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THE ASSESSMENT OF VIRTUAL REALITY
FOR
HUMAN ANATOMY INSTRUCTION

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INTRODUCTION

Virtual reality is the computer graphics creation of an environment which allows its participants to physically interact with objects within an electronic environment. A virtual reality applications program has been under development at the Marshall Space Flight Center (MSFC) since 1989. The MSFC VR systems consists of VPL Research, Inc. Eyephones (Models 1 and LX), DataGloves, and software (Swivel 3D, Body Electric, and ISAAC), Polhemus Isotrak and Fastrak spatial tracking systems, two Macintosh IIfx computers and two Silicon Graphics Inc. graphics computers (4D/310VGX and 4D/320VGXB). The objectives of the MSFC VR applications program are to develop, assess, validate, and utilize VR in hardware development, operations development and support, mission operations training, and science training.

This research project seeks to meet the objective of science training by developing, assessing and validating VR as a human anatomy training medium. Current anatomy instruction is primarily in the form of lectures and usage of textbooks. In ideal situations, anatomic models, computer-based instruction, and cadaver dissection are utilized to augment the traditional methods of instruction. At many institutions, lack of financial resources limits anatomy instruction to textbooks and lectures. However, human anatomy is three-dimensional, unlike the one-dimensional depiction found in textbooks and the two-dimensional depiction found on the computer. Virtual reality is a breakthrough technology that allows one to step through the computer screen into a 3-D artificial world. This technology offers many opportunities to enhance science education. Therefore, a virtual testing environment of the abdominopelvic region of a human cadaver was created to study the placement of body parts within the nine anatomical divisions of the abdominopelvic region and the four abdominal quadrants.

RESEARCH PLAN

The development of the VR training medium consisted of the following objectives: creation of a static three-dimensional model of the abdominopelvic region of a human cadaver utilizing RB2 Swivel software, creation of the behavioral relationship between objects in the virtual environment via Body Electric software and establishment of the communications between the two software packages- RB2 Swivel and Body Electric. Completion of these objectives resulted in the creation of a three-dimensional computer graphics model of the human body in which one is able to enter, "fly" around, grab and rearrange organs (see Figure 1). The

hypothesis of the research project is that an immersive learning environment affords quicker anatomic recognition and orientation and a greater level of retention in human anatomy instruction. Based on this hypothesis, the study will attempt to determine the most appropriate time to augment traditional human anatomy instruction with virtual reality training.

The proposed research study will be assessed and validated during the institutional cycle at Oakwood College and will utilize a cohort design with treatment partitioning. Two groups will exist- experimental and control. The purpose of the design will be to test whether the two groups differ. In the control group, students will be exposed to the traditional non-immersive learning environment. In the experimental group, students will be exposed to the non-traditional VR immersive learning environment. Comparisons of these two groups will be made with the ultimate goal of determining if there were quicker uptake and longer retention in the group exposed to the immersive non-traditional VR learning environment. Both groups will be given pre- and post- paper tests to validate the efficacy of VR as a teaching modality for human anatomy instruction.

The respondents will be partitioned into one of three groups based on the extent of their experience. This will be done to strengthen the internal validity of the cohort design. These groups will include the following: students who are enrolled in Medical Terminology, students who are repeating Medical Terminology, students who have been exposed to Anatomy & Physiology at the undergraduate level and students who have been exposed to Anatomy & Physiology at the high school level.

