Fluid & Crystallised Intelligence

Charles Spearman

Charles Spearman spent 15 years in the British Army and resigned to study for a PhD in experimental psychology. He obtained his PhD in 1906. This was on factor analysis of intelligence. He later became a professor at UCL, until 1931. He developed **rank correlation** (a non-parametric version of the conventional correlation developed by Pearson).

Spearman's Positive Manifold - The tendency for there to be more **positive** correlations than negative ones. By deduction, this also means that those good at one test **tend to be better on another.** This is an early interpretation of intelligence. Much of the debate about intelligence concerns how best to understand this.

Spearman's **one factor theory** argued that this positive manifold was evidence of an ability that is required to perform many types of test. He called this **g** ("general intelligence"). This is factor 1 in the theory.

Godfrey Thomsen (1939) argues that there is not necessarily one underlying ability. Instead there are many intelligences and positive manifold happens because **tests sample from many abilities.**

Two Factor Theory (1927) found that between some tests, there were higher correlations, which Spearman took to be evidence of secondary **specific factors** such as "verbal", "mechanical" and "arithmetic".

Raymond B. Cattell (1971)

Born in the UK and died in Hawaii. Cattell (1971) was a phD student of Spearman. He divided **g** in to two separate intelligences:

gf or Fluid Intelligence - This is the ability to solve novel problems and learn new things. Independent of one's knowledge.

gc or Crystallised Intelligence - The application of things we have already learned; our knowledge. This knowledge can be used to solve problems that are similar to those we have already encountered.

John Duncan et al. (2000) measured blood flow in the brain using PET during tasks that measure "g" to a high and low degree. He found that blood flow increases in **lateral prefrontal cortex** when people do high g tasks. He concluded that this was the seat of fluid intelligence, or **g.**

However, Duncan et al. (2010) also found evidence of 'new intelligences' that were separate from fluid intelligence. This suggests that there is both fluid intelligence but there are also "new intelligences" not considered before.

Cattell predicted that crystallised intelligence should not decline with age, as fluid intelligence. This does not appear to be the case (**Makintosh, 2005).**

Burgess et al. (2002) found that arithmetic abilities could be selectively impaired, with problem-solving, memory and spelling intact, suggesting that fluid intelligence utilises separate brain areas.. **Shallice & Burgess (1991)** reported 3 patients that had suffered damage to the frontal lobes. They had no problems with crystallised intelligence. However, they had serious problems with fluid tasks, like the **multiple errands test**: buying items from several shops and following rules like "don't go into a shop unless you are going to buy something".