SYDE 556/750

Simulating Neurobiological Systems
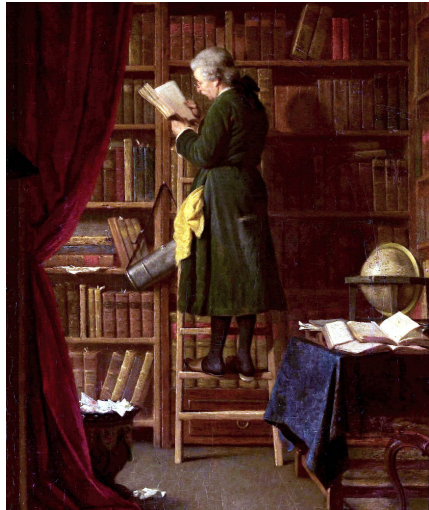**Lecture 11: The Semantic Pointer Architecture**

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March 24 & 26, 2020

UNIVERSITY OF
WATERLOO | **FACULTY OF ENGINEERING**

Administrative Notes – Remaining Deadlines

- **Assignment 4** – Due Tuesday, Mar. 24[*] (today!)
  - Worth 10% of the final mark

- **Interim Project Report** – Due Thursday, Apr. 2[*] (no late submission!)
  - One to two pages maximum; see the website for instructions
  - Not marked; either 0% (not submitted) or 100% (reasonable document submitted)
  - Worth 10 marks (25% of the final project) of the final project

- **Final Project** – Due Wednesday, Apr. 15[*]
  - Worth 40% of the final mark

[*] All deadlines are 11:59pm EDT

Shallow Versus Deep Semantics

TREE

0x54 0x52 0x45 0x45

Shallow semantics (relational)

$\forall x$ **is_a**$(x, \text{PINE}) \rightarrow$ **is_a**$(x, \text{TREE}) \land$ **has**$(x, \text{NEEDLES}) \land$ **is**$(x, \text{EVERGREEN})$,

$\forall x$ **is_a**$(x, \text{TREE}) \rightarrow$ **is_a**(x, PLANT),

$\forall x$ **is_a**$(x, \text{PLANT}) \rightarrow$ **is**(x, ALIVE).

Deep semantics ("subjective experience")

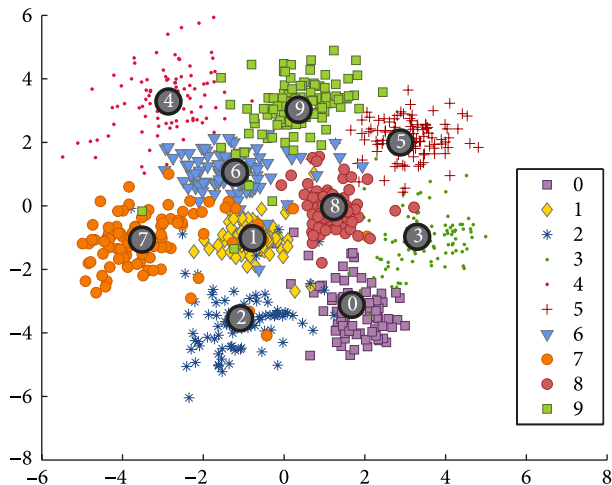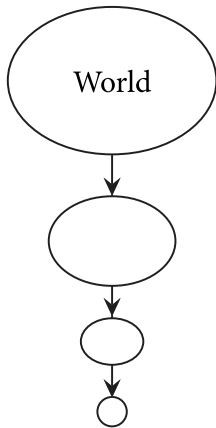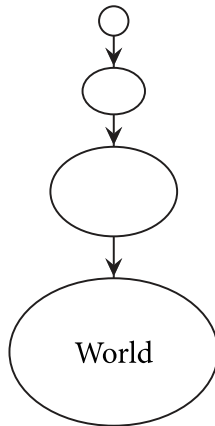# Deep Semantic in Perception: Dereferencing

