Project proposal: Building video games for science

Psychology has begun to embrace more realistic experiments: instead of testing peoples’ memory by showing participants still images on a computer monitor, behaviour is now often tested within immersive virtual environments. For example, the BioMotion lab at Queen’s recently acquired a Christie HoloStation for this purpose, a massive, whole-room setup in which multiple monitors surround the user while their head position is tracked and they navigate a 3D world on a treadmill. In addition, it is possible to run navigation studies while participants have their brain scanned in the Queen’s Functional Magnetic Imaging Centre. Finally, it is sometimes desirable to run experiments quickly on regular computer workstations. However, a 3D game environment to drive these various setups is not yet adapted to the needs of rigorous psychological testing.

Using Unity, the Poppenk Computational Cognitive Neuroimaging lab has begun development of a C#-based “game” environment suitable for driving these setups. While an initial Unity framework has been established to establish feasibility of project objectives and establish basic experimental functionality, the proposed project extends the current framework into a ready-to-use platform. It differs from that of typical “games” in that, further to challenging a user with various way-finding and object-locating objectives, the environment must do things like score aspects of the user’s behaviour (e.g., actual vs. optimal path to goal, reaction time, angular error for pointing camera at an object), and mess with the environment (e.g., rescale it; replace objects; play with traffic light timing; probe whether the participant noticed). To achieve sufficient realism, the environment must also constitute a detailed and interactive “small town” environment that is at least 15 blocks wide in each direction, includes a pedestrian and traffic AI system plus driving mode, and as much realism as can be reasonably accomplished within the project period while maintaining a minimum 30fps refresh rate on modern “mac mini” hardware. Buildings, car and characters in the game should have distinctive visual qualities that can be programatically manipulated (e.g., roof colour, choice of clothing). Workstations are available for this project, Unity plug-ins are available to facilitate many of these goals, and a “Unity Pro” upgrade can be made if needed. The resulting game “template” will be used for many years by Psychology labs at Queen’s on the HoloStation, inside the fMRI scanner and in other specialized testing setups.