Contour Memory Test

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My work in visualization began with my master's thesis at Arizona State University. I created a virtual application called Volcano Island: A simulation of field geology. Upon completing my masters I enrolled into the PhD program in Curriculum and Instruction: Science Education. Working with Dr. Steve Reynolds (ASU), I have engaged in research looking at the strategies students use when given a contour memory task along with their ability to create mental models of contour maps. To date I have run a pilot study and I'm in the process of putting together my dissertation proposal.

Proposal Summary

An important part of geology is being able to visualize the landscape using contoured topographic maps. In an introductory geology class multiple lab exercises are devoted to topographic map skills and interpretation. For non-science majors the visual/spatial aspects of map interpretation can be difficult to grasp. Research by Eley (1993) has attempted to show subjects mental processes while interpreting contour patterns. Results have indicated that the mental processes of practiced map users are both strategic and flexible. The practiced map user appears to select contoured features that lead to a simplified mental representation of the landscape that are both sensitive and efficient to the task. According to Eley (1993), the practiced topographic map user acts under deliberate purposive action, guided by efficiency-oriented and task-sensitive strategic decisions. The mental processes undertaken by subjects have shown some commonalities but can be influenced by training or map-user predisposition. The purpose of this study is to determine how introductory geology students describe contour map features and to determine the relationship between mental models and memory.

The conventional pattern for studying mental processes set by Eley (1987 and 1993) has been to have subjects study standardized contour maps and then judge separately and subsequently presented three dimensional representations. The response time for studying the contour map and for judging the three dimensional representation is recorded along with the accuracy. That same format was used for this study except instead of recording reaction times subjects were given a time limit to choose their answer.

Computer technology has become an integral part of the learning process and provides a unique opportunity to present visual/spatial information to students. It has enabled geology instructors to improve student visual/spatial skills and understanding of topographic features through interactive multimedia activities. Computerized three dimensional models along with color layering techniques have been found to assist in the visualization and detection of landform features (Phillips, 1982). For this study, students were taught using a combination of concrete modeling, computer simulation, and paper map interpretation. These lessons were part of the Hidden Earth Curriculum developed at Arizona State University and are designed to help students visualize the topography which in turn should improve their ability to generate and manipulate mental models of the landscape.

Pilot Study Methodology

Subjects

The subjects were 31 university students enrolled in an introductory geology class. 19 subjects were female and 12 male.

Materials

The subjects were given a computerized test consisting of 32 multiple choice questions and 8 short answer questions. The test was broken into two parts with 16 multiple choice and 4 short answer questions per part. The test was created using MicroDEM and Authorware.

Procedure

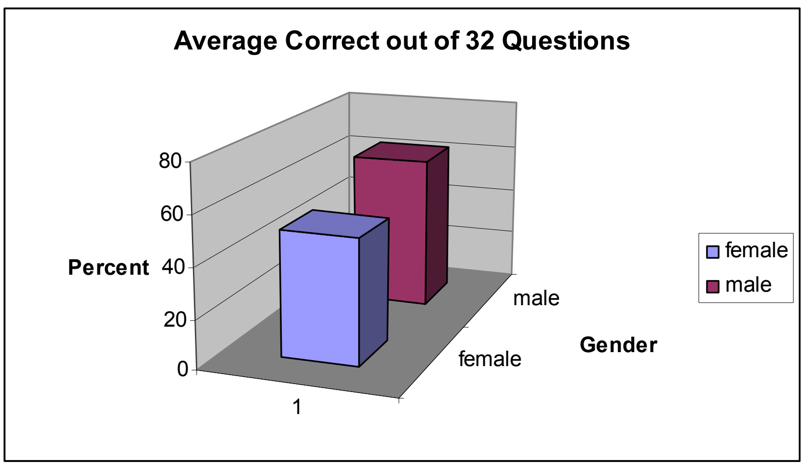
The test was administered as part of a laboratory assignment. Subjects were given a brief introduction stating the purpose of the test and told to follow the instructions. In Part 1, students were first shown four different contoured maps. For each map they were asked to describe how they would memorize the map. They were then given 16 multiple choice questions in which they are shown a contoured map for 5 seconds followed by 4 three-dimensional representations. Subjects were given 10 seconds to choose which representation correctly matched the contour map (see Figure 1). For half of the questions the contour map stayed on screen along with the representations. For the other half, the contour map disappeared and the subject had to rely on memory to determine the correct representation. Subjects did not know if the contour map would stay or disappear ahead of time. Part 2 was identical to Part 1 except for if the contour map remained on screen for a question in part 1 then it disappeared for the same question in Part 2.

