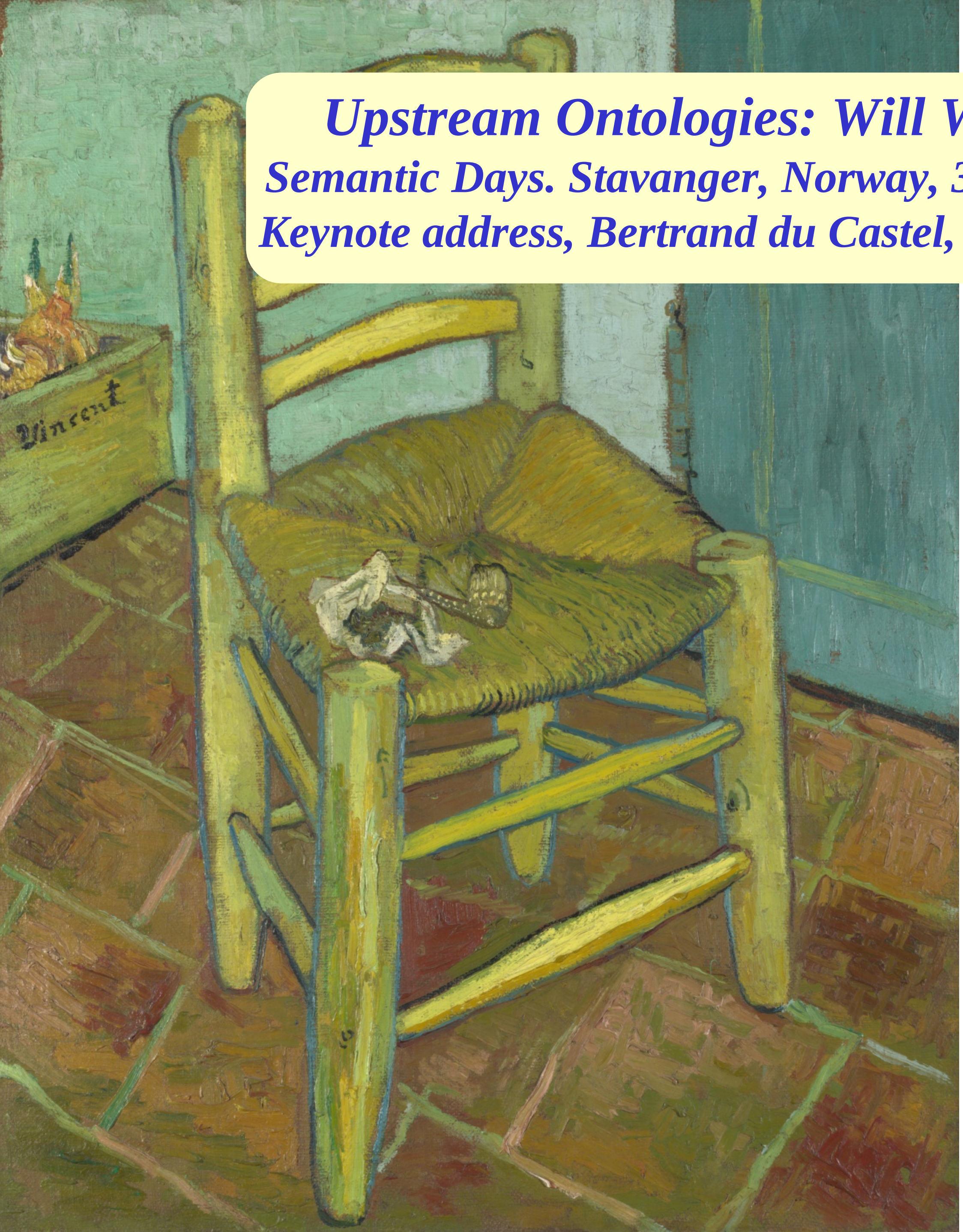

Upstream Ontologies: Will We Ever Learn?

