



How Minds Work

IDA and her Architecture

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Who is IDA?

IDA is an intelligent,
autonomous software agent
that does personnel work for
the US Navy



Introducing IDA



An intelligent software agent
capable of entirely automating
human information agents

- *Customer Service Agents*
- *Travel Agents*
- *Insurance Agents*
- *Loan Officers*



IDA Negotiates



IDA negotiates with clients in natural language—English



IDA Accesses Databases



IDA locates and understands information from databases



IDA Adheres to Policies



IDA understands and adheres to numerous company policies



IDA Makes Decisions



IDA makes sophisticated decisions involving deliberation and constraint satisfaction



IDA Produces a Product



IDA can produce useful products

- *Airline tickets*
- *Loan papers*
- *Insurance policies*



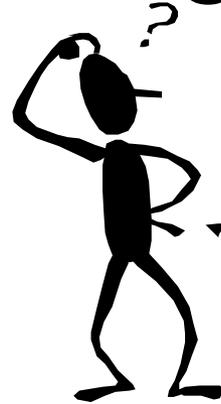
IDA Generates Hypotheses



IDA generates hypotheses about how minds work to guide cognitive scientists and neuroscientists



IDA: an Intelligent Distribution Agent



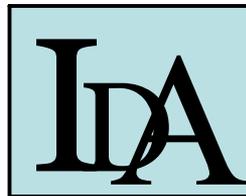
Detailer

- Dialogue with sailors
- Read personnel data
- Check job requisition lists
- Enforce Navy policies
- Choose options to offer members
- Negotiate with them about jobs

Telephone



Internet



IDA works for the US Navy

- Funded by Office of Naval Research & other Navy sources—\$1.5m
- IDA, an intelligent software agent, uses locally developed cutting edge Artificial Intelligence technology to
 - Model human cognition—the science side
 - Negotiate with sailors in everyday English about new jobs—the engineering side



