

Modularity in **Artificial and Natural** **Intelligence**

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Artificial models of natural Intelligence (AmonI)

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Who am I and What have I Done?

Education

Work

B.A. Behavioral Sci.

System Analyst, Financial Industry

M.Sc. AI

Object-Oriented Reengineering

M.Phil Psychology

Research Scientist, AI for VR (LEGO)

Ph.D. Computer Sci.

Dialog Tutoring Systems, Characters, Modelling Primates

My Chunk of Artificial Intelligence

- **Designing Intelligent Systems.**
 - Modules to encapsulate learning, action & perception.
 - Reactive Plans to arbitrate between modules.
- **Understanding Natural Intelligence.**
 - Animals moving in space, integrating information & goals.
 - Individuals learning new tasks.
 - Behavior and structure of societies emerging from individual intelligence.

Types of Projects

- Building AI systems with existing tools.
- Running experiments on existing AI systems.
- Making AI tools easier to use.

Example: A Mobile Robot

(Bryson ATAL97)



Example: VR

(Bryson & Thórisson 2000)



Macaque Social Order



- Some (e.g. Rhesus) show strict, hierarchical order, also violent but infrequent conflict.
- Some (e.g. Stumptail) show egalitarian social order, more frequent but less violent conflict.

Hypotheses of Macaque Social Order

- Less resources (e.g. food) \Rightarrow more violence \Rightarrow selective pressure for social structure
(Hemelrijk 2001, 2002)
- New conflict resolution behavior \Rightarrow less violence \Rightarrow less pressure for social structure
(de Waal 2001, Flack *in prep.*)

Basic Social Behaviors

	Navigate	Groom	Explore
<i>state</i>	x, y, size, name focus-of-attn	drive-level, partner groomed-when, being-groomed?	drive-level direction-of-interest
<i>actions</i>	approach wait, align untangle	groom, choose-partner partner-chosen? tolerate, notify	choose-new-location lose-target, explore want-novel-loc?

life (D)

untangle (tangled?)

untangle

(partner-chosen?) (aligned?)

notify groom

(being-groomed?)

choose-groomer-as-partner

groom (C) (want-to-groom?)

(partner-chosen?) (touching?)

notify align

(partner-chosen?)

notify approach

(T)

choose-partner

receive (being-groomed?)

tolerate-grooming

(place-chosen?) (there-yet?)

lose-target

explore (C) (want-novel-loc?)

(place-chosen?)

