between the rotating disc and fingertip (Fig. 1: top). The device consists of a disk for contact with the finger, a double-shaft motor with 20:1 gear for rotating the disk, a magnetic encoder, and Velcro for attaching both the finger and the device. All components are held in place by a 3D printed frame, with the disk and frame fabricated using 3D printing resin. The disk surface was polished using #600 sandpaper. The diameter of the disk was set at 12mm, taking into account that it would not exceed the width of a finger and would cover the contact area when tracing an object.

During the demonstration, the motion capture system is employed to deliver rotational stimuli to the fingertips of the users, based on the speed of their hand movement (Fig. 1: bottom). The user performs a tracing motion on the textured surface displayed on the virtual space, back and forth, left and right, and the disk rotates according to the motion, presenting a continuous and realistic texture sensation.

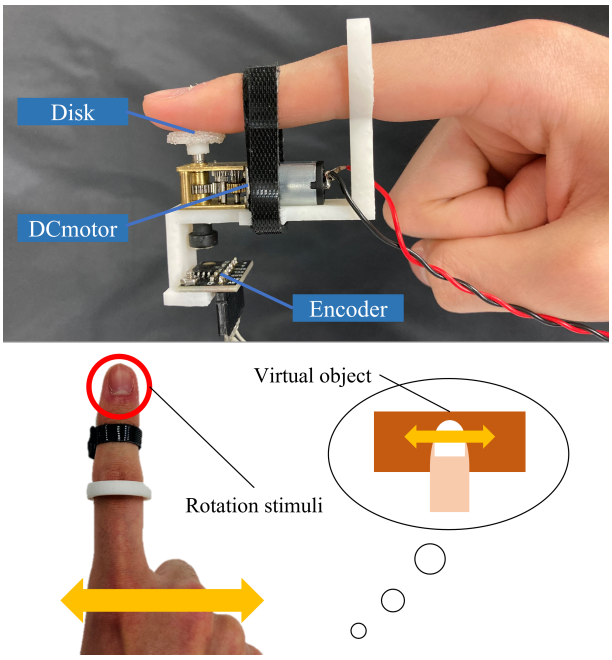


Fig. 1. (top) Exterior view of the equipment, (bottom) demonstration


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## References


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