Supplementary material:

Diagrams:

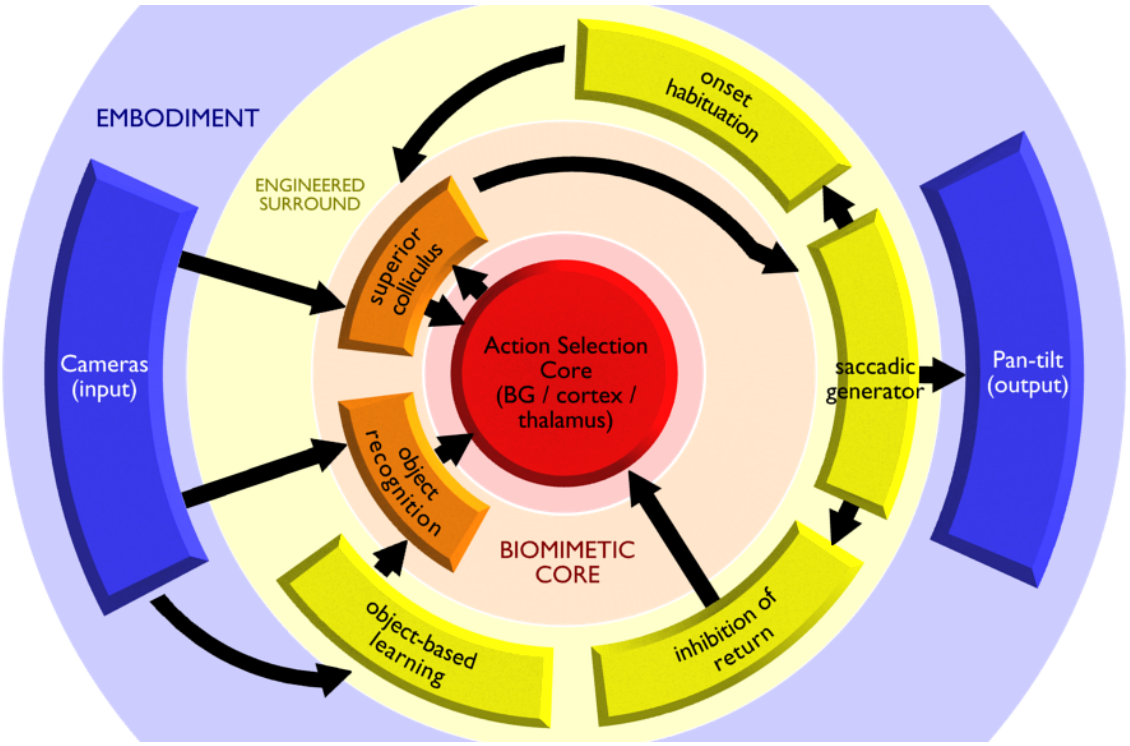

Figure 2: Diagram of model organisation

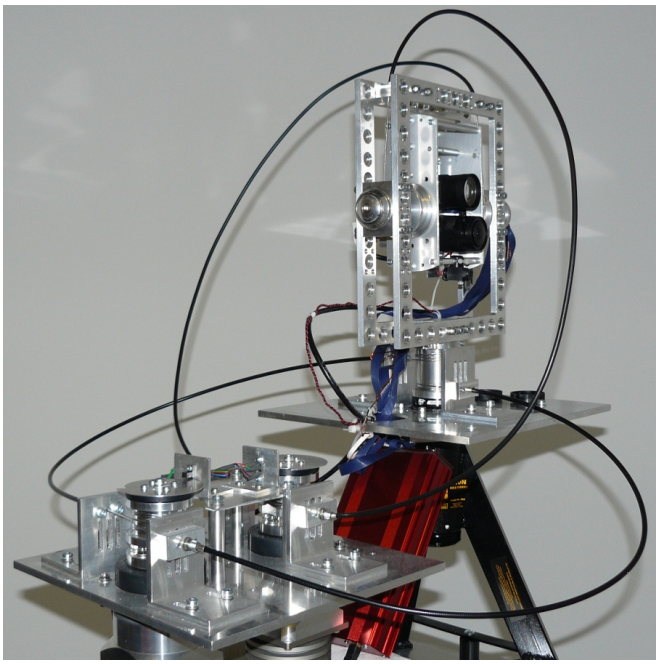

Figure 3: Custom high-performance pan-tilt and cameras.

Model details:

The full model centres around a core of biomimetic components composed of rate coded neurons. Central to this core is a model of action selection in the basal ganglia (BG) extended to include a cortico-thalamic loop (Chambers,

2007). Here noisy, spatially mapped, salience signals compete to direct gaze. Still within the biomimetic core sit two further components. The Arai et al. (1994) model of the superior colliculus is the entry point for salience signals relating to phasic luminance changes. Task specific salience signals are provided by a model of top-down object-based attentional bias in the ventral stream of the visual system(Cope et al., 2009). Around this core, engineered phenomenological models are added in order to fulfil the desired competencies and to close the agent-environment-agent loop, (see Figure 2) .

In order to embody the full model a custom high-performance pan-tilt with dynamics approaching those of the human eye is used. To mimic the distribution of photo-receptive cells on the human retina, we used two cameras; one with a wide-angle field of view for the periphery, and another (narrow angle) for the fovea. In addition to the high resolution, the foveal camera contains a custom analogue VLSI image processing chip (SCAMP) (Dudek and Carey, 2006) (see Figure 3). The SCAMP chip can perform complex array processing for almost no extra computational overhead (see Figure 1)

Distributed computation details:

The full model is integrated using the BRAHMS modular execution framework (Mitchinson et al., 2010). This framework simplifies the integration of different models and hardware resources by 'wrapping' them in a standard interface. BRAHMS automatically undertakes communication and synchronisation between components, and distribution of the model across processors networked machines, and disparate hardware resources, is greatly facilitated.

References

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Dudek, P. and Carey, S. (2006). General-purpose 128×128 simd processor array with integrated image sensor. *Electronics Letters*, 42(12):678.

Mitchinson, B., Chan, T.-S., Chambers, J., Pearson, M., Humphries, M., Fox, C., Gurney, K., and Prescott, T. J. (2010). Brahms: Novel middleware for integrated systems computation. *Advanced Engineering Informatics*, 24(1):49.