In the experimental group, students will be further subdivided into one of three groups: pre-VR training, concurrent VR training and post-VR training. All students will be given a paper pre-test one week prior to VR immersion and subsequently lectured on the placement of body parts in the nine anatomical divisions of the abdominopelvic region and the four abdominal quadrants. Students in the pre-VR training group will utilize the human anatomy VR training modality one day prior to the lecture. Students in the concurrent VR training group will utilize the human anatomy VR training modality one day after the lecture. Students in the post-VR training group will utilize the human anatomy VR training modality three days after the lecture. All students will be given a post-paper test one week and six weeks post-VR immersion.
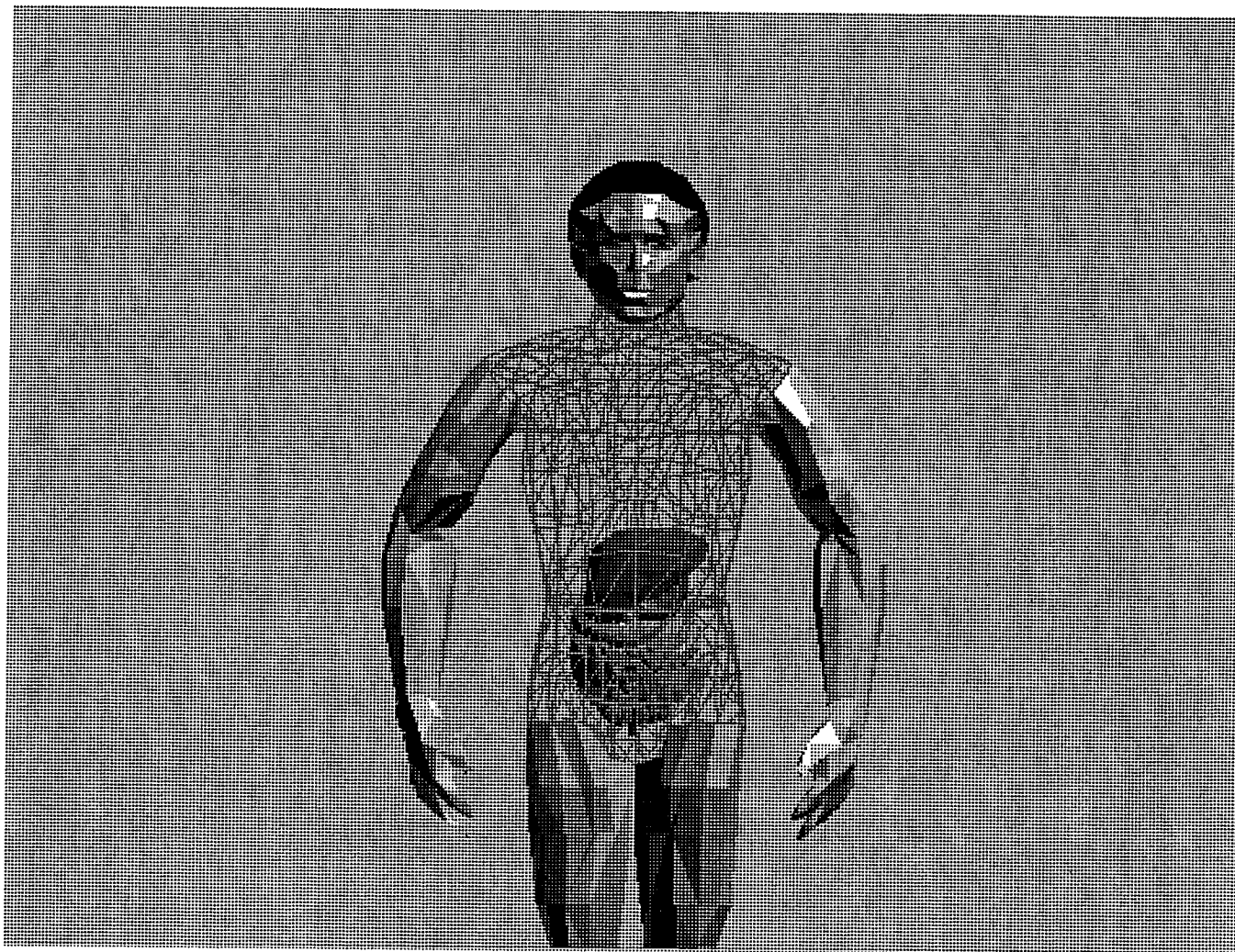
For the control group, archival records from the previous year's class will be obtained because it is reasonable to assume that the background characteristics of this group will be similar to those of the experimental group at the same institution. This cohort design will allow the drawing of causal 'quasi-comparability' inferences between the cohorts that do and do not receive VR training.

In conclusion, the assessment and validation of virtual reality as a tool for human anatomy instruction will determine the extent to which an artificial computer graphics simulation of the human body augments traditional modes of instruction.

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FIGURE 1