

Code BEAM SF 2019

StarCraft AI and the BEAM ecosystem

Applied research with Py / Torch, Lua and Erlang

Who we are



StarCraft: Brood War (1998)



StarCraft: The problem

StarCraft represent a well defined adversarial environment which pose a number of interesting challenges in areas of:

- Information gathering
- Planning
- Dealing with uncertainty
- Domain knowledge exploitation
- Task decomposition
- Spatial reasoning

Simplicity and principles

Simplicity means that the basic principles of your system, the underlying basic principles on which everything is built should be very simple.

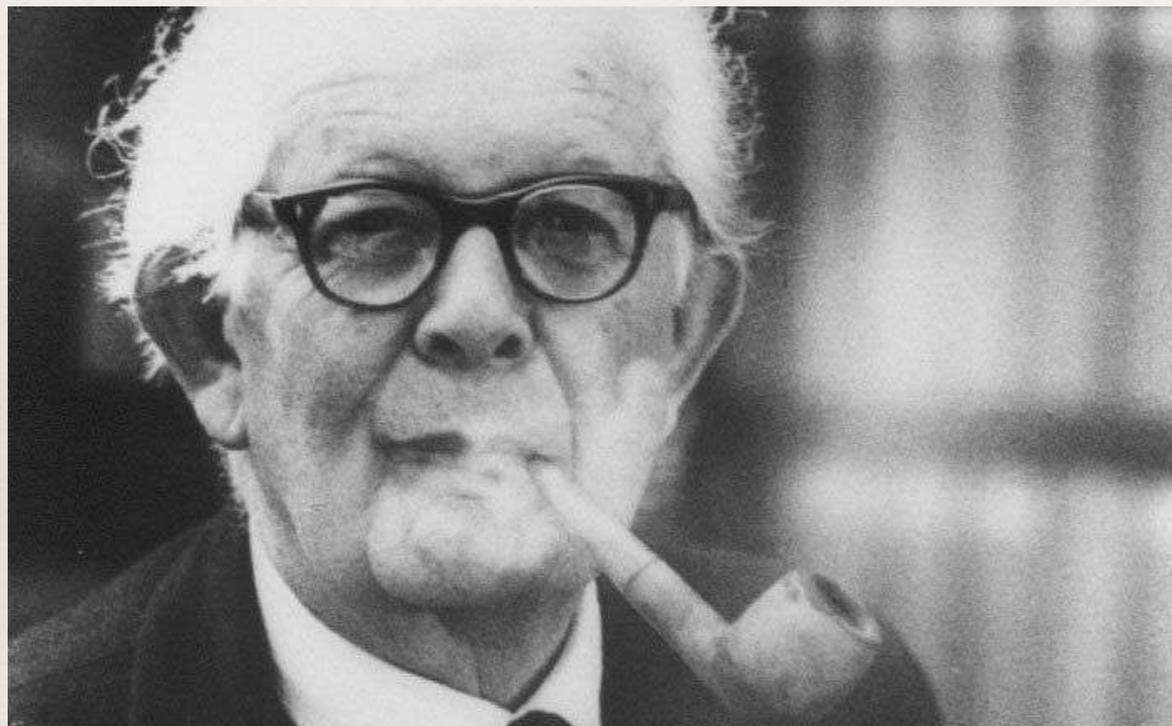
- Functions are a form of objects
- Message passing and function calling are analogous.
- Asynchronous message passing is necessary for non-blocking systems.
- Selective receive allow to ignore messages uninteresting now.

Constructivism



Cognitive framework

Organization refers to the tendency for all species to systematize their processes into coherent systems which may be either physical or psychological.



