Developing Three-Dimensional Spatial Cognition for the Visually Impaired Using Computational Depth Mapping and Vibro-Tactile Display

Delargy, Tyler (School: Bangor High School)

Blindness affects nearly 40 million people worldwide—a value expected to double before 2050. The modern world is incredibly dense with visual information, and incidentally, a Blind Visually Impaired (BVI) person is 3 times more likely to be unemployed, suffer from depression, and be seriously injured in an accident. In response to this problem, a device was built to expand the sensory horizons of the BVI by creating and interpreting a live infrared depth map through a vibrotactile array. This device was initially tested with a group of subjects asked to navigate 3 mazes under blindfolded, blindfolded with the device, and sighted conditions; for variables; time and rate of success. The improvement to collision rate when wearing the device was extremely statistically significant at a P-value of 0.00001, which was indicative of the device's intuitive display of complex spatial information. This justified improvements to the device and a new study which used Virtual Reality to simulate maze environments in an open room. As subjects navigated these environments with the device, constant data streams logged subject location, virtual collisions, and time; showing that the device, on average, is able to direct users within 1.68% of the optimum path through the maze, with data deviating by 4% over 12 subjects, all whilst only increasing spatial cognition time by an average of 8.31%.

Awards Won:

Third Award of $1,000