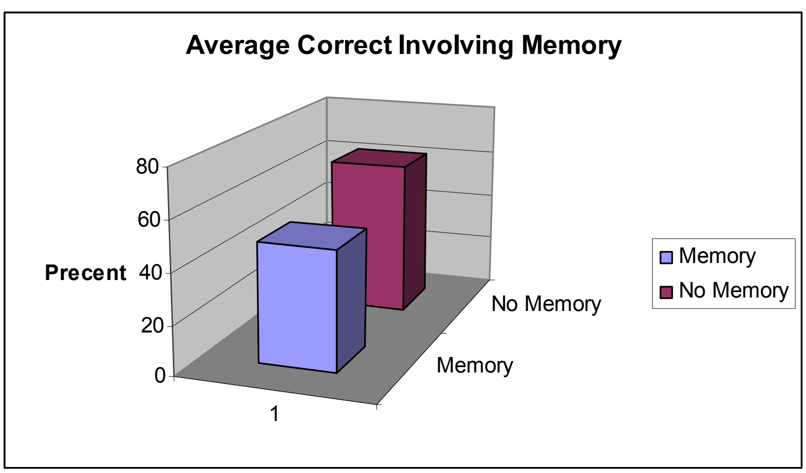
Data Collected

Gender, contour strategy, and the answers to the 32 multiple choice questions were collected.

Results

A two-tailed paired t-test was conducted for gender and memory. The corresponding p-value for gender was 0.032 and for memory was 0.047. There is a significant difference between genders and between no memory and memory. Further data analysis is still in progress including a qualitative assessment of subject's strategies.





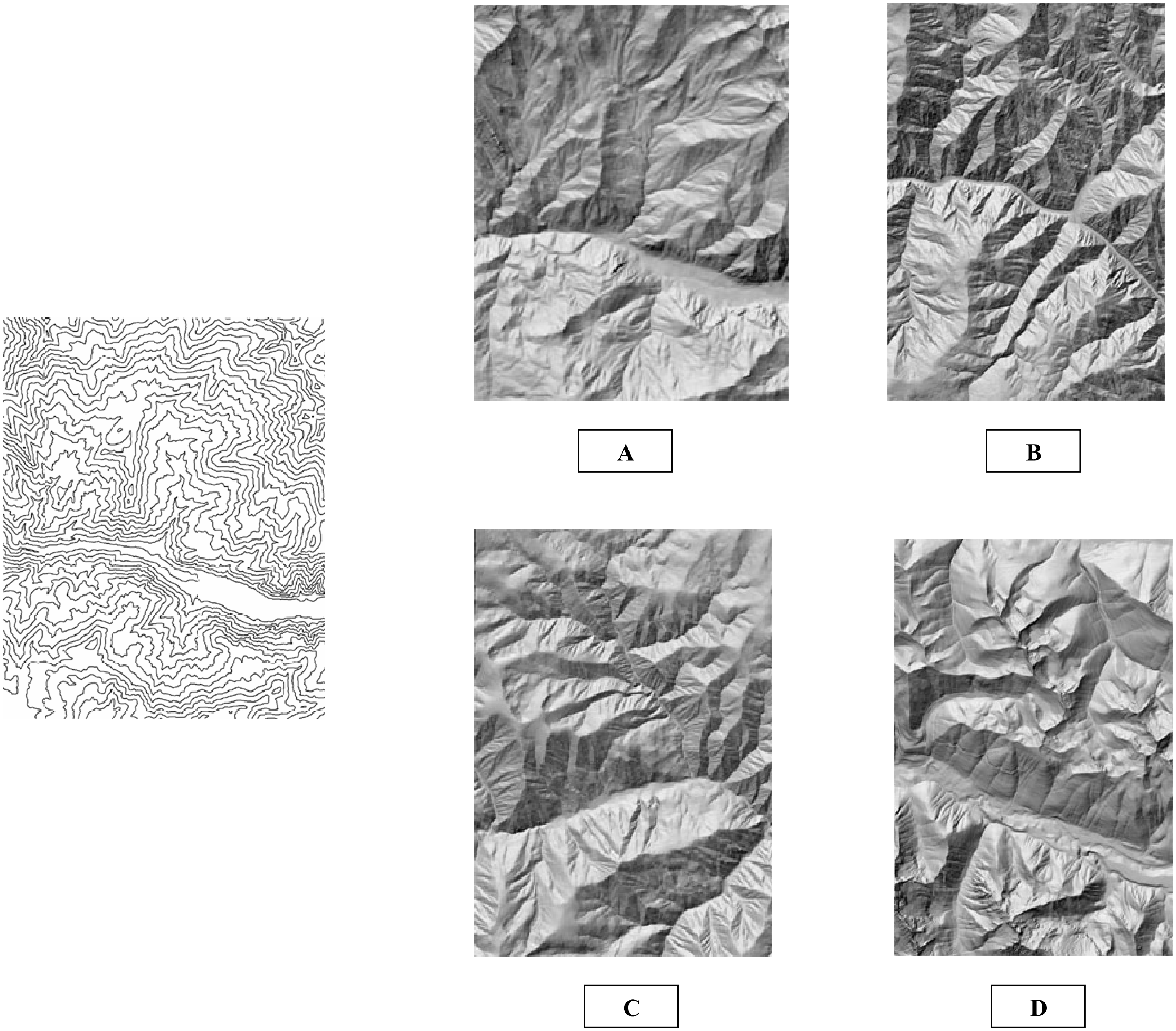


Figure 1: Test Question Design

References

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