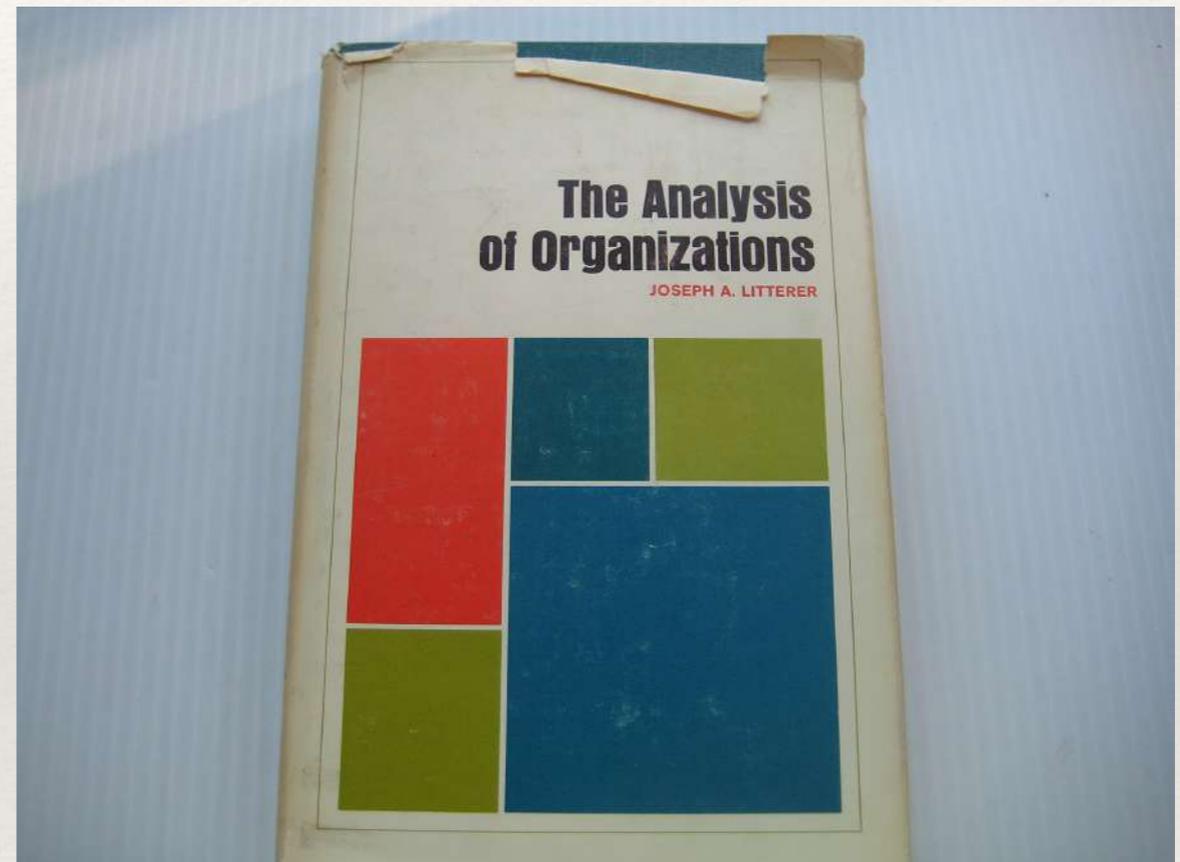
Jean Piaget

Adaptation is the balance in-between the independent processes of assimilation and accommodation.