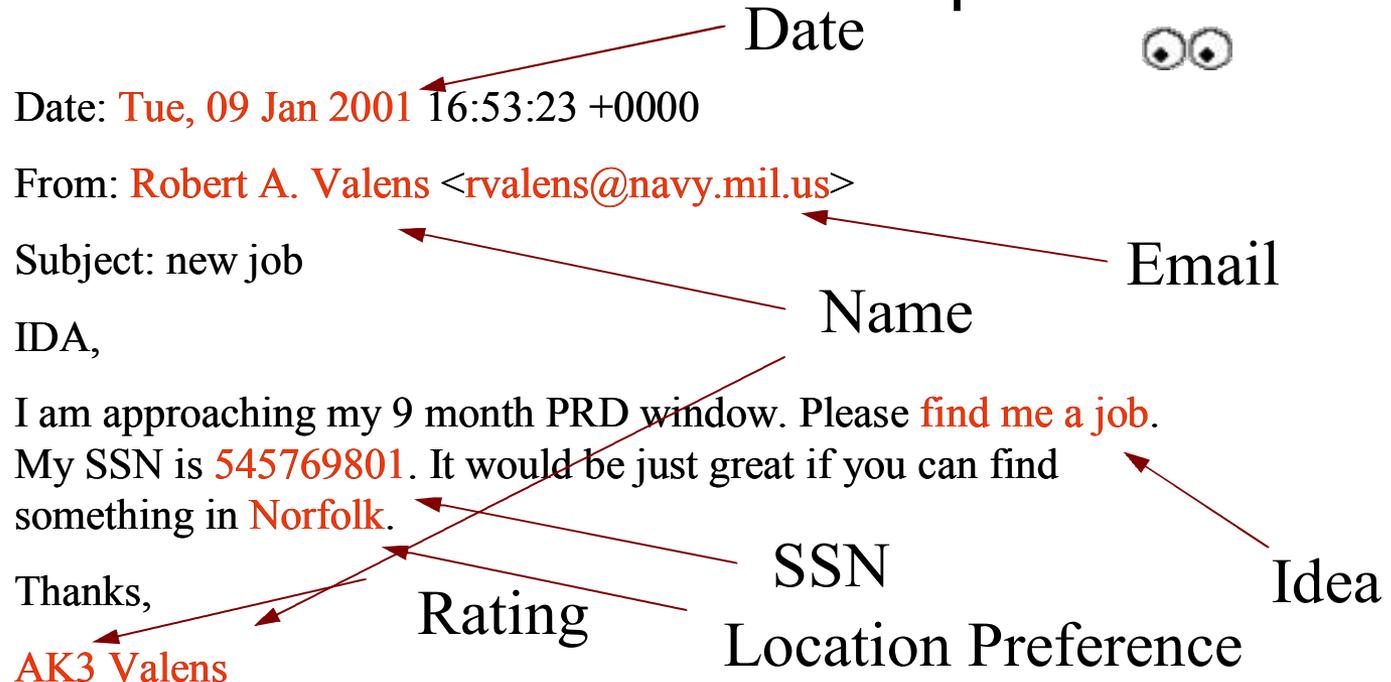
IDA finds jobs for sailors

- Communicates with sailors in English via email
- Selects jobs to offer a sailor, taking into account
 - the Navy's policies and needs
 - the sailor's preferences
- Deliberates about feasible dates
- Negotiates with the sailor about job selection over the course of several emails



How does IDA read emails?

- Read sailor emails and extract pertinent data



How does IDA gather data?

- Gather necessary data from Navy formatted databases
 - Personnel
 - Job Requisitions
 - Training
 - Rollovers
 - AutoCost (PCS cost calculator)

392700222 Steven Lee Pribnow							
Rate:	AS1	Pay Grade:	6	PRD:	9805	NEC1:	7617
NEC2:	7607	NEC3:	EMPTY-FIELD	NEC4:	EMPTY-FIELD	NEC5:	EMPTY-FIELD
SeaShore:	2	ONBD UIC:	03364	Dep:	A	Sea Loc1:	KPS
Sea Loc2:	BPT	Sea Loc3:	KSD	Shore Loc1:	HCC	Shore Loc2:	MWI
Shore Loc3:	KCK	Over Seas Loc1:	GUM	Over Seas Loc2:	ADA	Over Seas Loc3:	JAT
Sex:	M	EAOS:	9610	ONBD Act. Nam... CV 64 CONSTE...	Limited Duty:	EMPTY-FIELD	
Geo. Loc:	KSD						



How does IDA rate jobs?

- Evaluate jobs for sailors
Fitness values from
IDA's workspace

Req. Date	Paygrade	TUM	Priority	Act. Name	UIC	Sea/Shore	ATC	NEC1	NEC2	Fitness
961005	5	9903	001	HSL 45	53915	1	KSD	EMPTY-FIE...	EMPTY-FIE...	0.58987
961005	6	9907	001	VF 101	09067	1	FOA	EMPTY-FIE...	EMPTY-FIE...	0.7799499...
961005	6	9909	001	FITWPSCO...	52912	1	LFA	EMPTY-FIE...	EMPTY-FIE...	0.7799499...
961005	6	9902	001	NAS WHFL...	60508	1	GML	EMPTY-FIE...	EMPTY-FIE...	0.7799499...
961005	5	9903	002	NAS WHID...	00620	1	MWI	EMPTY-FIE...	EMPTY-FIE...	0.6615199...
961005	6	9907	002	MCAS YUMA	62974	1	KYU	EMPTY-FIE...	EMPTY-FIE...	0.77645
961005	5	9901	003	NAWS CL...	47609	1	KCK	EMPTY-FIE...	EMPTY-FIE...	0.58287
961005	6	9903	003	TRARON 21	0400A	1	HKI	EMPTY-FIE...	EMPTY-FIE...	0.7729499...
961005	6	9905	003	STRKFIGH...	55257	1	KEC	EMPTY-FIE...	EMPTY-FIE...	0.7729499...
961005	5	9811	003	VX 9	55646	1	KCK	EMPTY-FIE...	EMPTY-FIE...	0.58287
961005	6	9903	004	NAPMI PE...	0751A	1	GPE	EMPTY-FIE...	EMPTY-FIE...	0.7694499...
961005	6	9906	004	COMNAVA...	57012	1	FNO	EMPTY-FIE...	EMPTY-FIE...	0.7694499...
961005	5	9905	004	NAWS P M...	49146	1	KPS	EMPTY-FIE...	EMPTY-FIE...	0.5793699...
961005	6	9904	005	NRLFLOPD...	48498	1	PPA	EMPTY-FIE...	EMPTY-FIE...	0.76595
961005	6	9906	005	NAS FALL...	60495	1	LFA	EMPTY-FIE...	EMPTY-FIE...	0.76595
961005	5	9905	005	NAWS P M...	49146	1	KPS	EMPTY-FIE...	EMPTY-FIE...	0.57587
961005	5	9904	005	VF 101	09067	1	FOA	EMPTY-FIE...	EMPTY-FIE...	0.57587
961005	6	9906	006	COMSTRA...	55575	1	HTA	EMPTY-FIE...	EMPTY-FIE...	0.76245
961005	5	9906	007	AMTGD M...	66069	1	GMY	EMPTY-FIE...	EMPTY-FIE...	0.56887
961005	5	9904	007	NAS KEY ...	00213	1	GKE	EMPTY-FIE...	EMPTY-FIE...	0.56887



How does IDA deliberate?

