

**Paying Attention to What's Important:  
Using Focus of Attention to Improve Unsupervised Learning**

by  
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SB EECS  
Massachusetts Institute of Technology  
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Submitted to the Program in Media Arts and Sciences,  
School of Architecture and Planning,  
in Partial Fulfillment of the requirements of the degree of

MASTER OF SCIENCE  
in  
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## **Abstract**

Adaptive autonomous agents have to learn about the effects of their actions so as to be able to improve their performance and adapt to long term changes. The problem of correlating actions with changes in sensor data is  $O(n^2)$  and therefore computationally expensive for any non-trivial application. I propose to make this problem more manageable by using focus of attention. In particular, I discuss two complementary methods for focus of attention: *perceptual selectivity* restricts the set of sensor data the agent attends to at a particular point in time, while *cognitive selectivity* restricts the set of internal structures that is updated at a particular point in time. I present results of several implemented algorithms—variants of the *schema mechanism* [Drescher 91]—which employ these two forms of focus of attention. The results demonstrate that incorporating focus of attention dramatically decreases the computational expense of learning action models without affecting the quality of the knowledge learned, with only small increases in the number of training examples required to learn the same knowledge.

Thesis Supervisor: Pattie Maes  
Title: Assistant Professor, Media Arts and Sciences

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The following people served as readers for this thesis:

Reader

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Gary Drescher  
Research Scientist  
Thinking Machines Corporation

Reader

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Marvin Minsky  
Toshiba Professor of Media Arts and Sciences  
Program in Media Arts and Sciences



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