3. The Rod and Frame Illusion: Can You Hang a Picture Straight?

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3.1 Background

Many animals can walk immediately after birth. Within a few minutes of being born foals and calves struggle to their feet, and become fully mobile within a day or so. Presumably to achieve this remarkable feat they must have a strong inbuilt sense of what is "up" – ie vertical. Not so humans. It is only one to two years after birth that we manage to learn to balance upright and walk, and it takes many years of often painful experience to achieve full control over remaining upright.

During this learning phase the brain is continually using inputs from sensory systems all over the body to construct an internal representation of 'what is up'. There are three major systems that contribute to the perception of vertical: i. the inner ear detects gravity and movement of the head; ii. sense organs (proprioceptors) in the muscles and joints, indicate the position of the body in space; and iii. the eyes provide evidence from the environment – trees usually grow vertically and the horizon is usually horizontal.

Our brain uses all these cues to calculate our body position relative to gravity or 'up'. Most of the time this system works remarkably well, and once we have learned to walk we seldom have to think about staying upright. However the brain sometimes gets conflicting evidence from the sense organs. Infections of the inner ear, or drugs such as alcohol, can cause dizziness and loss of balance. Unfamiliar movements, such as experienced on a boat at sea, can cause nausea and seasickness, as can loss of gravity in space travel and the 'vomit comet'.

It is common experience that some people are better able to cope with disturbances in these sensory systems than others. The Rod and Frame Test is a simple procedure that allows investigation of the effects of changes in the visual environment on the perception of vertical. It is based on the 'Rod and Frame Illusion' an everyday example of which is the difficulty that people experience when trying to align a picture if the background wallpaper contains patterns that are skewed from vertical.

In the Rod and Frame Test the subject uses the mouse buttons to rotate a rod on a computer screen to the orientation that they consider to be vertical. The rod is surrounded by a square frame which can be either upright or tilted at different angles to the vertical. In most subjects tilting the frame causes the subject's estimate of vertical to be distorted in the direction of the frame tilt, and this 'error' is measured by the computer. Some people are able to ignore the tilted frame and have very small errors, these people are classified as 'Field (or Frame) Independent'. At the other end of the spectrum are 'Field (or Frame) Dependent' subjects whose perception of vertical is strongly influenced by the tilt of the background frame.

Over the years many claims have been made concerning differences between Frame Dependent and Frame Independent people, amongst which are –

females are more frame dependent than males;

Frame Independent people are better at individual sports and Frame Dependent people are better at team games;

children are more Field Dependent than adults.

3.2 Suggestions for projects

1. Investigate the effect of the angle of the frame tilt upon the errors produced in the perception of vertical.

2. Does the perception of vertical change when the subject lays down – change in the direction of vertical?

3. Are team sports players more frame dependant than those who undertake individual sports?

4. Is there a difference in alignment errors between females and males?

5. Is there a relationship between balance (eg one leg standing) and Rod and Frame errors?

6. Are subjects who take longer over making the Rod and Frame alignment more or less accurate than those who do it rapidly?

7. Does a rotating disc in the background induce similar errors to a tilted frame?

3.3 Equipment.

PC running Windows XP or possibly Windows 7 – not Vista
Rod and Frame Software
Video glasses or some other method of reducing external vertical and horizontal cues – e.g. darkened room – black circular mask over screen – black hood.
Excel or similar spreadsheet for data analysis
Statistics program

3.4 Ethical Considerations

Written informed consent.
Confidentiality of data – use subject numbers not names.

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