HapStack Game

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Table of Contents

Introduction

This document presents **HapStack Game**- A game application developed on the Unity Game Engine (http://unity3d.com) which uses the Haptic plug-in for Unity provided by The Digital Design Studio (DDS), part of Glasgow School of Art, for Geomagic® OpenHaptics Toolkit version 3.3.0 by 3DSystems™, along with the Oculus Rift ® DK2 for stereoscopic visualization.

This application is provided with:

1. *HapStack.exe*

   The executable file to view the scene game on your PC monitor

2. *HapStack_DirectToRift.exe (to be launched to use Oculus Rift ®)*

   The executable file to view the scene game through the Oculus Rift © Development Kit 2

3. *HapStack_Data*

   The folder that contains the data of the game including, among other things:

   a. *ASimpleHapticPlugin.dll*

      The Haptic plug-in for Unity provided FREE OF CHARGE by The Digital Design Studio (DDS), part of Glasgow School of Art

   b. *OculusPlugin.dll*

      The plug-in for Oculus Rift ® to function on Unity (for more information see OVR licencing)

4. *HapStackSingleScreen.exe*

   The executable file to view the scene game through a computer screen

5. *HapStackSingleScreen_Data*

   The folder that contains the data of the game including, among other things:

   a. *ASimpleHapticPlugin.dll*

      The Haptic plug-in for Unity provided FREE OF CHARGE by The Digital Design Studio (DDS), part of Glasgow School of Art

The Development was carried out at the Digital Design Studio (DSS), part of the Glasgow School of Art, The Hub, Pacific Quay, G51 1EA.Glasgow, United Kingdom.

HapStack Game with Oculus Rift ® - SOFTWARE DISCLAIMER

The HapStack Game has been tested only on the Touch device from Geomagic® using the OpenHaptics toolkit version 3.3.0, along with Oculus Rift ® DK2 to support stereoscopic visualization.

Oculus Rift ® license agreement is provided in the documentation folder.

Limitation of Liability

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW EVEN IF A REMEDY FAILS ITS ESSENTIAL PURPOSE, IN NO EVENT SHALL DDS OR ITS SUPPLIERS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, DIRECT, INDIRECT OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION, OR ANY OTHER PECUNIARY LOSS) ARISING OUT OF THE USE OF OR INABILITY TO USE THE SOFTWARE OR THE PROVISION OF OR FAILURE TO PROVIDE SUPPORT SERVICES, EVEN IF DDS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN ANY CASE, DDS' ENTIRE LIABILITY UNDER ANY PROVISION OF THIS SUPPLY SHALL BE LIMITED TO THE AMOUNT ACTUALLY PAID BY YOU FOR THE SOFTWARE PRODUCT. Because some European/US states and jurisdictions do not allow the exclusion or limitation of liability, the above limitation may not apply to you. In such states and jurisdictions, DDS liability shall be limited to the greatest extent permitted by law and the limitations or exclusions of warranties and liability contained herein do not prejudice applicable statutory consumer rights of person acquiring goods otherwise than in the course of business. The disclaimer and limited liability above are fundamental to this Agreement between DDS and you.

Haptic Plug-in for Unity - SOFTWARE DISCLAIMER

The Haptic plug-in for Unity is provided FREE OF CHARGE by The Digital Design Studio (DDS), part of Glasgow School of Art, and has been tested only on the Geomagic® Touch devices, formerly known as Sensable Phantom Omni, with Openhaptics toolkit version 3.0, and the Touch device from Geomagic® with the Openhaptics toolkit version 3.3.0. The plug-in is not yet tested on any other Haptic Device. This software is supplied "AS IS" without any warranties and support.

DDS assumes no responsibility or liability for the use of the software, conveys no license or title under any patent, copyright, or mask work right to the product.

DDS reserves the right to make changes in the software without notification. DDS also makes no representation or warranty that such application will be suitable for the specified use without further testing or modification.

Any scientific contribution using the Haptic plug-in for Unity provided by the DDS, "MUST" be properly referenced to the DDS in corresponding publications under the following statement:

> *Haptic Plug-In for Unity (2014)- M. Poyade, M. Kargas, V. Portela, Digital Design Studio (DDS), Glasgow School of Art, Glasgow, United Kingdom.*

Additionally, any scientific contribution using the custom force effects provided by the Haptic plug-in for Unity for the simulation of power tools, "MUST" reference the following literature in corresponding publications:

> *Poyade, M., (2013), Motor Skill Training using Virtual Reality and Haptic Interaction: a case study in industrial maintenance, PhD Thesis, University of Malaga, Malaga, Spain. (Available on Demand). Viva defended on July the 4th, 2013, University of Malaga, Malaga, Spain.*

Any development using the Haptic plug-in for Unity provided by the DDS, for commercial purpose "MUST" be notified and agreed with the responsible persons at the DDS.