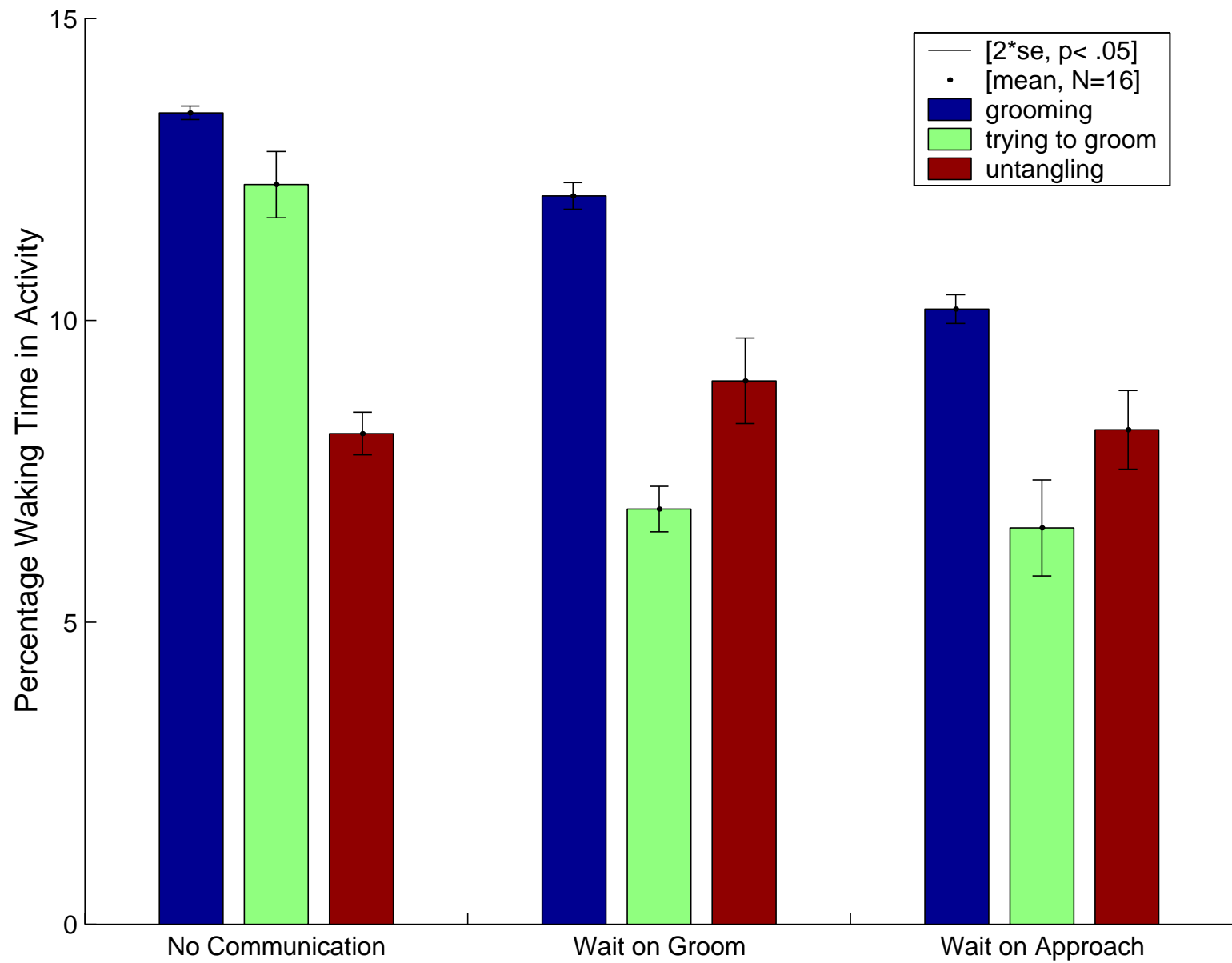
explore-that-a-way

(T)

choose-explore-target

wait (T)

