‘Tacitus’ Project: Identifying Multi-Sensory Perceptions in Creative 3D Practice for Development of a Haptic Computing System for Applied Artists.

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Abstract

This paper outlines the major motivating factors concerning a novel collaborative project between Edinburgh College of Art and Edinburgh Virtual Environment Centre. The “Tacitus” project will investigate the use of multimodal virtual environments, specifically, the haptic modality, with regards to the creative processes employed by designers working within the field of applied arts. The salient areas of research are described, and the methods by which information regarding these areas will be obtained are considered. Initial investigations have revealed a strong need to mimic the traditional applied artists’ workspaces, with co-location of visual and haptic cues a priority.

1. Introduction

The advent of new virtual media and haptic computing means that technology offers not only new tools but also the prospect of entirely new ways of developing work in virtual space. Current computer interfaces are often alienating, impoverished worlds, with little to support the intuitive heuristic working practices of applied artists. Applied artists are designer makers and artist craftsmen, i.e. people who work creatively with their hands, using a chosen material and often with an element of functionality. Examples of applied arts disciplines include ceramics, glass, jewellery, furniture, textiles, metalwork, bookbinding, and calligraphy.

Many art and design students are denied the opportunities presented by Information Technology (IT), due to their fear or dislike of computers. Perhaps even more importantly, this also deprives many IT based developments of their potentially valuable input [1].

Central to the field of applied arts is the notion of “intelligent making”; a mix of formal knowledge, tacit knowledge, physical and mental skill, contextual awareness, innovation, and personal creative autonomy [2]. An applied artist’s instinctive grasp of constructing and visualising in three dimensions, their spatial thinking and sense of touch are integral to their process of creativity. Makers combine all their sensory modalities, such as sight, hand motions, and sound in order to explore and bring intended qualities to the object they are making. Results can only be achieved through ongoing dialogue between the maker, materials and process [3].

In October 2000, with the above indications, Edinburgh College of Art (ECA) and Edinburgh Virtual Environment Centre (EdVEC) began a three-year collaborative research project, funded by the Arts and Humanities Research Board. The principal aim of their user-centred project is to investigate the development of three-dimensional haptic and multi-sensory computer applications for creative processes in applied arts and design.

2. Project Overview

The main aims of the "Tacitus" project can be summarised as follows:

- To explore the potential advantages of being able to work, think and respond to physical and visual stimuli, in a virtual, fully three-dimensional, non-gravity context, with particular reference to the education of designers and artists and the development of three-dimensional work.
- To discover the degrees of haptic and other multi-sensory feedback required within digital systems to assist designers and artists to work more intuitively.
- To develop viable software applications and virtual 'hand tools' to enhance the creative practice of applied artists.

Initial studies indicate that a central notion to the development of the project will be that of tacit knowledge regarding material constraints. In the case of the creative process of applied artists, material constraints provide an affordance to the imagination, rather than a barrier. An artist must understand the potential of materials, tools and techniques, whilst having the skill to control the actions required to achieve creative intent. For example Figure 1 illustrates a silversmith forming a vessel from a flat sheet of metal. Audio, tactile and proprioceptive cues are all necessary for the skilful and controlled manipulation of the material.

Figure 1. Silver vessel in the process of being formed from flat sheet.

This view of constraints is in stark contrast to the traditional notion of virtual reality (VR), which allows us to interrupt the sensory feedback loop with the perceived world, and therefore facilitates the omission of material and physical constraints. While this presents many advantages for data visualisation and manipulation, to the applied artist, it removes an essential catalyst to their creativity. Hence, research will initially seek to identify material properties, tools and processes that are salient to the creative process of the applied artist.

Glass blowing (Figure 2) is a good example of the complex skills and tacit knowledge artists possess in regard to properties and constraints of a material and tools used to manipulate it. Temperature, viscosity and adhesive properties must all be judged accurately with split second timing for a successful outcome. In transference to a virtual environment, some of these variables may be removed or controlled with benefit to the artistic process. However, post work interviews determined that a constraint such as a gravitational field is fundamental to the tacit knowledge and skills of these artists. Hence this constraint must be embodied to some degree in any virtual environment, if the artist is to transfer their skills and tacit knowledge to the virtual workspace.

Figure 2. Skilful co-operation of glass artists to produce a complex artefact.