Semantic Days. Stavanger, Norway, 31 May – 2 June 2010

Keynote address, Bertrand du Castel, Schlumberger Fellow

all

automation

It’s

upstream

about

Schlumberger

Human-Centered Automation - Principles

Where automation applies

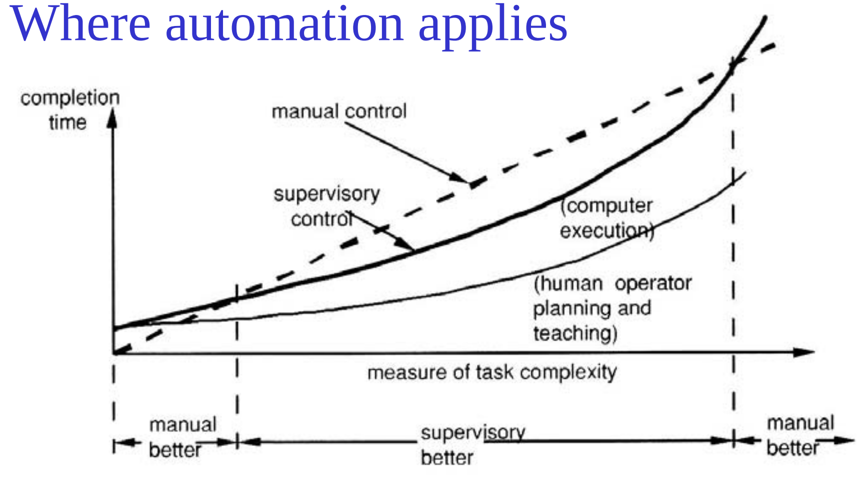

Figure 6.6 Range in which supervisory control outperforms manual control.

Scale of automation

TABLE 3.2
A Scale of Degrees of Automation

1.	The computer offers no assistance; the human must do it all.
2.	The computer suggests alternative ways to do the task.
3.	The computer selects one way to do the task and
4.	executes that suggestion if the human approves, or
5.	allows the human a restricted time to veto before automatic execution, or
6.	executes automatically, then necessarily informs the human, or
7.	executes automatically, then informs the human only if asked.
8.	The computer selects the method, executes the task, and ignores the human.

Levels of automation

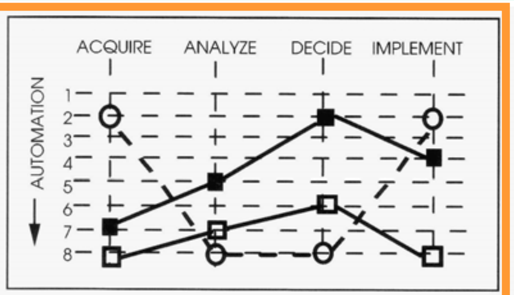

Figure 3.4 Examples of different levels of automation at different task stages.