- Create and Adjust Job Transition Timelines

Detach date, Take up month, and Training (if needed) are put in first

Next, Leave time is put in

If Training is needed, then travel time to the school is added

Finally, Travel time to the job is calculated to determine when the sailor will arrive.

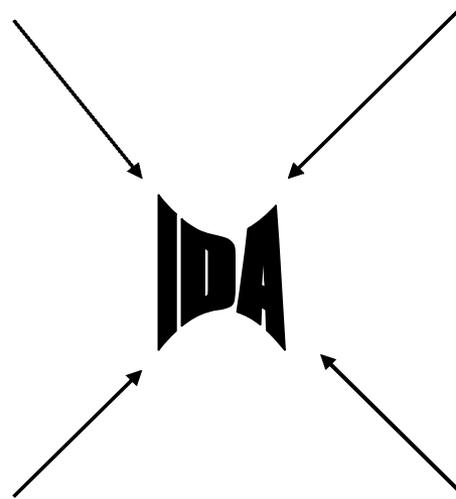
Timeline is displayed as dates are adjusted



IDA: a 'conscious' software agent

Autonomous Agent

GW Theory



Conceptual Model

Computational Model

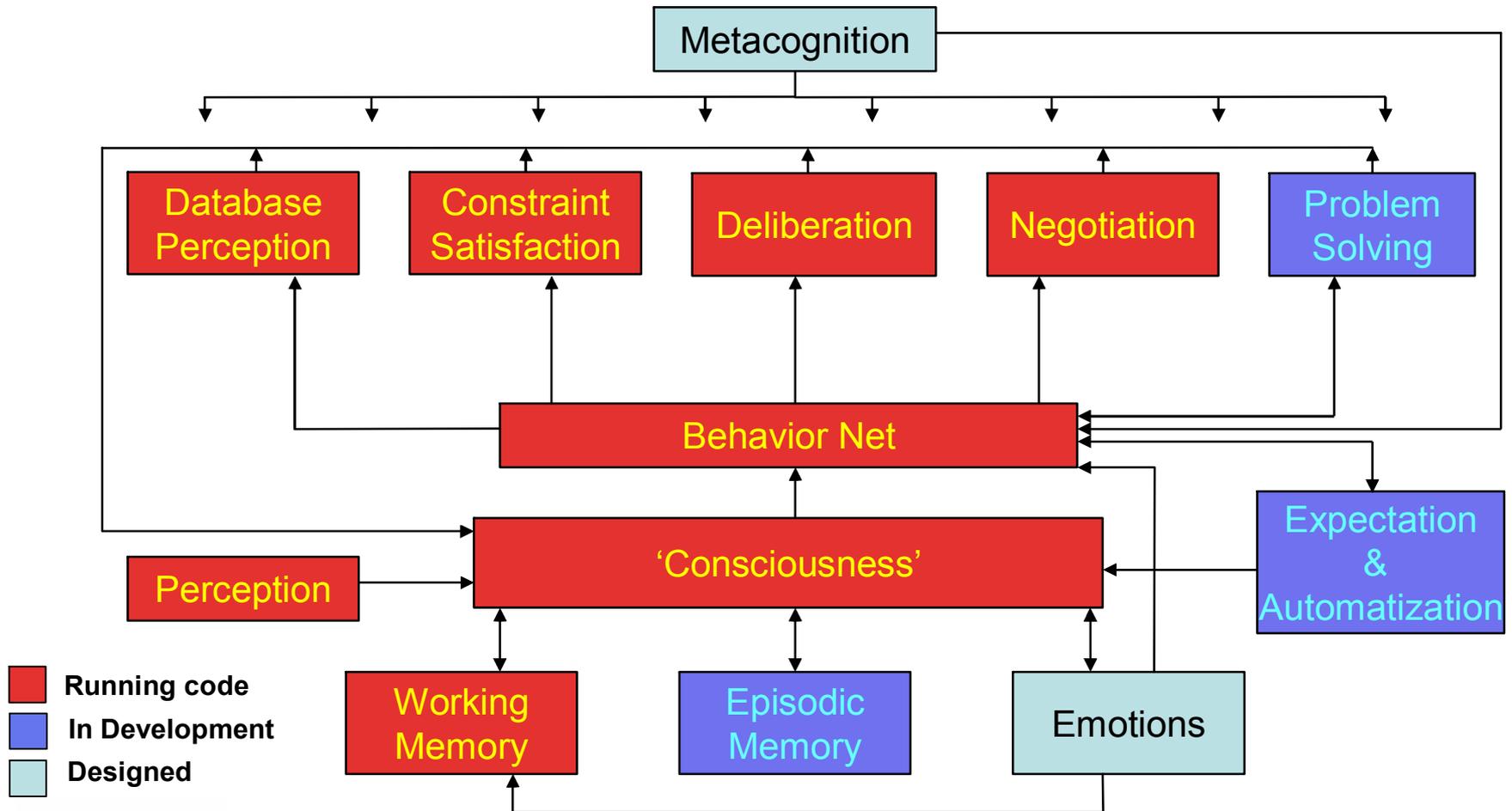


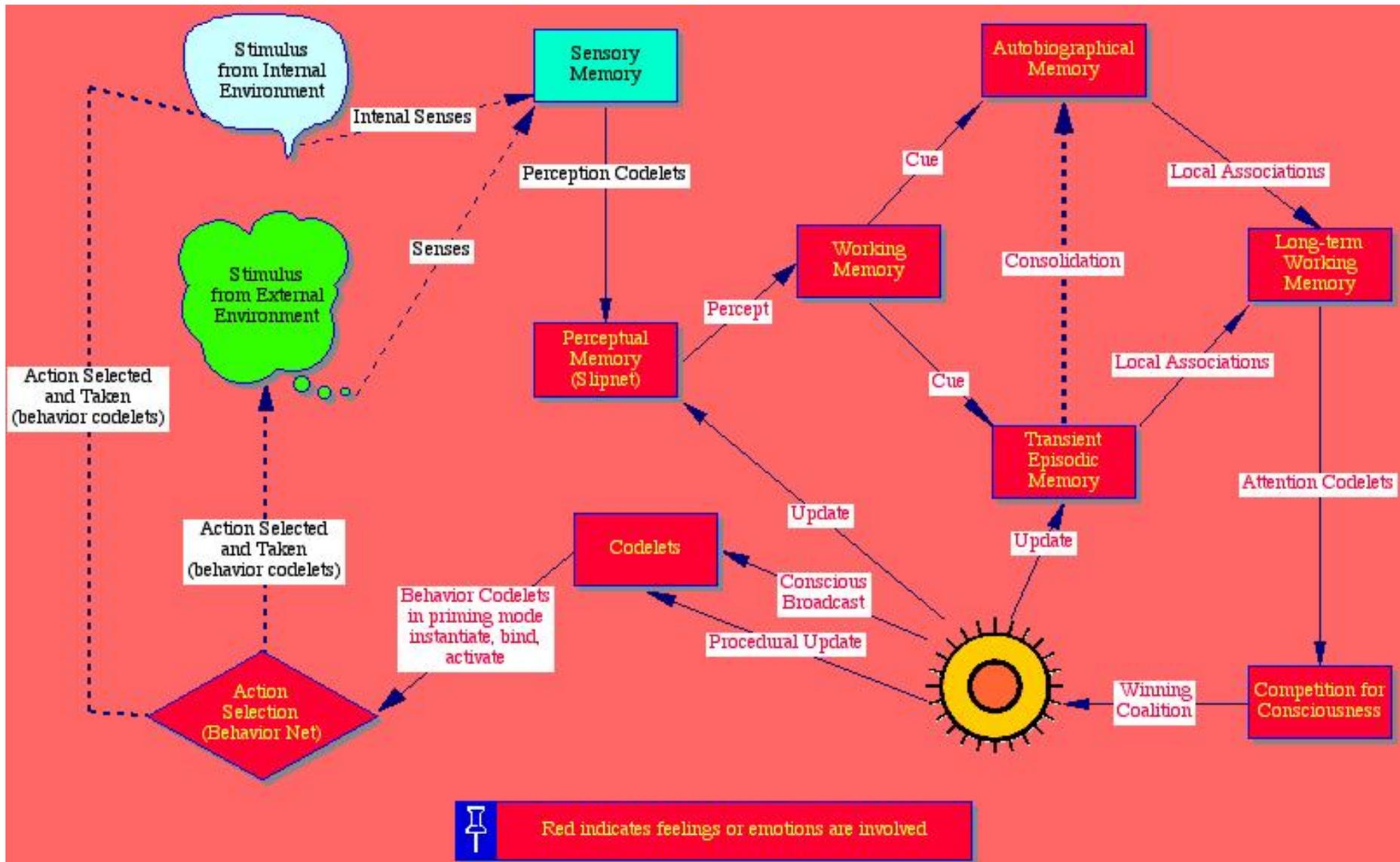
IDA'S Modules and Mechanisms

Perception	Copycat Architecture	Hofstadter
Action Selection	Behavior Net	Maes
Episodic Memory	Sparse Distributed Memory	Kanerva
Emotions	Pandemonium Theory	Jackson
Metacognition	Fuzzy Classifier Systems	Holland
Learning	Copycat Arch., Reinforcement	
Constraint Satisfaction	Linear Functional	
