- Wednesday, July 17, 1996
  Vestibulomotor Problems in Changed Gravity

3.0 Otmar Bock (Institute for Sports Medicine (I think?), Koln University, Germany) "Vestibulomotor problems in changed gravity" (17 July 1996)

3.1 Under conditions of low or non-existent gravity (ie. in space), motor programmes that have been learned under normal g conditions become inappropriate. Proprioceptive feedback about movements and position become inappropriate. And the g force as registered by the vestibular end-organs becomes inappropriate by being out of their normal operating range. But little has been done to investigate the consequences of these 'inappropriatenesses' because i) takes ages to do space-related research, ii) very small n's, iii) no control over these remote experiments, iv) interactions with other experiments. But things can be done, especially with the aid of 'plug and play' hardware and software, some of which has now been developed in the Bock lab. This consists of a device for measuring pointing to dots of light without you being able to see your finger. Preliminary experiments have been done on a plane, commonly referred to as the 'vomit comet', that executes a parabolic flight path such gravity is cancelled out in one half of its flight cycle (a couple of minutes, I think) and doubled in the other.

3.2.1 Exp. 1 (normal g). Point to a dot of light that comes on at one place and then jumps to another. Where you point depends on the gap between them. Your motor programme changes at the rate of about 0.2 degs/ms (about the same speed as mental rotation).

3.2.2 (on plane). When Exp. 1 is done on the plane, you tend to point too high in both micro- and hyper-g conditions. Hmmm.

3.3.1 Exp. 2 (normal g). Adjust your finger grip to match a target size. Big to small takes longer than small to big (347ms compared to 256 ms).

3.3.2 (on plane). You hold your fingers closer together (underestimate size of target or overestimate the position of your fingers) under both micro- and hyper-g conditions.

3.4.1 Exp. 3 (normal g). Follow a dot moving in a circular path. You finger marks out an ellipse which is squashed left to right.

3.4.2 (on plane) for both micro- and hyper-g conditions the effects are exaggerated.

3.5 Conclusions: Gravity has an effect but isn't it funny that micro- and hyper-g effects are in the same direction? No answer, I am afraid. Three groups of possibilities were discussed without any very definite theory emerging. Perhaps $1,000,000 worth of experiments on the space shuttle will sort it out.

3.5.1 Just greater variability? Apparently not.

3.5.2 Explanations based on limited resources available to distribute between POSTURE and SKILL. Since posture needs more 'attention', then less available for these skill-testing tasks. Hmm. Seems to me that would just introduce more variability...

3.5.3 Alternatives based on muscle spindle performance...

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