Cognitive AI Community Group

Dave Raggett <dsr@w3.org>

W3C AC meeting 2026
Hangzhou, China
20-22 April 2026

Cognitive AI Community Group

- Cognitive science is the interdisciplinary scientific study of the mind and its processes
- There a lot we can apply to AI based upon decades of work on the human mind
- Cognitive AI Community Group was launched in late 2019
- Chairs: Dave Raggett & Ronald Reck; 63 participants

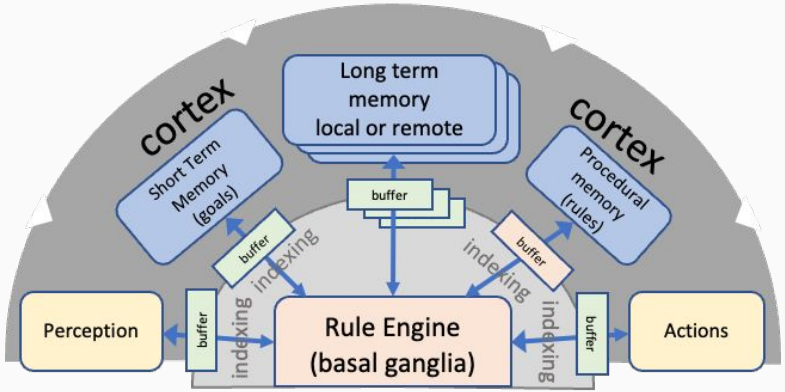
- CG Reports
  - Chunks & Rules
  - Plausible Knowledge Notation
  - WebNNM (coming soon)
- Suite of web demos
  - Test suites
  - Smart homes
  - Smart factories
  - Plausible reasoning
  - Edge AI

See: CogAI CG GitHub page for background and links

Chunks & Rules for Modeling Behavior

- Inspired by John Anderson's work on ACT-R as a model of human cognition
- Simple syntax at higher level than RDF with chunks that are collections of properties (names, numbers or lists thereof)
- Chunk rules act on cognitive buffers, mimicking characteristics of human cognition and memory, including stochastic recall, spreading activation and the forgetting curve
- Rule conditions match buffers, rule actions either immediately update cognitive buffers or invoke asynchronous operations that subsequently update the buffer when complete
- Predefined suite of built-in cortical operations plus application defined extensions for controlling digital twins
- Reasoning decoupled from intent-based real-time control over external actions, e.g. for a robot arm, layered on top of ROS, a popular framework for robots
- Excellent for concurrent threads of event-driven behavior, using distributed models of context-sensitive perception with directed attention
- Recent extensions support task delegation and synchronization across a swarm of cognitive agents

Cognition – Sequential Rule Engine



Cognitive Buffers hold single chunks
Analogy with HTTP request-response model

Suitable for combining with agentic AI for smart factories, where the LLM-based agent directs many simpler agents tasked with mostly repetitive behaviors

See: Web-based monitoring, orchestration and simulation, GIECS-2025

From Logical Proof to Rational Arguments

- In the real-world, knowledge is usually uncertain, imprecise, context sensitive, incomplete, inconsistent and subject to change
- But logic only works with perfect unchanging knowledge
- Goodbye logical proof, hello rational arguments for and against a proposition
- Aristotle got there first with his guidelines for effective rhetoric
- Arguments are used in courtrooms, businesses and abused in politics

- PKN (**plausible knowledge notation**) is a simple syntax for expressing imperfect knowledge
- Inspired by work by Alan Collins and colleagues in the 1980's
- Web-based demo with a suite of premises that shows a variety of argument forms
- PKN offers an opportunity to develop **next generation cognitive databases** that complement large language models by making imperfect knowledge explicit

Simplifying Web AI with WebNNM

- WebNN is W3C's platform-neutral API for AI in the web browser
  - Acceleration with NPU, GPU and CPU
- Existing libraries for WebNN are huge and hard for newcomers
- ***WebNNM*** is a new lightweight library to address that gap
  - Very simple high-level syntax for models that is parsed to a DAG and used to build executable WebNN graphs for inference, testing and training
  - Export to MLIR for cloud-based pre-training
  - See above link for web-based demos
- Edge AI will complement much larger models in the cloud, as well as allowing for privacy-friendly personalization

- **Aim**: high quality accessible user experiences in the Immersive Web
  - Allowing users to select how they interact with applications according to their personal preferences and capabilities
  - Low-latency multi-modal models for video and audio that project your facial expressions onto your avatar, whilst allowing to you use spoken commands to convey your intents
  - Intent-based real-time full body animation – your avatar moves realistically whilst you are actually still slumped on your sofa in your living room
- **Aim**: Experiment with AI models that better mimic human cognition
  - Sentient AI agents with continual learning, episodic memory, emotional control, etc.
  - Feedback on gaps in WebNN standard, e.g. enabling faster recurrent networks