



U.S. ARMY
RDECOM

A Developmental Process for
Autonomous Systems



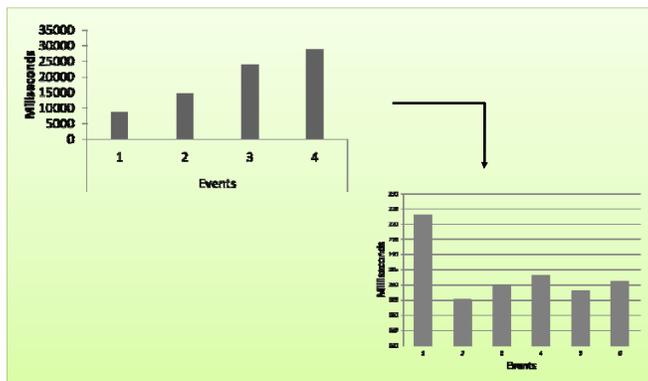
S&T Campaign: Human Sciences

Human Behavior

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Research Objective

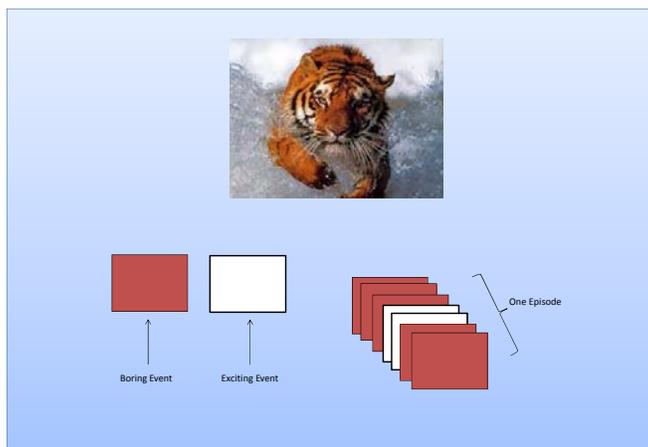
- Make more efficient robotic systems that can support real-time field operations
- Examine whether human cognitive mechanisms (e.g. boredom, REM sleep memory consolidation) aid in improving memory storage and retrieval in robotic systems



Memory retrieval times before (upper-left) and after (lower-right) the addition of boredom and consolidation mechanisms

Challenges

- Adaptive robotic systems tend to get slower as the number of stored memories increases
- Scene novelty classification
- Generalization from one scene to similar scenes
- Lack of memory consolidation models appropriate for real-world embodied agents



Frame novelty can serve as a key qualification for long-term storage

ARL Facilities and Capabilities Available to Support Collaborative Research

- Robotics lab at Aberdeen Proving Ground with several mobile robotic platforms with various sensor arrays, including:
 - 3D cameras
 - Kinect sensors
 - Laser scanners
 - Ultrasonic sensors
 - Bumpers
 - Microphones
- Pods for human experiments
- Virtual simulation environments
- Cognitive modeling expertise
- ARL-developed cognitive architecture for robotic systems (SS-RICS; Symbolic Sub-symbolic Robotic Intelligence Control System)



Kelley, T. D. (2014). Robotic Dreams: A Computational Justification for the Post-Hoc Processing of Episodic Memories. *International Journal of Machine Consciousness*, 6(02), 109-123

Kelley, T. D. and Veksler, V.D. (accepted for publication). *Computational Benefits of Seemingly Suboptimal Behavior: Sleep, Boredom, and Distraction*. *American Philosophical Association Newsletter on Philosophy and Computers*. Fall. 2015.

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Experience with long term cognitive development and learning in robotics
- Developmental psychology
- Childhood development and post hoc episodic processing (dreaming) in early childhood development
- Robotics test courses and development centers