A Computational Model
of the Perception of Partially Occluded and Fragmented Figures

A proposal submitted for the Faculty Research Grant at IUSB
by

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a. What is the project intended to accomplish (objectives, significance)?

Consider Figure 1 (Appendix). Most would readily acknowledge the presence of an automobile partially occluded by a fence in this photograph. Generally, humans are quite good and typically fast at perceiving **partially occluded** figures. In spite of this possibly obvious observation, prior theories of *how* we accomplish this task are at best incomplete. Now, consider Figures 2 and 3, which are examples of **fragmented** figures. We readily 'see the figure' in some cases (e.g., Figure 2), while in other cases we 'see the figure' either not at all or only after some initial difficulty (e.g., Figure 3). There has been no satisfactory explanation of this phenomenon. Building from prior literature and based on the results of a number of human psychophysical experiments that I performed, I have developed (with Professor Zygmunt Pizlo of Purdue University) a theory of the perception of partially occluded and fragmented figures. In so doing, I have built a computer model that implements this theory. Computer simulations performed for a number of conditions from my human experiments showed that this model accounts well for human performance. Additionally, these simulations led to further predictions by the theory, one of which has been verified in a subsequent human psychophysical experiment.

I plan to further test this psychological theory and also to 'build out' my computer model in order to demonstrate its potential efficacy to a more technology-oriented audience (e.g., machine vision community). My overall research plan will be elaborated in the next section after a brief review of prior literature and of my research to date. The specific piece of this plan for which I now request funding is the work to 'build out' the model. Details will be given in the next section after the review.

The theoretical significance of this line of research stems from the lack of an adequate explanation for human perception of partially occluded and fragmented figures. The practical significance of a computer model based on an adequate theory is that there are currently no machine vision systems that can handle partial occlusion in the general case (there are systems which can deal with partial occlusion under very restricted conditions). A 'perceiving' agent (e.g., a robot equipped with a vision system) that could

successfully negotiate our environment as well as we do would likely require a vision system capable of handling ever-present partial occlusions in the environment. Such an agent should also have some capability for interpreting fragmented figures. In everyday life, camouflage and low contrast can serve to fragment figures. An agent should be able to solve this problem at least as well as we do.