3. Methodology

The first series of studies will seek to establish a data resource on fundamental user requirements, in order to begin developing haptic computing for applied artists. These are in progress at Edinburgh College of Art, first studying students and staff working in the departments of Design and Applied Art, followed by studies of selected professionals working in a variety of disciplines and using a range of materials, tools and skills.

3.1 Key Areas

In order to establish a meaningful data resource for development of a haptic computing system, the initial studies will be focused in three areas.

A: Conceptual Approach

The pathways into the initial creative process of design, e.g. experimenting, sketching, modelling, testing, searching, playing. Factors in the design process that support creativity.

B: Skills / Tools / Materials

The range of, and preferred, tools and materials employed, and the creative effects that can be achieved via use of these. The material tool qualities and properties, and the skills required to achieve effects.

C: Computers

Limitations of current computer graphics and 3D design applications, for example, range and intended use of available design software, assessment of the software's capacity to accommodate range of design processes and creativity, and a "wish list" for ideal virtual design tools and environment.

3.2 Data Acquisition

3.2.1 Stimulated Response. Interview during the design procedure would be highly disruptive to the artists' thought process, and difficult, due to the vast amount of information that must be conveyed regarding procedures, tools and materials. Therefore, photography and video are currently being employed to obtain a record of artists' working methods in process, as opposed to staged demonstration. Subsequent review of the tapes, and post-work interviews will allow detailed investigation of individual artist's tacit inferences.

3.2.2 Questionnaires / Self-analysis. Focussed debate and questionnaires will be employed to encourage ECA staff and students to articulate the reasons for preferred materials and tools, and virtual environments that would help to enhance the creative process. Two of the researchers on the project are applied artists of international status. Their self-observation during initiation and development of their own work will provide a valuable resource.

3.2.3 Further Studies. Further stages of the research project will investigate tacit knowledge, haptic and other senses. Data from these studies will be used in an iterative process to evolve digital systems to assist designers and artists to work more intuitively and support development of virtual hand tools and viable software application to enhance creative practice.

4. Initial Findings

4.1 Haptic Device Implementation

The specific aims of the project dictate the choice of haptic device to be employed to a high degree. The artists and designers who would use the equipment had subjective requirements on the method of operation, which also constrained choice. This required that the virtual object being manipulated, and the tools being used to do so, should occupy a position in physical space similar to that when working in real life and that the mode of working should feel the same.

The equipment finally chosen also had to have reached a commercial stage of development with adequate support and have a reasonable development environment.

The Reachin (www.reachin.se) system, based on the PHANToM (www.sensable.com) haptic device was chosen for the project. The main reasons for this choice were the relative product maturity of the PHANToM, the co-location design of the real probe with its virtual depiction, and the high level Reachin API development environment. Figure 3 illustrates the high degree of similarity present between a typical jeweller's workbench, and the Reachin system.

Figure 3. Comparison between traditional jeweller's working position and co-located haptic/visual display.

4.2 Questionnaire Results

A general questionnaire completed at project presentations by ECA students, and by professional applied artists revealed the following points concerning computer and tool use within the field of applied arts:

- A wide variety of preferred hand tools, therefore the need to categorise these tools so that generic properties across the disciplines can be extracted and analysed.
- Of ECA students across all disciplines in applied arts, 46% use computers, software named included AutoCAD, CorelDraw and PhotoShop.
- All students in furniture, but no students in jewellery and metalwork, used computers for designing.
- Of professional applied artists invited and attending a presentation about the project, 84% use computer with 23% specifically for design. This high percentage could be reflected in the interest of those attending in computer applications.

These preliminary results show a relatively low use of computers within the applied artist community, while there was a wide variety of hand tools employed. It was also observed that single tools are often used for a number of different purposes (e.g. a welding torch can be used to cut, bend or join material), and are therefore very flexible in the hands of a maker. This suggests that the inherent rigidity of current software tools is a barrier to the creative process.

5. Conclusion

This paper has outlined the primary research goals of the Tacitus project, which seeks to develop a multimodal virtual environment capable of meeting the needs of applied artists, craftsmen and designers. In particular, the project will focus on the use of tacit knowledge by artists and designers, and the role of material constraints and properties in the creative process.

Our goal is not to imitate the working practices and environment of the craftsman, but to create a generic virtual environment that can be applied to a variety of 3D creative disciplines, in which the applied artist feels comfortable and uninhibited by the novel synthetic environment and yet can bring their experience and knowledge to extend their levels of creativity more fluidly using a new digital medium.

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