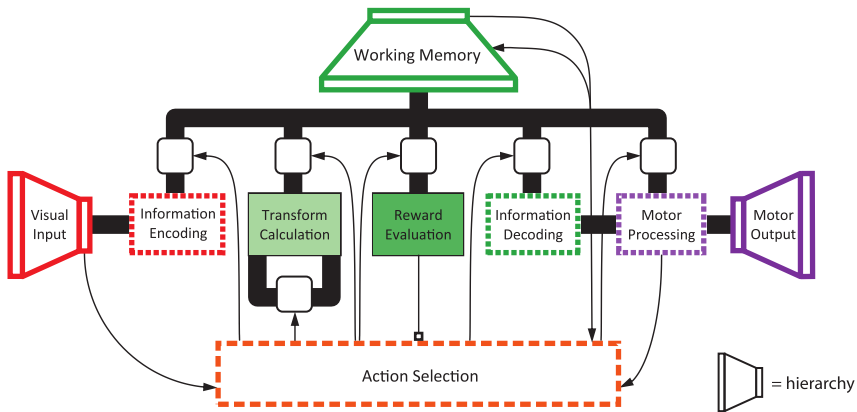A.

B.

C.

D.

Perception vs. Action
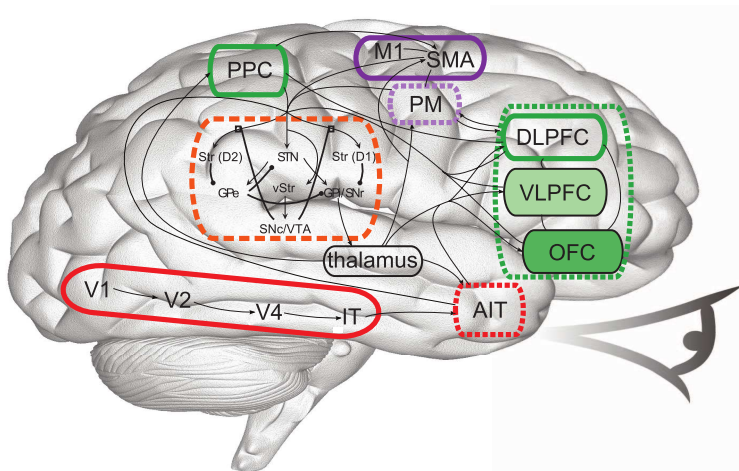

Perception

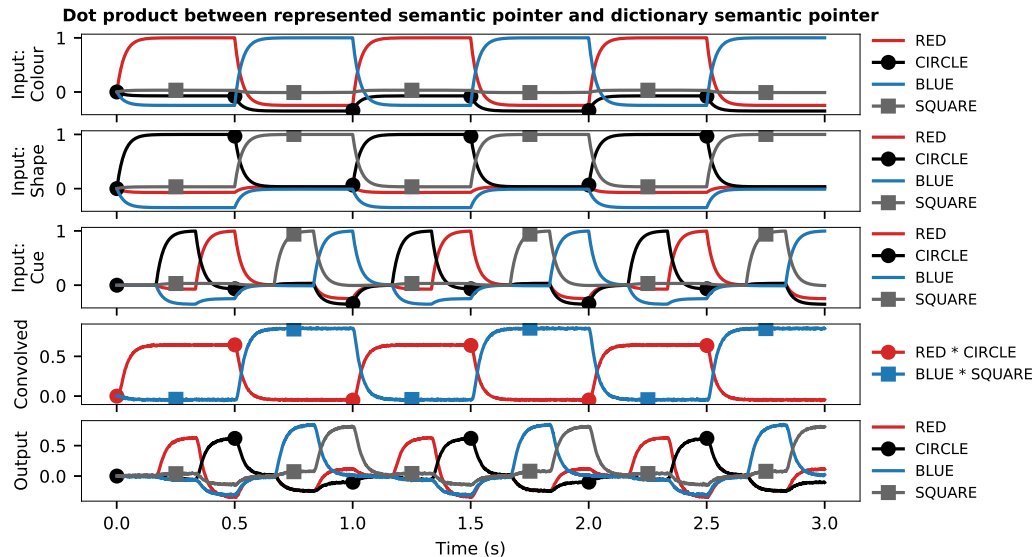Motor Control

World → Representation

Representation → World

Spaun – Semantic Pointer Architecture Unified Network (I)

