WeATaViX: Wearable Actuated Tangibles for Virtual Reality Experiences

Thomas Howard, Xavier de Tinguy, Guillaume Gicquel, Maud Marchal, Anatole Lécuyer, Claudio Pacchierotti

WeATaViX:
Wearable Actuated Tangibles for Virtual Reality Experiences

Thomas Howard[1], Xavier de Tinguy[2], Guillaume Gicquel[1], Maud Marchal[2],
Anatole Lécuyer[3] and Claudio Pacchierotti[1]

Abstract— This demo presents the WeATaViX: a wearable haptic interface for natural manipulation of tangible objects in Virtual Reality (VR). The device uses an interaction concept between encounter-type and tangible haptics, bringing a tangible object in and out of contact with a user's palm, allowing rendering of making and breaking of contact with virtual objects, as well as grasping and manipulation. The demo places the user in a virtual orchard in which they can experience the availability of tangible counterparts to any grasped interactible object in the virtual environment, as they pick and place apples, play fetch with a virtual dog and his ball, and even actuate the virtual handle of a juice machine preparing fresh virtual organic apple juice.

I. DEVICE AND DEMO SETUP

Fig. 1. The WeATaViX interface - From Left to Right: CAD assembly, disengaged device (free hand), engaged device (user grasps a virtual object)

The WeATaViX[1] is a novel wearable 1-DoF device capable of bringing a tangible object in and out of contact with a user's hand as needed to render making and breaking of contact between a user's virtual hand and virtual object, as well as grasp and release interactions in immersive VR (see Fig. 1). It consists of a 3D printed base attached to the back of the user's hand using an adhesive silicone layer, which holds a HTC Vive tracker as well as a servomotor armature. The servomotor actuates an arm supporting the tangible object (in this case, a sphere) equipped with capacitive sensors allowing grasp detection. Movements of the user's hand are reproduced onto the virtual hand thanks to information from the mounted tracker, while the user views the virtual environment through an HTC Vive VR headset. The device is designed with wearability in mind, weighing under 90g without the tracker, and keeping the palm and fingers completely free of any straps thanks to the adhesive silicone fixation. The silicone layer is capable of securely attaching the device during prolonged use (>45 min) and throughout multiple attaching/detaching cycles (>30).

II. INTERACTIONS

Our demo is set in a virtual orchard (see Fig. 2) in which the user can grasp, manipulate and release multiple interactible objects as they pick and place apples (see Fig. 2-(B & C)), play coconut shie (see Fig. 2-D) or fetch with a virtual dog and his ball (see Fig. 2-E), and actuate the virtual handle of a juice machine preparing fresh organic virtual apple juice (see Fig. 2-F). The demo highlights the capability for easily
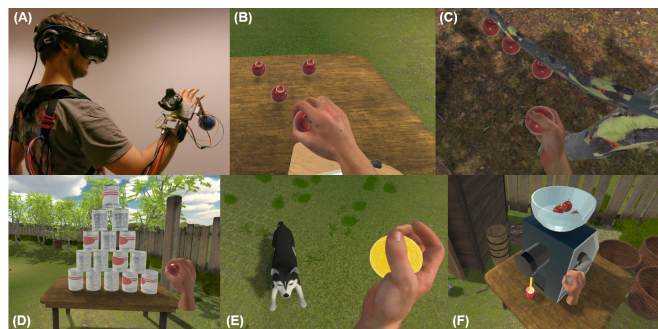

Fig. 2. (A) The user views the virtual scene via a HTC Vive HMD, while their hand is tracked using the Vive tracker mounted on the WeATaViX. When their virtual hand interacts with virtual objects, the device brings the tangible sphere in and out of contact with the user's hand as needed. This allows various picking and grasping interactions, e.g. (A) picking up apples or (B) picking them from a tree. It also enables throwing interactions (D & E) and the tangible representation of handles of virtual objects (E). (D), (E) & (F) also highlight the capability for rendering interactions with different virtual objects of similar shapes or dimensions.

providing tangible haptic feedback for an object anywhere in the workspace by using a teleportation mechanic to move between interaction locations, leading to reconfiguration of the interactible virtual elements' locations relative to the user. Furthermore, it shows that even with a fixed shape end-effector (in this case a sphere), it is possible to convincingly render interaction with different virtual objects whose shape (see Fig. 2-(B,C,D,E)) or different (see Fig. 2-F) to that of the actual tangible end-effector, so long as their dimensions remain similar. The latter case is showcased by the actuation of the virtual juicer's cylindrical handle, and picking and placing of the cylindrical cup of virtual apple juice.

A video showing the demo interactions can be found at https://youtu.be/59fW1zRtaAo and as supplemental material.

REFERENCES

[1] X. de Tinguy et al., Weatavix: wearable actuated tangibles for virtual reality experiences, *Proc. Eurohaptics Conf.* (2020)