Pseudo Haptic interaction with CAD data

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In a previous work [1], the VENISE team proposed a proof of concept on a model allowing direct modification of native CAD data from VR immersive environments. Recently, a new interaction technique enhanced this model to make possible the modifications on internal parameters of such complex 3D objects by non CAD experts (such as designers) thanks to "natural" gestures.

Usually, 3D shapes of CAD parts are defined from sketches defined from 2D elements, several constrains and parameters. These 2D sketches are used to generate 3D objects thanks to the application of operations (revolution, extrusion, sweep, pocket, hole...). On CAD workstation, these settings are defined and modified using 2D widgets and requires user skills on using the CAD system. Our new interaction technique allows a non CAD expert to select between possible alternative shapes of a part linked to a discrete variation of one CAD parameter value (distance, radius, angle…). Moreover, this technique uses haptic assistance to guide the user gesture while exploring the alternative solutions.

Currently, users select the CAD parameter using a simple collision detection with the 3D shape extracting a list of available parameters, from which only a "default" parameter is used to generate alternative shape solutions.

To allow users to select intuitively any of the available parameters, this internship aims to study various pseudo-haptic assistance approaches [2]. After a bibliographical study of previous works based on such "haptic illusion", the research focus will be to propose and design pseudo-haptic metaphors allowing efficient selection of CAD parameters. Then, a user study will be carried out to compare these approaches. Software development will be performed on MiddleVR/Unity using a customized visuo-haptic C++ library (VHServer). Implementation will be done on the most advanced immersive installations of the VENISE team, its

CAVE (http://www.limsi.fr/venise/EVEsystem) or some of its HTC VIVE headset.

User modifying a CAD part in the EVE system using "Haption Scale One" haptic device.
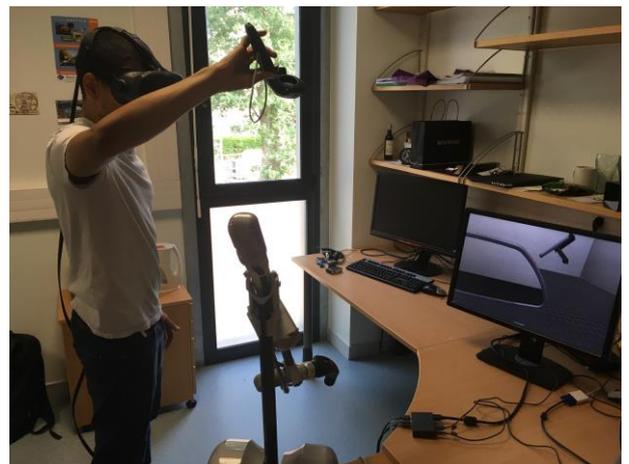
User modifying a CAD part from 3D gesture using HTC VIVE head mounted display.

CONTEXT: CAD (Computer Aided Design), CATIA (Dassault Systèmes), MiddleVR, Unity.

MANDATORY SKILLS: C++/C# Programming.   OPTIONNAL SKILL: GPU Programming

REFERENCES:
[1]   P. Martin, S. Masfrand, Y. Okuya, and P. Bourdot: A VR-CAD Data Model for Immersive Design - The cRea-VR Proof of Concept. Augmented Reality, Virtual Reality, and Computer Graphics - 4th International Conference, AVR 2017, Ugento, Italy, Proceedings, Part I, pp. 222-241. LNCS 10324, Springer, 2017.
[2]   A. Lecuyer &Al, Pseudo-Haptic Feedback: Can Isometric Input Devices Simulate Force Feedback?, IEEE VR, 2000
      (see http://people.rennes.inria.fr/Anatole.Lecuyer/).