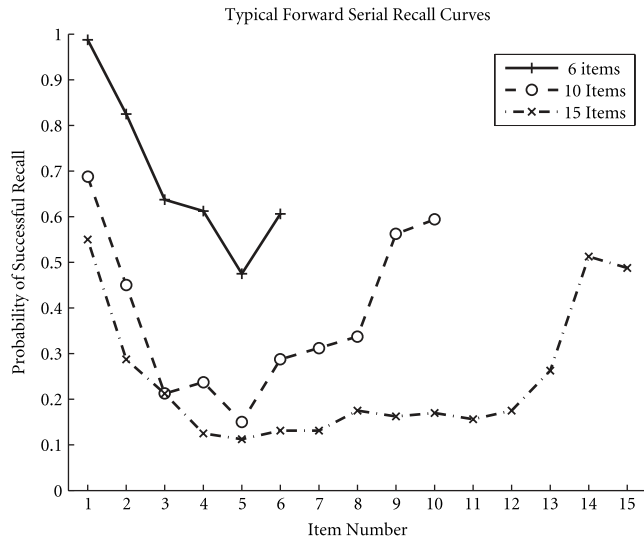# Spaun – Semantic Pointer Architecture Unified Network (I)
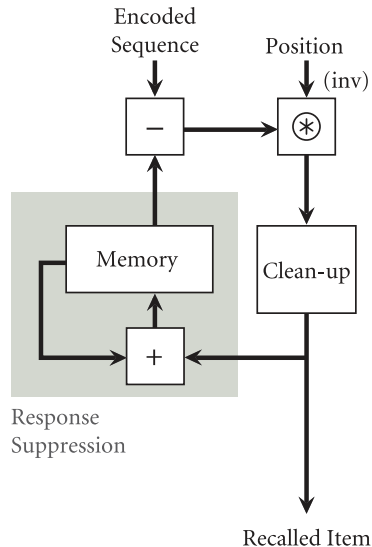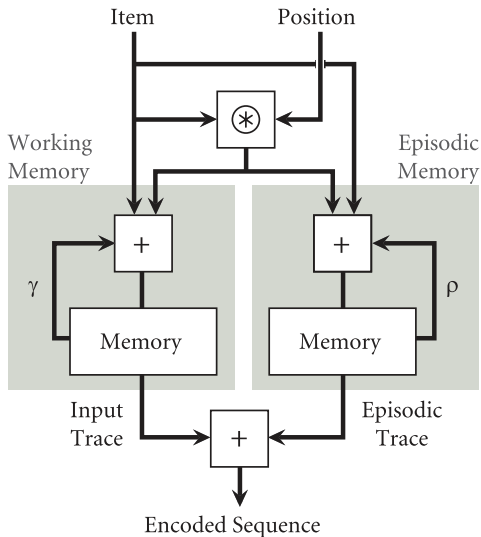
Nengo SPA Example

Dot product between represented semantic pointer and dictionary semantic pointer

Recency and Primacy Experiment

Experiment: Remember this list

1. robot	6. conglomerates
2. teflon	7. waxberries
3. kettlemaking	8. electrograph
4. big-league	9. overjoyous
5. troubleshooter	10. unquailing

Recency and Primacy Data

Typical Forward Serial Recall Curves

Ordinal Serial Encoding (OSE) Model

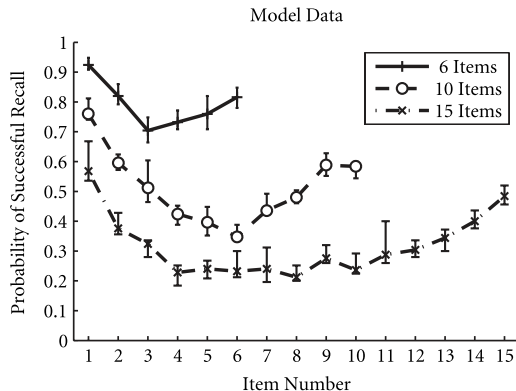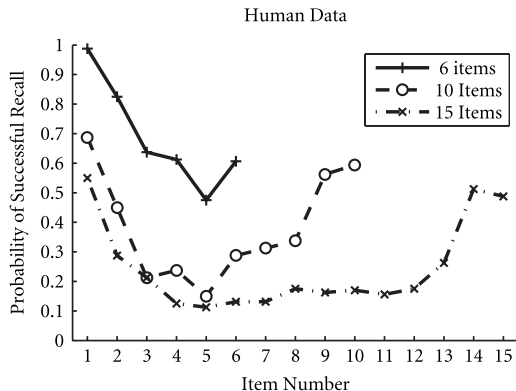# Ordinal Serial Encoding (OSE) Model: Experiment

Image sources

Title slide
Librarian (In a library), between 1850 and 1866, Georg Reimer
Wikimedia.