- Friday, January 10, 1997
  Filling In

2.0 Evan Thompson, from the Philosophy department of York, told us about "filling in". Filling in refers to perceptual completion.

2.1 Examples of perceptual completion include how we don't notice the blind spot and a phenomenon called NEON SPREAD in which when some part of some of the bars of a regular grid are coloured, the colour seems to leak from the coloured sections into surrounding areas creating an illusory patch of dim colour.

2.2 First Evan divided occasions of filling in as being of one of two types called modal and amodal.

2.2.1 MODAL in which information in one sub-modality of vision (eg, a boundary) creates an illusion in that same mode eg. the Kanizsa triangle: a triangle created by cutting corner shapes out of circles. Here the boundaries presented at one end of each line lead to a "filling in" of the rest of the same boundary.

2.2.2 AMODAL in which information is created without any help from the existing image. An example would be a partially occluded circle. This requires information not present in the image -- knowledge of the occluded form.

2.3 Perceptually these phenomena are clear, but what is their mechanism? Is it done by a neural filling in? That is, do cells fire as they would if the stimulus was really present? Now we get into the philosophy....

2.3.1 If there are neurones (and I guess we are talking about very high level neurones) that fire in the same way during filling in as they do when the stimulus is actually present, it would imply a 'bridge locus': that is a point in the brain where neural and perceptual events were isomorphic. Whenever a particular cell fires, a particular perception occurs, and if it doesn't fire, then the perception doesn't happen.

2.3.1.1 (LRH: Actually these two parts of the statement are not logically linked -- you could have a redundant neural system which could produce the same perception through multiple routes: with or without the activity of a particular cell. And you could have a cell that was active during more than one perception. Also, the perceptions of filling in - at least some of them - are not identical in their actual-stimulus and filled-in versions. So finding a cell with either of these properties might not help you decide if the mechanism was isomorphic or not.)

2.3.2 An alternative is that cells that fire during the stimulus-present version are NOT active during the filling-in version but instead some LABEL is activated to instruct perception to fill in. This would be not be ISOMORPHISM.

2.4 Three experiments (not done by Evan) were discussed which were very stimulating to consider from this point of view but which did not turn out to solve the mind-brain problem:

2.4.1 A motion after effect (look at motion for a while and afterwards things appear to move the other way) evoked in one eye (adapted eye) by a patch of movement that includes that eye's blind spot transfers to images viewed by the other eye (test eye). What about the area in the test eye that corresponds to the blind spot of the adapted eye? That area turns out to show an after effect. But cortical cells with fields in this area do NOT fire like they do to real movement. This addresses, I think, amodal filling in (because the blind spot is like an occlusion) and provides EVIDENCE AGAINST ISOMORPHISM.

2.4.2 Half the cells in monkey V2 visual cortex (Peterhans and von der Heydt, 1989, J, Neurosci. 9: 1749) respond to both illusory and real contours passing through their receptive fields. This addresses modal filling in (see 2.2.1) and provides EVIDENCE FOR ISOMORPHISM.

2.4.3 The after image of a white circle on a dark background has various appearances after briefly (50-100ms) viewing a mask. The results indicate that the edges are more difficult to mask than the rest of the shape. This suggests that perception of the centre is constructed by a labelling process rather than the activity of a matrix of cells and is therefore EVIDENCE AGAINST ISOMORPHISM.

2.5 You had to be there to hear the discussion...

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