Individual Differences in the Use of an External Visualization during an Internal Visualization Task

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Individual differences can influence a learner's ability to extract information from dynamic, interactive animations. (Lowe, 2004). In three previous experiments, the author demonstrated that 1) spatial ability; and 2) the frequency with which participants interacted with an animated computer model made significant contributions to performance on a spatial visualization task in which they had to imagine and draw the cross-section of a three-dimensional object (Cohen et al., 2004). The present protocol study investigated the strategy differences between high- and low- spatial individuals, including differences on how they interacted with 3D visualizations during task performance.

Method

Six graduate students (3 high- and 3 low-spatial ability) were recruited for the study. Participants were screened for mental rotation (Vandenberg & Kuse, 1978) and perspective change abilities (Guay, R. & Mc Daniels, E., 1976, as modified by Lippa, et al., 2002). Participants completed 10 paper-and-pencil trials in which they drew the cross-section of an imaginary object, presented as both a 2D image and 3D computer visualizations. Participants were instructed to imagine that the object was slice at an indicated line, to imagine viewing the object from the perspective of an indicated arrow, and to draw the resulting cross-section. The line indicated either a horizontal cut (as in Fig. 1) or a vertical cut. While performing the task, participants had unrestricted access to two interactive animations of the stimulus object.

Results

Consistent with the author's previous research, high-spatial participants drew more accurate representations of cross-sections than did low-spatial participants. (Fig. 2). There was no trend for high-spatial protocol participants to rotate, or to view a previously rotated animation, more frequently than low spatial participants (Fig. 3). Compared to low spatial participants, however, there was a trend for high-spatial protocol subjects to more frequently rotate the animations to the perspective of the object seen by the arrow in the stimulus figure ("the arrow view"). (Fig. 4). All of the high-spatial individuals rotated the view to this perspective, whereas only one of the low-spatial participants did.

Discussion

As seen by comparing drawing performance (Fig. 2) to arrow view access (Fig. 4), not all participants produced accurate spatial representations of the stimulus object, even when they saw the maximally informative view of the object. Further analysis is planned to define the strategies that allow individuals of all spatial abilities to extract key spatial information from maximally informative views of an external animation.

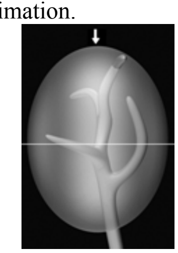

Fig. 1. The stimulus object. The arrow indicates the suggested viewing perspective.

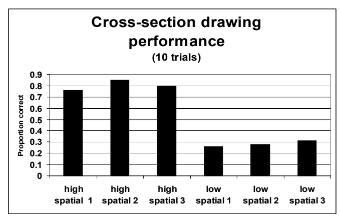

Fig. 2. Drawing performance

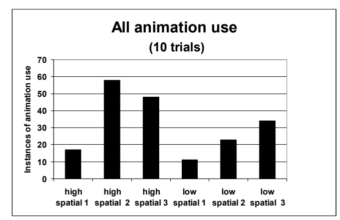

Fig. 3. All animation use

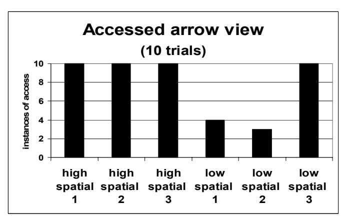

Fig. 4. Frequency of arrow view access

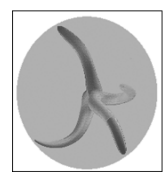

Fig. 5. Arrow view of horizontal trial

References

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