The experimental question
Is orientation perception in astronauts different from undergraduate students?

Two groups: astronauts (n=13, mean age 48.5 years, 4 females) and students (n=48, mean age 19.6 years, 28 females) performed the oriented character recognition test (OCHART) (see right hand panel).

Although students have a tendency to be more influenced by the orientation of the visual background, this difference is non-significant. However students are much more variable in their responses than astronauts. Could noise in the student group's data be masking an underlying group difference?

We divided the student group in half by selecting those students with lower variability for OCHART against a grey (control) background forming a low-variability sub-group of 24 students (average age 19.6 years, 14 females).

Comparing this “variability matched” student group and astronaut data shows similar trends to the “whole” student group/astronaut comparison, but there are no significant differences between this new group and astronauts.

** What is OCHART? **
The Oriented Character Recognition Test (OCHART) is a method for measuring the influence of ambient orientation cues on perceived object orientation.

** What does OCHART measure? **
OCHART measures the perceptual upright (PU) - the orientation at which the probe (“p”) is least ambiguous. OCHART also captures the intra-observer performance variability: the mean slopes (“b” value) of the two psychometric functions used to calculate PU. Measuring the “b” value in the presence of a neutral (grey) background provides a measure of baseline observer variability.

** Which cues influence PU? **
The relative orientation of ambient visual cues AND the axis of gravity AND the long body axis of the observer all contribute to the measured PU. The function which describes the change in PU for a series of oriented ambient visual cues changes qualitatively depending on the relative orientation of body orientation and the axis of gravity.

** How is OCHART run? **
Observers view a laptop computer screen seen through a circular aperture (as control visual cues). The letter probe and background are presented for 500ms after which the observer reports whether the letter was a “d” or a “p”. PU and “b” are calculated for each background presented. Data collection in different observer body orientations is possible by holding the laptop in a specially constructed frame.

** How can PU and “b” data be used experimentally? **
By using OCHART to calculate PU and “b” values for relatively few backgrounds (and in two or more body orientation) we can determine the relative weighting applied to the body, vision and gravity cues. It is these three cues which combine to form the perception of “up”.

** Conclusions **
1. Astronauts have significantly lower variability than the student group.
2. A sub-group of students, formed by selecting those students with the lowest variability in a control task, have strikingly similar patterns of results to those of astronauts; however astronauts showed markedly lower weighting of gravity in determining PU.
3. For all hi-variability observers, the influence of vision in shifting PU can be predicted from the variability of OCHART responses against a neutral grey background.