1115-68-308 **Dan P. Guralnik*** (guraldan@seas.upenn.edu), Dept. of Electrical and Systems Engineering, 200 South 33rd Street, Moore bldg. 203, Philadelphia, PA 19104, and **Daniel E. Koditschek** (kod@seas.upenn.edu), Dept. of Electrical and Systems Engineering, 200 South 33rd Street, Moore bldg. 203, Philadelphia, PA 19104. *Universal Memory Architectures: CAT(0) cubical event representations for learning and control.*

We show how the Sageev-Roller duality between poc-sets and median algebras may be applied to allow the construction of agents capable of autonomously forming an internal representation of their interactions with their environment *from scratch*, given no prior knowledge and based only on observations of binary data streams (or *'sensors'*). This representation takes the form of the CAT(0) cubical envelope of the set of sensory equivalence classes permitted by implications learned from the environment. It is completely encoded in a data structure supported on the dual poc set. As a result, maintenance and reactive planning costs are reduced from exponential to quadratic in the number of sensors. Maintaining this representation *dynamically* required (1) an extension of Sageev-Roller duality to cover a larger class of complemented ordered structures, and (2) the characterization of data structures enabling efficient statistical learning of implications in the environment. Time permitting, we will discuss the topological and geometric obstructions to planning in our representations and how they impact the possible application range of this approach as seen through the lenses provided by Category Theory. (Received September 21, 2015)