Language Generation	Pandemonium Theory	Jackson
Deliberation	Pandemonium Theory	Jackson
'Consciousness'	Pandemonium Theory	Jackson



IDA's Architecture





Cognitive Cycle Processing

- Hypothesis— Like IDA's, human cognitive processing is via a continuing sequence of Cognitive Cycles
- Duration— Each cognitive cycle takes roughly 200 ms with steps 1 through 5 occupying about 80 ms
- Overlapping— Several cycles may have parts running simultaneously in parallel
- Seriality— Consciousness maintains serial order and the illusion of continuity
- Start— Cycle may start with action selection instead of perception



IDA Project Accomplishments

- Funding - ~\$1.5m from ONR & Navy sources
- Publications—past five years
 - 12 Journal articles or book chapters
 - 15 Refereed conference presentations
- Degrees completed—past five years
 - 10 Masters
 - 5 Ph.D.'s
- Numerous invited & contributed presentations



Current IDA Projects

Automatization	Negatu, McCauley, Franklin
Non-routine problem solving	Negatu, McCauley, Franklin
Episodic Memory	Ramamurthy, D'Mello, Ventura, Franklin
Procedural learning	D'Mello, Ramakrishna, Negatu, McCauley, Franklin
Perceptual learning	D'Mello, Ramamurthy, Bodipudi, Brown, Franklin
Perceptual automatization	Brown, Ramamurthy, Franklin
Self	Brown, Ramamurthy, Franklin



Is IDA Conscious?



IDA is functionally 'conscious', but what about subjective experience?

Is IDA the world's first conscious artifact?



Readings in *Artificial Minds*

Pandemonium Theory

pp. 234-244

Copycat Architecture

pp. 347-362

Schema Mechanism

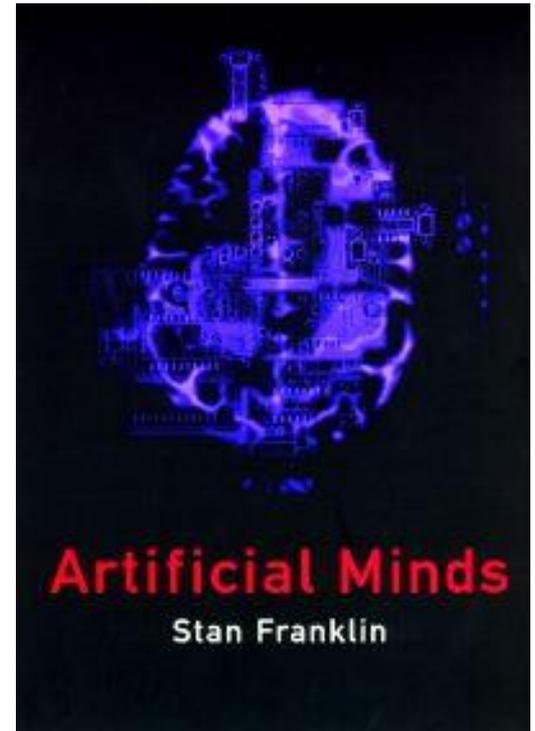
pp. 314-324

Sparse Distributed Memory

pp. 330-344

Behavior Networks

pp. 244-258



MIT Press, 1995



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