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Direct Feedforward techniques for the ViRgilites system

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Figure 1: Implementations of Direct Feedforward in ViRgilites. Left: Avatar demonstration of the interaction selected in the user interface. Right: Multiple Alternative Interactions of the same action

ABSTRACT

In this poster we propose an implementation of direct feedforward for the ViRgilites system. The project defines two alternative uses, with respect to the current implementation, that only shows in an indirect way (icons, target object images, text) how to perform an interaction in the simulated environment. The first representation is a single avatar mode where the user sees a virtual avatar performing an action in the same environment as the user, while the second representation is a multiple avatar mode, where the user can choose to compare two interactions and see the avatar representations side by side in dedicated panels. We report on the initial ideas and proof-of-concepts, while we envision further modifications and a future evaluation of the final outcome.

CCS CONCEPTS

• **Human-centered computing** → **Virtual reality**; *Graphical user interfaces*; • **Applied computing** → **Education**.

KEYWORDS

virtual reality, toolkit, meta-design, vocational education, feedforward

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1 INTRODUCTION

In recent years, Virtual Reality (VR) has seen an increased interest towards the general population. Headsets can be used from entertainment and educational purposes, and in this field we have seen many commercial products. Casual users that approach this technology often find difficulties at understanding how to interact with the virtual environment, and the ViRgilites system [1] was developed to support the user to explore, discover and perform interactions with virtual objects.

ViRgilites is a meta-level user interface [2] made in the Unity Game Engine, meant to In ViRgilites users perform standard MRTK [3] interactions, as indicated in the user interface, to complete a procedure, that defines the steps to perform a real-world task in the virtual environment. The current interface implements an "indirect representation" feedforward approach for letting users understand how to perform an interaction (as seen in Figure 1, the central part of the interface shows necessary data to let the user know that performing the action described in the topmost card will result in the completion of the step itself - description texts, modality

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icon, target object). The current implementation, by design, does not show how the action is actually performed, leaving the user only with the necessary instructions for performing it. While this is sufficient for simple tasks, it can be limiting for more complex or intricate procedures that involve multiple steps or actions. One possible solution to this problem is to provide visual feedback in the form of a real-time representation of the virtual environment, demonstrating what the user needs to do to complete the interaction. This can help users understand and perform complex interactions more effectively.

2 DIRECT FEEDFORWARD IMPLEMENTATIONS

In this poster we propose two possible additions to the project, portraying "direct representation" approaches of feedforward elements that we currently show inside the user interface. We will use the feedforward classification of Muresan et al. [4] for describing the implementation of our proposals.

The first representation (Figure 1 - Left) uses a transparent (Rendering), full (Avatar Type) avatar for showing how to perform an animation inside the virtual environment where the user currently is located. This representation can be triggered using a dedicated button in the interface (Trigger type), and the avatar shows how to perform the interaction in third person and using a separate object that spawns at the same spot of the original one and gets interacted exclusively by the avatar (Perspective, Duplication, Targets). An interesting detail about the avatar is that it has been developed in a way that does not require a priori knowledge of the virtual environment. Indeed, the moment the user requests a demonstration of the interaction, the avatar will disembody from the body of the user and then it will perform the action, either from a distance (if the modality does not require a close interaction) or near the object (by approaching the object by avatar translation), using Inverse Kinematics [1] to adapt the standard animation with respect to the position of the target object. The animation will stop itself at the end of the sequence (Untrigger) but it can be freely restarted at any point, and if the user swaps card mid-animation a new avatar will appear, performing the latest selected animation (Playback).

The second representation (Figure 1 - Right) takes advantage of the previous one, inheriting most of the features previously described (Rendering, Avatar Type, Perspective, Duplication, Targets, Untrigger) with a different intention: instead of showing the animation in the main virtual environment, it shows the animations inside virtual screens, that appear on-demand after having flagged two different cards for comparison and started the animations using the comparison button (Trigger Type). The animations view show the avatars performing the interactions using a shoulder-mounted virtual camera, and they play at the same time in dedicated screens that appear when the comparison button is pressed.

This is the starting point for the evolution of the system. Future development will envision further modifications to the current interface. In particular, a different view for the second representation will show the avatar interaction directly inside the cards, instead of showing them in a separate view. Moreover, we will implement a different, alternative comparison interaction flow: the user, once he selects a card, can press the comparison button to pin the card to the red view; once in this new interface, the user can scroll the other cards and compare the interactions just by scrolling the card stack (the topmost card will be shown as the green card). These modifications will not be final: we are expecting to further discuss the design of the project with expert members of the HCI and XR community, to converge to a candidate final version that will be finally tested in user evaluations.

[1] https://en.wikipedia.org/wiki/Inverse_kinematics

3 CONCLUSIONS

We have presented two possible practical ways to demonstrate how to perform an interaction in a virtual environment, while using the ViRgilites system. These representations makes use of full avatars that are animated in a way to dynamically interact with the system, and hence being relevant to the task that has to be shown to the user. This intermediate state will be further improved with refinements suggested by experts in the field, and finally, evaluated comparing the current indirect representation with respect to the presented direct one. Moreover, we will study similar works and compare them with the proposed work, for finding positive and pain points that need to be improved in subsequent research.

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