Notes on the enclosed papers

I have included four papers (all short) with my application. They are ordered in importance, and these notes should help you decide which are worth reading.


This is a good place to begin. GeoRep is a spatial representation engine that builds representations from line drawings. This conference paper provides a good overview of GeoRep’s abilities and architecture, but also touches on a lot of my prior research.


This paper is a good example of how MAGI, my computational model of symmetry detection, can be used in cognitive research. Here, I want to understand orientation effects in symmetry detection – why people judge symmetry more quickly and accurately when the symmetry is vertical than when it is horizontal, and do worst at diagonal symmetry. This may seem like a trifling human quirk, but in fact perceptual psychologists have been arguing about it for over a century (ever since Ernst Mach first described the effect). My explanation, based on MAGI, is novel, but I provide evidence for it by using MAGI to simulate the results of a classic psychology experiment in this area (Palmer & Hemenway, 1978).


GeoRep has some pretty strict limitations on the kinds of visual structure it can handle. Given that freehand sketches contain a lot of difficult-to-recognize structure, how do you get past this brittleness? This workshop paper describes one answer: you allow the user to perform sketch-like gestures (which still feels natural to the user) and then bypass symbol recognition problems using speech recognition. As a result, users can draw naturally and GeoRep still gets enough information to make lots of spatial inferences. This system is still under development.


It is self-evident that visual regularity is salient, but why is it useful? Diagrams provide one answer. The diagrammatic reasoner described here, JUXTA, demonstrates how diagrams use repetition to convey a point, and how diagrammatic reasoners can use this to their advantage. Given a diagram that depicts two similar physical scenarios side-by-side, JUXTA detects the repeating structure, determines the aligned differences between the repeating parts, and then interprets the differences in light of the diagram’s caption. The kind of diagram JUXTA handles is a type that can be found in any physics textbook, where such side-by-side diagrams are common.