HapStack Game - Conditions of Use

For proper use, please follow the instruction below:

Sit comfortably in front of the haptic device and the Oculus Rift ® Camera located about your monitor.

Launch the application by clicking the "HapStack_DirectToRift.exe" file. Switch on the Oculus Rift ® and put it on your head, ensuring that it is adjusted to fit. if the game is not displayed in the Oculus Rift ®, restart the Oculus Rift ® (until the diode switches from orange to blue).

*Attempt to approximately match the stylus of the haptic device in the real world, with its representation in the game (*Figure 1*).To do so, move the base of your haptic device on your desk. This match is an approximation and is subjective to each user. The idea is to have a natural sensation during the manipulation so that "I can see the representation of the haptic device stylus in the game where I perceive my hand to be".*

Figure 1. Conditions of use

Be aware of the Health and Safety considerations when using the Oculus Rift ®. Health and Safety warning is displayed on launching the game. For more legal information about Oculus Rift ® Health and Safety, please report to the license agreement provided in the documentation folder.

For a proper use of the game, ensure that your haptic device is calibrated.

Use the right and left arrow key on your keyboard to rotate the haptic workspace around the block stacks

Use the up and down arrow keys on your keyboard to respectively zoom in and out with the camera.

HapStack Game - Rules

HapStack Game is a single player computer game, which is inspired by a popular motor coordination game, but the interaction is ensured by a Geomagic® Touch haptic device from 3DSystems™.

The aim of the game is to pick the blocks one by one, between the bottom of the stack and below the top two layers, and to place them on top of the stack in order to build the highest stack as possible.

The blocks that are eligible to be picked up will be highlighted with a shade of green when touching them with the haptic device (Figure 2). On the contrary, the block not eligible to be picked up (those located in the top two layers of the stack) will be highlighted with a shade of red when touching them with the haptic device (Figure 3).
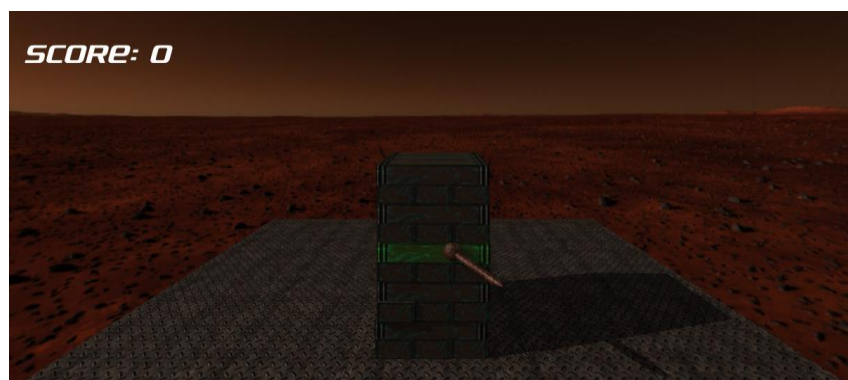

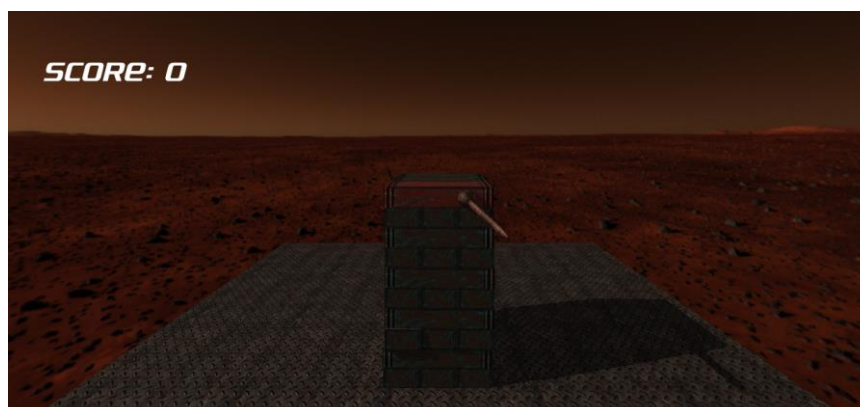Figure 2. Selection of a eligible block.

Figure 3. Selection of a non-eligible block.