Supervisory control

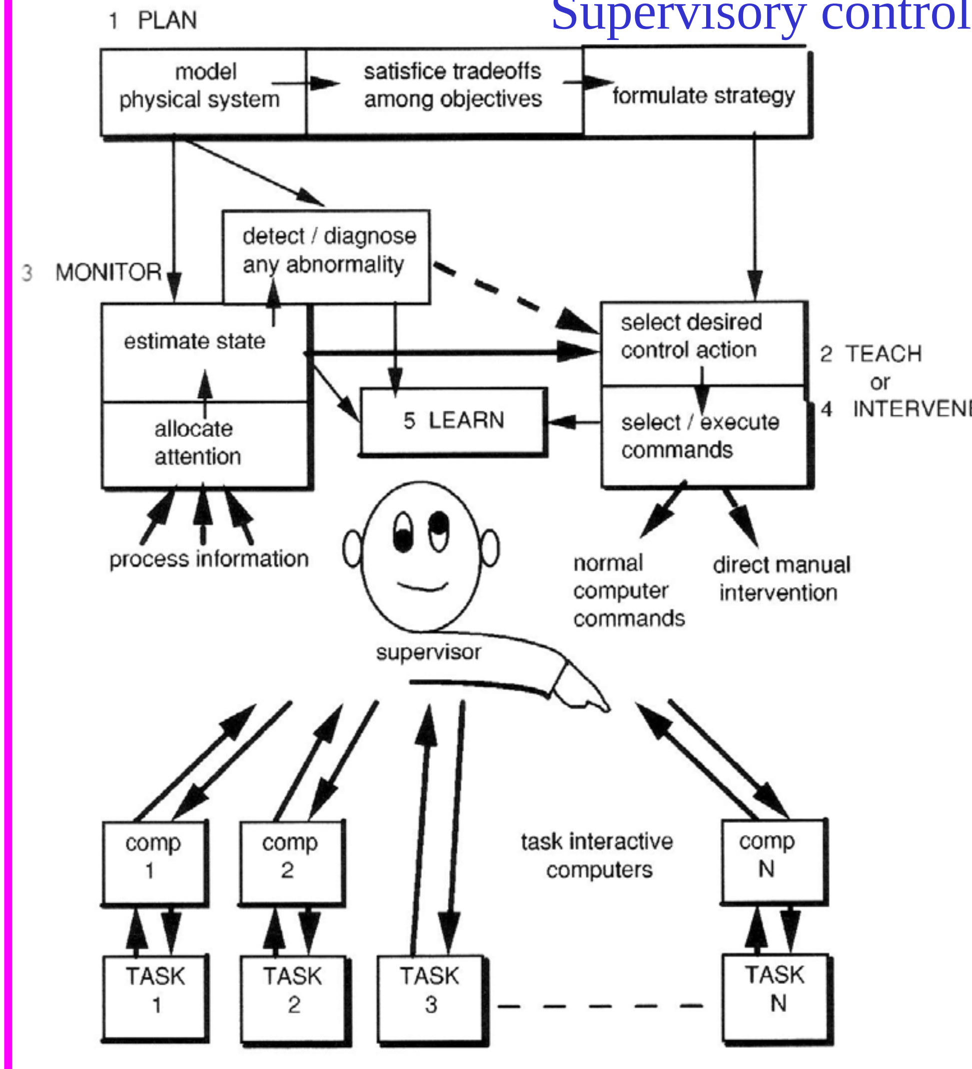

Figure 6.5 A composite picture of supervisory control.

Humans and Automation: System Design and Research Issues
Thomas B. Sheridan, John Wiley, 2002

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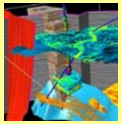
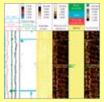
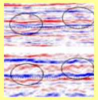
Upstream Human-Centered Automation

Value	Production	Development	Characterization	Delineation	
Expertise is distributed around the world in and between companies. Expertise is enhanced by automation in data management, simulation, uncertainty management, prognostics. Experts make decisions, and are part of the automation continuous improvement process. Administration is seamless with logistics automated through web services.			 	 	Office
Field locations have the benefits of local autonomy with logistics and resources optimized across the company. Local staff have access to expertise through automated systems, particularly in case of break down. Work schedules are attractive because of the elasticity of response created by automation and access to multiple remote experts.					Base
Multi-vendor asset equipment is fully networked from down-hole to seabed to surface. Information about the performance of the asset, and the levels of uncertainty in future performance, is constantly updated. Automation plays a key role in a rolling simulation, uncertainty analysis, and optimization of asset exploitation.					Asset
Surface systems are networked and can be controlled remotely. Automation drives efficiency, safety, and economics. The surface environment is safe and attractive. Dangerous, unpleasant and inefficient tasks, and tasks prone to human error are automated. Well trained technicians operate surface equipment with input from remote experts.		 	  		Surface
Down-hole information and control is available through higher bandwidth communication channels throughout well construction, completion, and production. Installation of completion hardware is predictable and reliable. Flexible, semi autonomous, bandwidth optimized, and context aware systems reduce the need for intervention.			 		Subsurface

Artificial Intelligence is a Means to Automation

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Upstream Automation

Measurement and Control, Processes and Technology,
Maximizing the *Value of People Expertise*

Pay

Cycle Risk | Distribution Optimization | Discovery Production | Tagging Tripping | Exceptions Tractor

Finance	Asset	Reservoir	Well	Zone
Governance Standard Decision	Resolution Federation Uncertainty	Ontology Architecture Model	Evaluation Learning Simulation	Inversion Web Services

Elaboration

Remote operation
Auto-pilot
High-level commands
Low-level commands
Manual operation

There is much to human beings, of which little has been decoded. Artificial intelligence is remote, but leveraging what's known is within reach.

