A Haptic Virtual Reality Training Tool for Paper Conservators (sketches_0291)

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1 Introduction

In paper conservation training, students are often required to gain many hours of experience in specific manual tasks. This is necessary to acquire the skills for the successful and safe treatment of delicate and fragile works of art. The haptic virtual reality (VR) environment offers a means of creating an enhanced training tool for conservators. Simulated conservation operations, such as backing removal, can be performed without risk to the objects, while building skills. Training can be accelerated through enhanced performance feedback using visual, aural and touch stimuli. The simulation software can also track the student's progress by compiling statistical data on their performance that can be reviewed by the tutor.

Figure 1. A backing removal in progress.

Figure 2. A 19th Century print with backing.

2 Context

A significant problem for the preservation of works of art on paper is the presence of aged and degraded backing material adhered to the reverse of the original artefact[1]. The conservation task of removing such backings is the focus for the simulation training tool. Fragile and delicate watercolours or prints can be damaged by the presence of these often poor quality, highly acidic paper or board backings. Mechanical removal using hand tools such as scalpels and spatulas is in many cases the only viable means of detaching the backing. Moisture or solvent based treatments such as soaking or steam humidification can be effective for backing reversal, but may not be possible due to the sensitivity of the original object. Mechanical removal, although slow and exacting, allows a greater degree of control and precision.

The time available in a typical conservation Masters degree course is limited and the number of hours needed to acquire diverse manual skills is great. This often means that students begin with training on genuine works of art. The extended period usually needed for students to master backing removal treatments can be shortened by the use of the VR training tool. It will also allow manual skills to be developed prior to commencing work on real objects.

3 Constructing the Simulation

In the simulations currently under development the physical properties of the paper objects and their backings are modelled according to values from existing conservation research and paper industry standards[2]. Parameters within the virtual environment for properties such as strength, rigidity, elasticity, and flexibility are variable and may be adjusted according to specified age and embrittlement, a range of material types and environmental humidity modulation. The realism of the interaction experience within the simulation is also critical to the validity of the training tool. The authenticity of haptic characteristics, such as surface friction and texture, will be essential to its success in convincing the user. These are being modelled and tested in close consultation with a range of experienced conservators.

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4 The Technology

The project uses the Reachin® stereoscopic display system[3] with a PHANTOM® Premium 1.5 3D haptic arm[4] and application programming interface (API). The environment geometry and haptic characterisation will be built in Virtual Reality Modelling Language (VRML). The API also supports additional non-standard VRML nodes that can be used to control surface characteristics and dynamic properties such as frictional behaviour, texture and inertia. PythonScript (an interpreted, interactive, object-oriented programming language, extensible in C and C++) is also supported by the API and will be used to build more sophisticated behaviours involving user interactivity. C++ programming will be used to create the architecture and object structure for the final application.
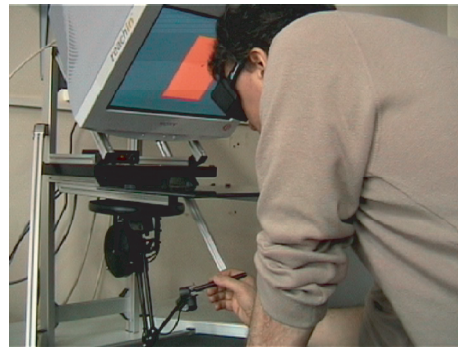

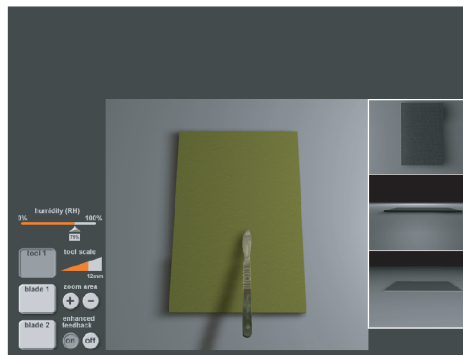**Figure 3. Developing the simulation on the Reachin® display.**

Figure 4. A prototype interface for the VR training tool.

See also: http://www.option5.co.uk/haptic

References

1 Mohr, P. 1985. Backing Removal, *Paper Conservation Catalogue,* AIC Book and Paper Group, Washington.

2 Mark, R.E. (ed.) 1983. *Handbook of Physical and Mechanical Testing of Paper and Paperboard*, Volumes 1 & 2. Marcel Dekker Inc., New York.

3 Reachin Technologies: http://www.reachin.se

4 SensAble Technologies: http://www.sensable.com