# Advanced joystick, 9 Jul 1991

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As the note says, joysticks back in 1991 were pretty primitive, but it was becoming obvious that they could be a lot better with many extra functions. Later in the 1990s, many advanced joysticks came out for playing computer games, some especially designed for flight simulation. Here is the idea I had for adding several extra degrees of freedom:

# Enhanced Joystick Interface

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Figure 1 shows a simple joystick interface. Current implementations of this device offer movement in two dimensions and are therefore equivalent to the mouse. This note questions this restriction and proposes realisation of a further 7 degrees of freedom.

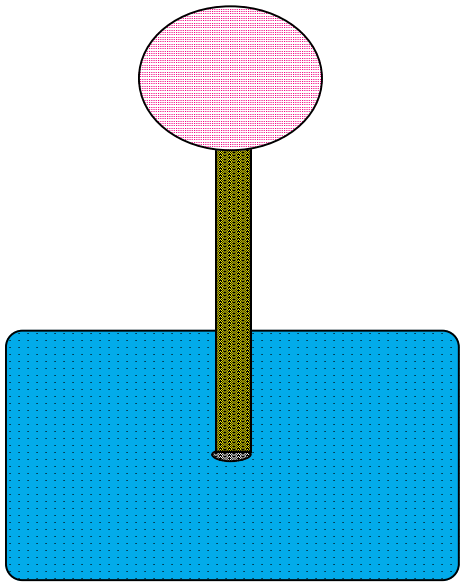

Figure 1 - Joystick

Degrees of Freedom

Table 1 shows the degrees of freedom available to the three components that make up the joystick if each component is free to move.

| Degree of Freedom | Translation | Rotation | Tilt | Sheer | Bend | Twist |
|---|---|---|---|---|---|---|
| | | | | | | |
| Base | 2 - 3 | 1 | 0 - 2 | 0 | 0 | 0 |
| | | | | | | |
| Stem | 3 | 1 | 2 | 2 | 2 | 1 |
| | | | | | | |
| Top | 3 | 3 | 0 | 0 | 0 | 0 |

Some of these degrees are probably impractical to realise. For instance, with two hands it is not easy to manipulate three components independently simultaneously. For this reason, those degrees associated with the stem, ie rotation, tilt, sheer, bend and twist are too tricky to implement and can be ignored. Sheer could be implemented in the top instead, but this would easily be confused with rotation / translation so would not be sensible here either. Similarly, some of the options for the base are probably tricky, although more feasible than those for the stem. There thus remain 3 - 6 degrees of freedom for the base and 6 for the top, still at least 7 more than for a conventional mouse and at least 6 more than a 'bat'.

All of these can be implemented using conventional strain gauge mechanisms. It is probably an advantage to have a rigid device since this makes the strains easier to measure and removes the need to make complex contacts. Base construction could be in two parts with the bottom fixed so that movements would be detected by strain rather than actual movement.