Computer Theology, Bertrand du Castel & Timothy M. Jurgensen, Midori Press, 2008

égalité	**religious**	**mythic**	**mimetic**	**sensori-motor**
rhythm	*inversion*	*blending*	*metaphor*	*action*
dominance	ecstasy	intelligence	habits	instinct
rhetoric	poetry	language	symbol	sign
uniform	vestment	fashion	clothing	naked
manufacturing	art	process	tool	object
lending	money	gold	bulla	shell
logic	reduction	description	number	digit
policy	trust	narrative	sentence	word

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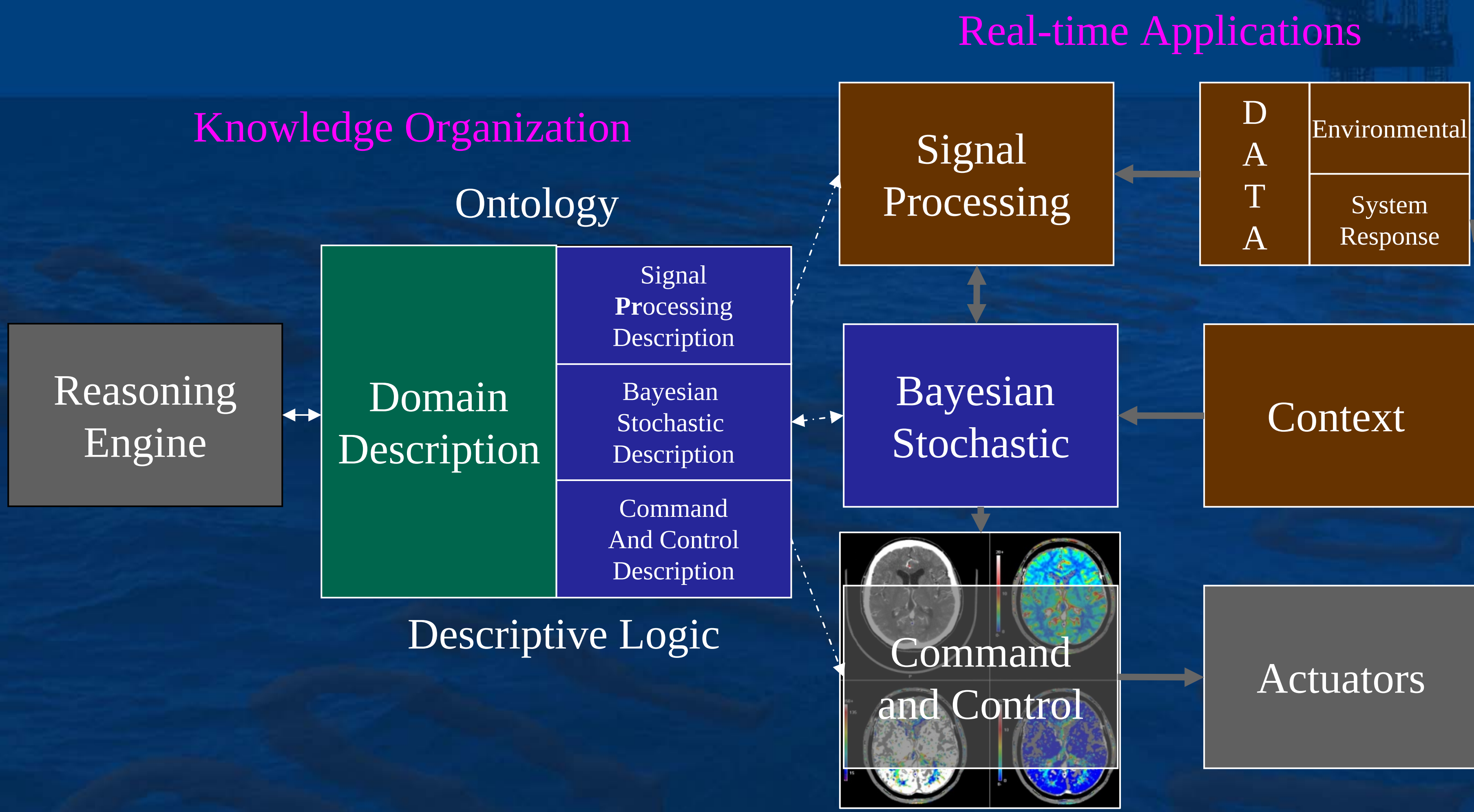
Upstream Human-Centered Automation