To pick up a block, touch it with the haptic device, and continuously press button 1 (Figure 4). The block will be selected and controlled in position and orientation by the

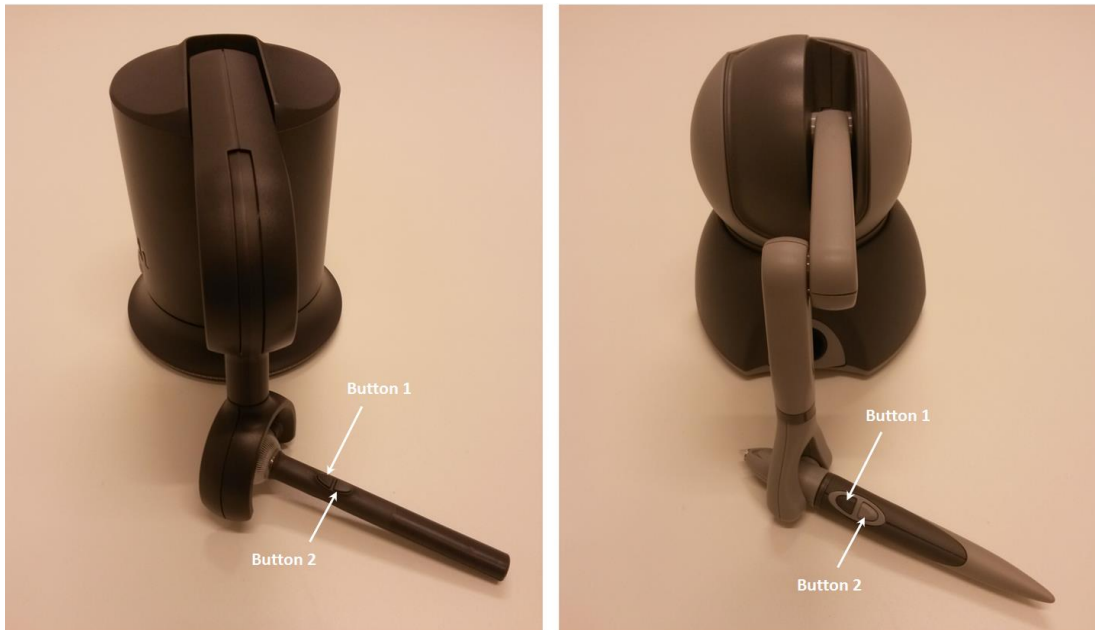haptic device. When releasing button 1, the selected block will be released and fall down.

Figure 4. Buttons on the Touch Device (left) and the Geomagic Touch (right), formerly known as Phantom Omni.

Once a block has been dropped on the top of the stack, its position cannot be modified anymore, as it belongs to the top two layer of the stack.

If a block is dropped onto the wooden platform onto which the stack stands, the game will be over. Likewise, if the stack falls down onto the wooden platform, the game will also be over.

Once the game is over, press button 2 on the haptic device to reset (Figure 4). Reset can also be done by pressing the keyboard space bar.

The application provides in real-time a punctuation of the performance (Figure 5). Each block picked up and correctly placed on the top of the stack will increase the score. Blocks located in the bottom of the stack will give more points than those located in the layers above.
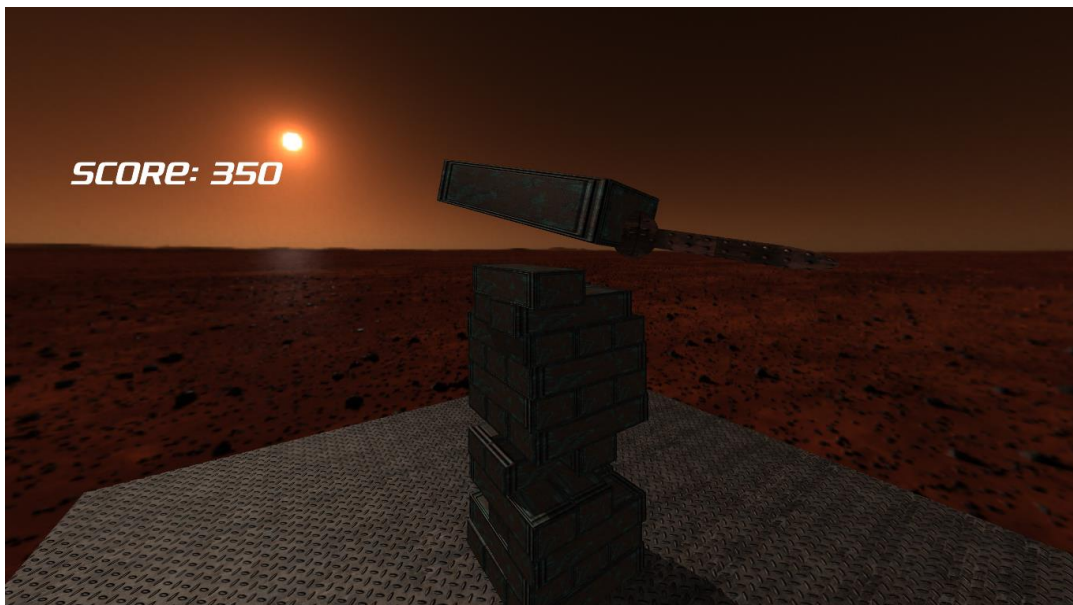
Figure 5. Score indicator

Finally, press the "Esc" Key to quit.