Organizational behavior



Joseph Litterer



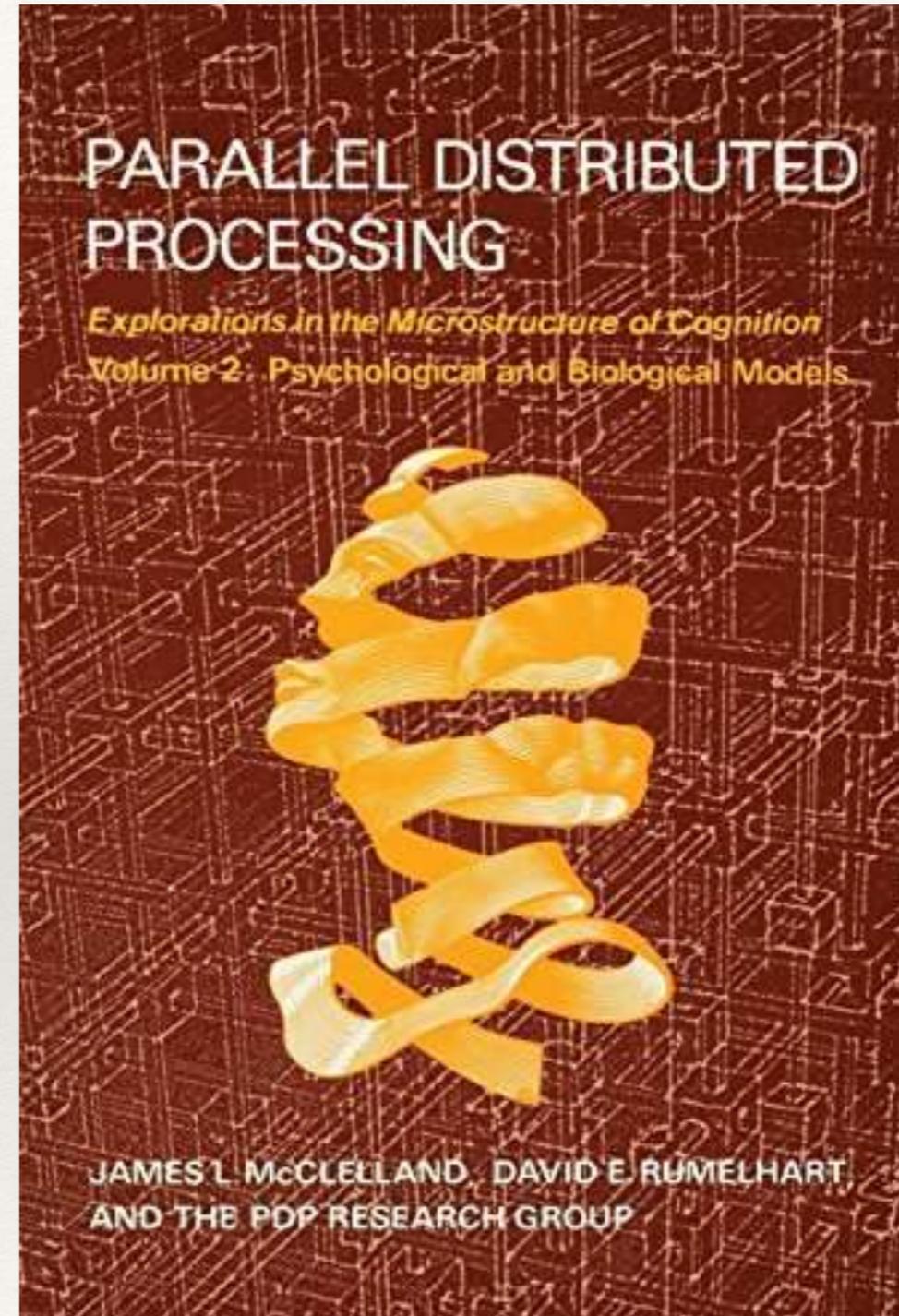
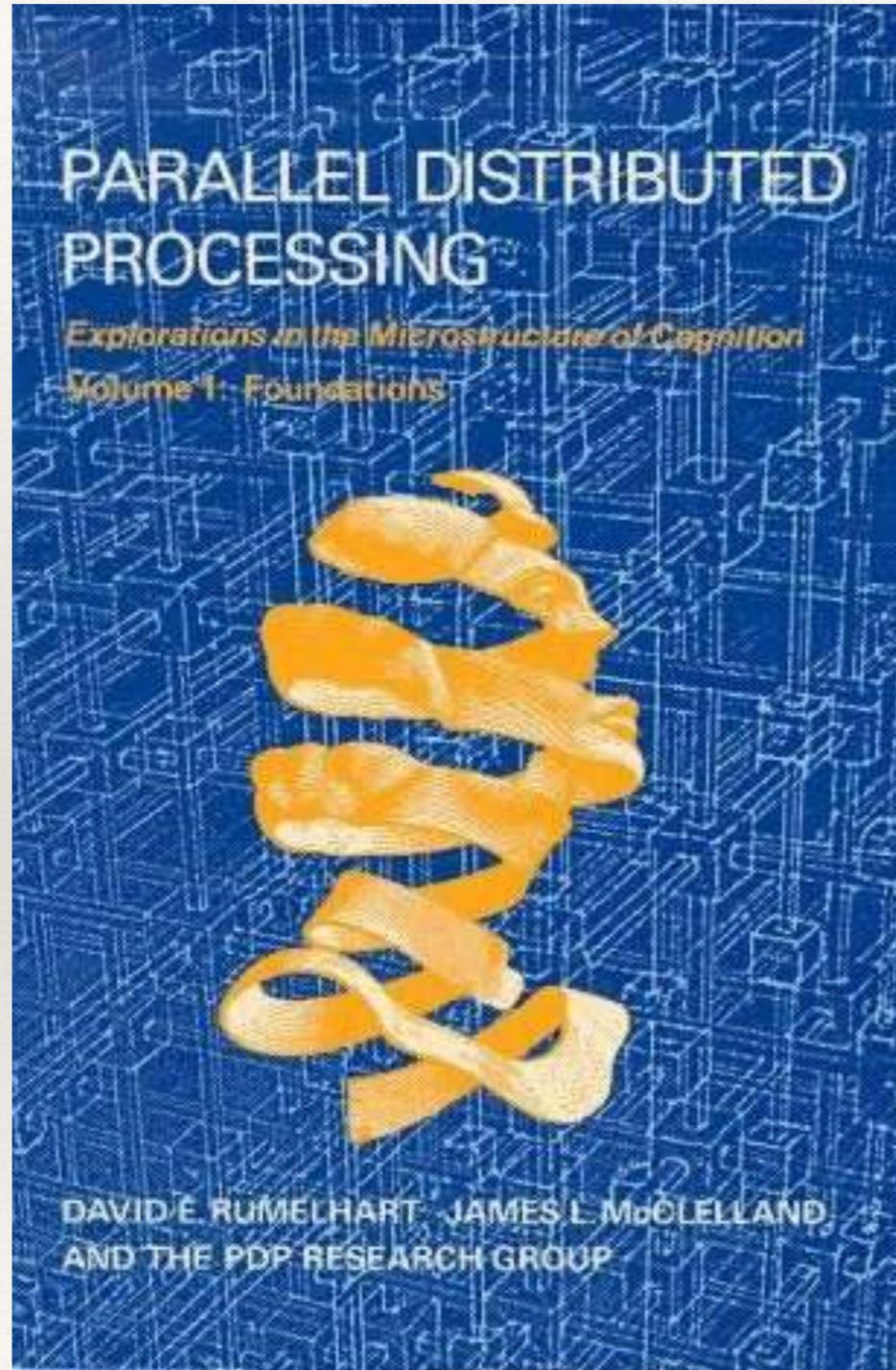
Organization purpose