The ontology describes sensor fusion and control activities in a uniform manner so that reasoning can automatically process data input into commands.

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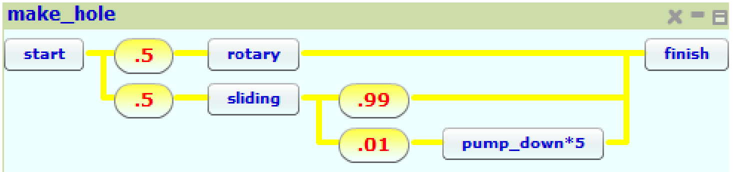
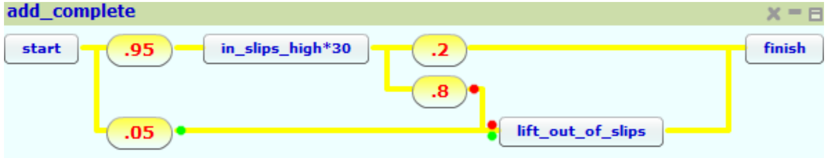
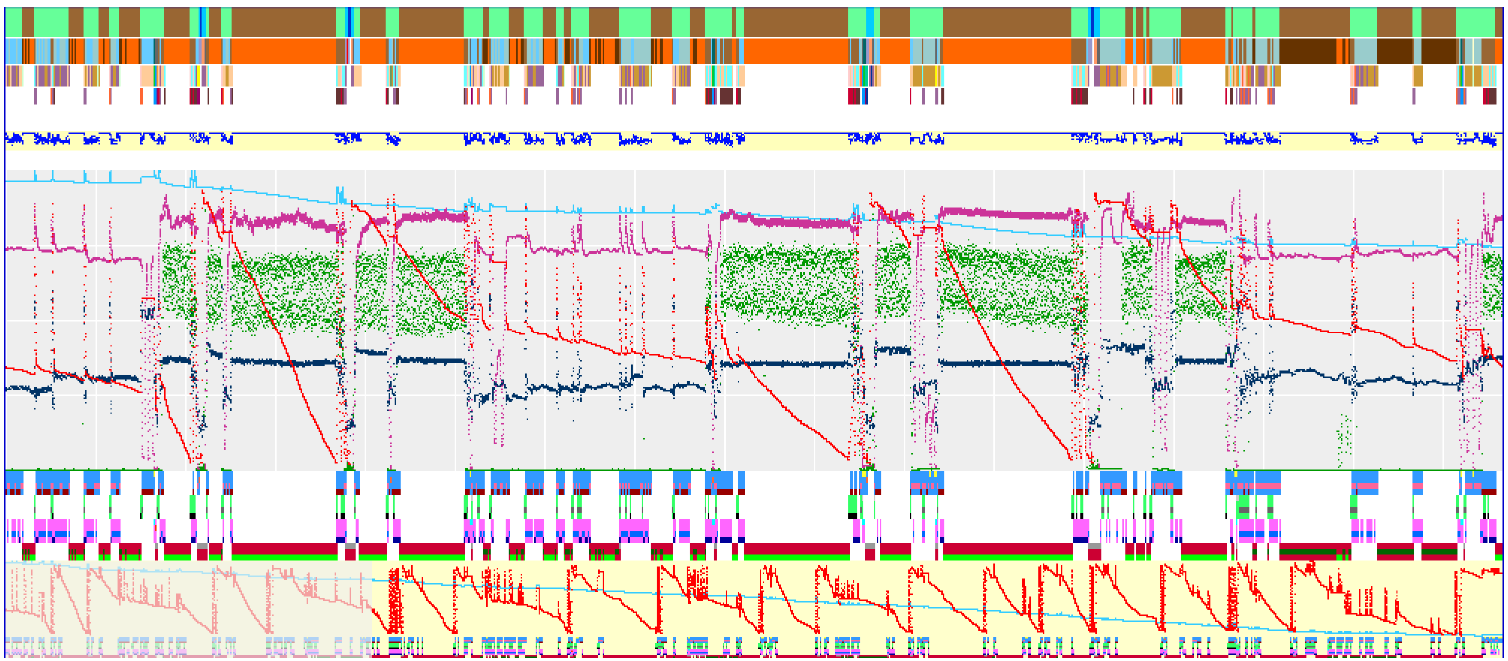
Stochastic Grammars

