Literature Review – 2

Student's Name: Ankit Nimje

Student Id: 01760450

Papers for review:

1. Locomotive Recalibration and Prism Adaptation of Children and Teens in Immersive Virtual Environments (Primary)
2. The representation of landmarks and routes in children and adults: A study in a virtual environment (Reference)

The representation of landmarks and routes in children and adults: A study in a virtual environment

This presented paper is motivated by a traditional experiment by Cohen and Schuepfer where participants learnt a predesigned route by computer generated simulation. Various age groups participants were used to successfully prove this experiment like pre-teens, teens and adults. Many different results were found after implementation of experimental environments and presented in further paper. One of the primary phrase accepted in said paper is "Humans acquire spatial knowledge of a new environmental space – a space, which is not perceivable from one single vantage point."

It is said that, humans use wayfinding ability to sense their surroundings. It can be accomplished by various means – cue-based piloting, path integration, navigation by cognitive maps and by guidance instruments like compass and photos. Further, some external environments like landmarks play important role in maintaining orientation. Landmarks can be defined differently by different type of people. One can see it is as organizing concept while other can see it as navigation aids.

Experiment was primarily focused on some research samples. Children and adults sense their landmarks differently. Adults tend to pay more attention to landmarks near routes whereas teens can be taught easily to pay attention to details than pre-teens. Furthermore, females depend more on landmarks and on procedural routes than males. Males usually prefer configurational strategies. For children, boys have better sense of orientation whereas girls depend on greater amount of landmarks. Primary goal of this experiment is to evaluate the use of Virtual Environments in developmental and spatial cognition research.

On basis of Cohen and Schuepfer research results, these can be hypothesized – Children rely more on position and sequence of landmarks than adults, children recall fewer landmarks than adults, landmarks which have a route maintaining function are better remembered than landmarks which don not have such a function.

Experiment is implemented with participants from above explained age groups. An initial survey was conducted to know their participants and their influence of computer games. A software called 3D GameStudio A5 was used on Pentium 4 (2.0 GHz) PC with nVidia Geoforce 4 graphics card. A virtual maze was projected on a screen by video-beamer. Participants could explore the virtual world by a joystick. A predefined sequence was needed to reach goal which was same for all the participants. Each test sessions lasted for 20 minutes and were held in Heinrich Heine University of Duesseldorf. There were 4 experimental phases: Learning phase 1, Test Trial, Learning Phase 2 and Recall Test. Path taken by participants was recorded for analysis and was analysed by a computer software designed especially for this experiment.

Some findings by this experiment are: the youngest children made more incorrect turn choices when landmarks were removed and they are the one who walked longer distance than older children and adults. Furthermore, landmarks placed on turns were better recalled than turns without any landmarks. Thus, they suggested that in official buildings, there should be some landmark structure on turns which led to some common departments. Virtual Environments seems to be more reliable method and thus should be encouraged for children.

Locomotive Recalibration and Prism Adaptation of Children and Teens in Immersive Virtual Environments (Primary)

Virtual Reality is gaining popularity across everyone in this world. Even though, most of the research is performed on adults, Teens and Preteens are left out. The main purpose of this experiment is to assess how preteens (children aged 8 – 12 years) and teenager (children aged 15 – 18 years) respond to mismatches between their motor behaviour and visual information presented by Immersive Virtual Environment. They perform two experiments to achieve their goal. In first experiment, analysis of forward walking recalibration after exposure to an IVE with either increased or decreased visual flow was conducted. In second experiment, subjects show the typical prism adaptation behaviour of a throwing after-effect error.

Children are passionate adopters of technology and are exposed to Virtual reality for both learning and entertainment. In the past, Head-Mounted-Displays (HMD's) were expensive and heavier. But now, world is changing and developing. More cheaper and lighter HMD's are available in the market. Author here also mentioned related work in the field including referenced paper. Many of the assumptions are inherited from referenced paper above.

Every virtual or real interaction with environment require to perceive stimuli and to act upon them with precision. Such responses, involves constant calibrations both physical and perceptual allow everyone to perform everyday tasks such as walking in the park, writing an essay, playing, etc. These adjustments are done due to mapping between perception and action which is also called as perceptual-motor calibration. When one interacts with their environment, a synthesis of contextual, casual and ultimately multimodal information informs both understanding and interaction of the body. When such information changes, the perceptual motor mapping changes. This process is called as recalibration which is discussed in most part of this paper and is the background of this experiment.

Another concept is introduced in this paper called as Prism Adaptation. It is another way to evaluate the effect of visual feedback on human perception and motor control in both real world and virtual reality. Special wedge-shaped goggles are used which shifts one's visual field laterally or vertically. Results can be seen in two phases: Prism adaptation phase and post-adaptation phase. In Prism adaptation phase, participants initially make many errors while pointing any object, but with many trials they tend to learn and adopt this vision. In post adaptation phase, goggles are removed and immediately pointing results in error in reverse direction. Studies reveal that humans can recalibrate their vision.

Experiment 1 was to investigate whether visual motor recalibration effects would be observed using commodity level equipment in children. There were two hypothesis by authors. First is to test whether commodity level equipment allows participants to recalibrate. And the second hypothesis that they will find age related difference in recalibration. The experiment setup was performed in Unity, a multi-platform game engine and used HTC Vive as VR headset. The field view of the Vive consists of 110 degrees diagonally. Participants were asked to perform practice trials and then the real trials where targets were kept at a distance more that 4 metres. They presented results such as recalibration happens when pairing of visual flow information is mismatched from biomechanical information.

Experiment 2 tested for recalibration effect in a different motor task which utilizes different effector in human body. Traditional prism throwing technique was used in this experiment (explained in much detail in another referenced paper). Participants were asked to throw objects on a target. This experiment consists of three phases: The pre-exposure phase, the prism exposure phase and post-exposure phase. Same technical setup was used which was used in experiment 1. Children were asked to throw Vive controllers on target which was at short distance. This experiment results in some conclusion which proved their both of the hypothesis true.

References:

1] Haley Adams, Gayathri Narasimham, John Rieser, Sarah Creem-Regehr, Jeanine Stefanucci, and Bobby Bodenheimer, *Member, IEEE*
Locomotive Recalibration and Prism Adaptation of Children and Teens in Immersive Virtual Environments

2] P. Jansen-Osmann and G. Wiedenbauer. The representation of landmarks and routes in children and adults: A study in a virtual environment. *Journal of Environmental Psychology*, 24(3):347 – 357, 2004. doi: 10.1016/j.jenvp .2004.08.003