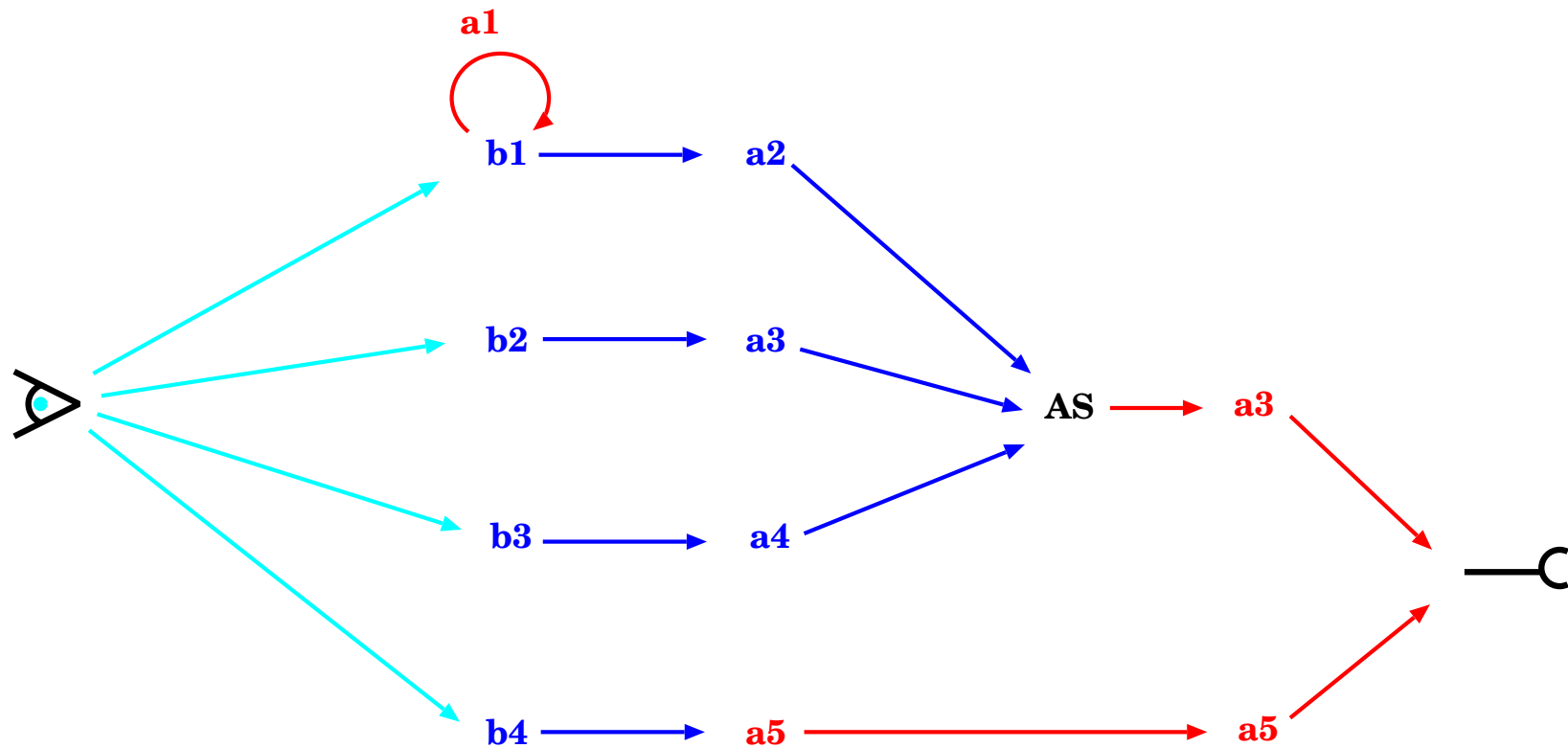
wait



Reactive Planning

- Modularity leads to coordination problems.
- Reactive plans are engineered solutions.
 - Planning
 - Reactive Planning
 - Reactive Plans
- Plans (and memory) are what create the individual personality of agents.

The Place of Reactive Planning in an Agent



Project 1: Monkeys in a Simulation Tool

1. Connect an IDE for Reactive Plans to an existing simulation tool.
2. Replicate (extend?) my social primate experiments.
3. If it works, will be used by *lots* of people.
4. Should be a good programmer. Some HCI, some research,
 - must pick *which* simulation tool, must evaluate them. Breve, Mason, RePast, others?
 - may have to polish the IDE.

Project 2: Monkeys in a MUD

1. Anarres (see <http://docs.anarres.org/>) developed by Ben Mankin here at Bath. Well-used MUD with human and AI occupants.
2. Want to have it inhabited by a troop of monkeys.
3. If one monkey gets kicked, it should go find a bunch of other monkeys and then come and hassle the aggressor.
4. No VR, no natural language, some navigation, lots of coding.

5. Native language for MUD is LPC. Mr. Mankin is willing to work out an API to the python version of POSH planning.

Project 3: Test an Emotional Representation and Facial Animation Tool

1. Emotions evolved as a part of action selection.
2. Important characteristic: duration of emotions, rate of change.
3. Emmanuel Tanguy has developed a Facial Simulation tool.
4. Want experiments run on it with human subjects to test believability.

5. Not much coding (unless you want to – could hack tool, or put experiments on line).
6. Must do good quality usability studies following proper experimental method including analysis!

Project 4: Passing the Turing Test in a Games Environment: Language and Action in UnReal Tournament

1. Use afore-mentioned IDE, which has already been attached to UnReal.
2. Try to pass Turing test (get mistaken for real player) at least for a while.
3. Requires serious programming: interest in natural language, building parsers, interest in true AI / philosophy of mind.

4. Will have to convince me you will work very, very hard before I let you try this.

Working with JB

1. All my students will be expected to attend group meetings, and to contribute to AI projects in some way.
2. I hope to get publishable results and/or systems out of every project.
3. All the proposed projects involve working with existing code — just like the real world.
4. AI is really cool & you can tell your friends about it.

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