Comment	Input ▲	absent	block	bottom	classified
Rotary Drill	0	no	slow	onbottom	yes
Slide Drill	1	no	slow	onbottom	yes
InSlips	2	no	...	offbottom	yes
Ream	3	no	down	offbottom	yes
Run In, Pump	4	no	down	offbottom	yes
Run in, Rotate	5	no	down	offbottom	yes
Run In	6	no	down	offbottom	yes
Back Ream	7	no	up	offbottom	yes
Pull Up, Pump	8	no	up	offbottom	yes
Pull Up, Rotate	9	no	up	offbottom	yes

- ▶ add_complete(2)
- ▶ add_connect(3)
- ▶ add_ready(9)
- ▶ add_stand(3)
- ▶ add_up(1)
- ▶ drill(4)
- ▶ drill_a_section(2)
- ▶ drill_operation(7)
- ▶ drill_well(1)







An ontology of rules

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DL ontologies are monotonic

Table 1 | **Summary of number of contacts and release probability (p_r) in different connections**

CNS area	Presynaptic	Postsynaptic	N	p_r	Methods
Cat spinal cord	Group 1a axons	Motor neurons	2–5 (REFS 22,24,146)	0–1 (CB) (REFS 21,22,24)	R[21,22,24], LM[22,146], QA[21,22,24]
Cat spinal cord	Group 1a and 1b axons	DSCT neurons	1–18 (REF. 3)	0.07–1 (CB) (REF. 23) 0.06–0.85 (CB) (REF. 3)	R[3,23], LM[3], QA[3,23]
Frog spinal cord	Primary afferent fibres	Motor neurons	21–72	0.15–0.69	R, LM, QA[147]
Goldfish brainstem	Interneurons	Mauthner cells	3–28 (REFS 4,5)	0.17–0.62 (REFS 4,5)	PR[4,5], LM[4,5], EM[4,5], QA[4,5]
Cat and rat L2/3	Pyramidal cells	Interneurons	1–7 (REF. 15)	0–0.84 (CB) (REF. 15) 0.13–0.64 (REF. 49)	PR[15,49], LM[15], EM[15], QA[15], Cal[49]
Cat L2/3	Interneurons	Pyramidal and spiny stellate cells	3–17 (REF. 10)	ND	PR, LM, EM[10]
Cat and rat L2/3	Pyramidal cells	Pyramidal cells	3.9±0.8 (REF. 148) 2–4 (REF. 8) 7.6±4.7 (REF. 149)	0.5±0.05 (REF. 148) 0.46±0.26 (REF. 49) 0.65±0.18 (REF. 149)	PR[25,35,42,148], LM[8], QA[148,149], Cal[49]
Rat L2/3	L4 spiny cells	Pyramidal cells	4–5 (REF. 150) 4–6 (REF. 151)	0.79±0.04 (REF. 151)	PR[150,151], LM[150,151], EM[151], QA[151]
Cat and rat L4	L4 pyramidal and spiny stellate cells	L4 pyramidal and spiny stellate cells	2–5 (REF. 152) 8±4.2 (REF. 149)	0.69–0.98 (REF. 153) 0.86±1.09 (REF. 149)	PR[152], R[153], LM[22,153], QA[153]
Rat L5/6	Pyramidal cells	Pyramidal cells	2–8 (REF. 7) 4–8 (REF. 138) 8.1±4.2 (REF. 149)	0.16–0.9 (REF. 138) 0.53±0.22 (REF. 149)	PR[7,138,149], LM[7,138], EM[138], QA[138,149]
Rat L5/6	Interneurons	Pyramidal cells	1–5 (REF. 154)	ND	PR, LM, EM[154]