Whether it is formal or informal, work is accomplished by a collection of members whose effort and behavior become coordinated in order to attain sub-goals and objectives.

Organization features

- Perception and behavior
- Clues
- Threshold of perception
- Resonance
- Internal consistency
- Dealing with conflict
- Programmed links
- Goals and feedback

The connectionist



Pandemonium

The idea of using a common blackboard where multiple agents can read and write is very old in AI going back to the Pandemonium system created by Oliver Selfridge in 1959 to coordinate the action of several daemons.

Blackboard architecture

Based on the following model of problem solving: a group of experts watching solutions being develop and whenever an expert feels that he can make a contribution towards the solution, he goes to the blackboard and makes the appropriate changes or additions.

Blackboard key ideas

The key ideas behind this model are that problem solving should be both incremental and opportunistic.

The model emphasize the adaptation between strategies as data-loads, ambiguity system goals and available time.

Why use the Blackboard Approach?

- Many diverse, specialized knowledge representations are needed.
- Uncertain knowledge or limited data
- Multilevel reasoning or flexible, dynamic control of problem-solving activities is required by the application.

Share memory by copying

“I have not really done anything more than show how existing tools in the arsenal of parallel distributed processing can be used to create local copies of networks.” - J.L. McCLELLAND

Our Architecture

We build around the ideas behind the blackboard described by the connectionist, using a modified version of the ship-demo developed by Robert Virding.

Presenting a message passing system extracting events from StarCraft and send them to the simulator to interact between the rest of our components

Erlang

Erlang is the right tool for our blackboard and it's use as system for coordination, distribution and control.

Riak is used as distributed k-value storage for the rest of our backends and components.

Lua

Lua is the big protagonist in our system, we exploit the speed of LuaJIT for our bot game heuristics and the scripting capability that Luerl brings to the BEAM ecosystem.

Python 3

PyTorch and SciPy are used for data analysis and the implementation of artificial neural network models.

We use Salt for automatization tasks within our infrastructure and Tornado for our backends.

StarCraft AI competition

- 2010, The first StarCraft AI Competition was held at the University of California as part of the AIIDE.
- 2010, After the success of AIIDE, there was an attempt to hold a competition as part of IEEE CIG conference.
- 2011, The first SSCAIT was held at Comenius University.
- 2018, The BASIL ladder was announced with automated support from most SSCAIT bots based on Docker images, opening the door for non-windows competitive bots

Meet our bot



Thank you

@spacebeamio

<https://github.com/spacebeam>