A general problem in neuroscience is understanding how sensory systems organise information to be at the service of behaviour. Computational approaches can be useful for such studies as they allow one to simulate the sensory experience of a behaving animal whilst considering how sensory information should be encoded. In flies. small sub-populations of identifiable neurons are known to be necessary for particular visual tasks, and the reponse properties of these populations have now been described in detail. Surprisingly, these populations are small, with only twenty or so neurons, which suggests something of a sensory bottleneck. In our manuscript, we consider how the population code from these neurons relates to the information required to control specific behaviours*.* We conclude that, despite previous claims, flies are unlikely to possess a general-purpose pattern-learning ability. However, information about the shape and size of objects, which is necessary for many ecologically important visually guided behaviours, does pass through the sensory bottleneck. These findings show that nervous systems can be particularly economical when specific populations of cells are used for specific visually guided behaviours. This is a general interest finding for in computer vision, biomimetics as well as sensory neuroscience.