Rat L5/6	Pyramidal cells	Interneurons	6–12 (REF. 155)	<0.1 (REF. 155)	PR, LM, EM[155]
Rat CA1	Interneurons	Pyramidal cells	6–12 (REF. 9)	ND	PR, LM, EM[9]
Rat CA1	Pyramidal cells	Pyramidal cells	2 (REF. 156)	ND	PR, LM, EM[156]
Rat CA1	Stratum radiatum	Pyramidal cells	3–18 (REF. 157)	0.14–0.81 (REF. 157) 0.06–0.37 (REF. 26)	R[26,157] QA[157], MK[26]
Rat CA3	Interneurons	Pyramidal cells	2–13 (REF. 158)	ND	PR, LM, EM, QA[158]
Guinea pig CA3	Pyramidal cells	Interneurons	1–3 (REF. 159)	0.75±0.19 (REF. 159)	PR, LM, EM, QA[159]
Rat hippocampal cultures	Excitatory cells	(Autapse)	ND	0.09–0.54 (REF. 27) 0.05–0.9 (REF. 28)	R[27,28] MK[27] FM[28]
Rat hippocampal cultures	Excitatory cells	Excitatory and inhibitory cells	3–19 (REF. 14)	0.03–0.9 (REF. 14)	PR, FM, EM, QA[14]
Rat cerebellum	Climbing fibres	Purkinje cells	510±50 (REF. 25) 221–392 (REF. 11)	0.9±0.03 (REF. 25)	R[25], QA[25], LM[11], EM[11]
Rat cerebellum	Parallel fibres	Purkinje cells	1–2 (REF. 6)	0.05 (REF. 160)	R[160], M[160], LM[6], EM[6]
Rat cerebellum	Interneurons	Stellate and basket cells	ND	0.1–0.54 (REF. 161)	R, MS[161]
Striatum	L4/5 afferents	Medium spiny neurons	ND	0.42 (REF. 162)	R, QA[162]
Rat auditory brainstem	Calyx of Held	Principal cells in MNTB	637±113 (REF. 13)	0.25–0.4 (REF. 13)	PR, QA[13,163,164]
Striatum	Thalamic afferents	Medium spiny neurons	ND	0.72 (REF. 162)	R, QA[162]
Olfactory bulb	Olfactory receptor neurons	Principal mitral and tufted cells and periglomerular interneurons	ND	0.92±0.03 (REF. 6)	R, QA[6]
Olfactory bulb	Interneurons	Juxtaglomerular cell	ND	0.21–0.32 (REF. 165)	R, MS[165]

Summary of the number of release sites and p_r for some connections in the CNS, illustrating the diversity of these parameters across different connections. CA1, hippocampal area CA1; CA3, hippocampal area CA3; Cal, Ca^{2+} imaging; CB, compound binomial; DSCT, dorsal spinocerebellar tract; EM, electron microscopy; FM, FM-dye based method; L, layer; LM, light microscopy; M, modelling; MK, MK-801 method; MNTB, medial nucleus of the trapezoid body; MS, minimal stimulation; N, number of contacts; ND, not determined (no absolute value was estimated); PR, paired electrophysiological recording; QA, quantal analysis; R, electrophysiological recording.

The brain is stochastic and learns

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