SIMULATION OF NON-PRIMATE INTELLIGENCE VS HUMAN INTELLIGENCE VS SUPERHUMAN AGI VS ALIEN-LIKE AGI

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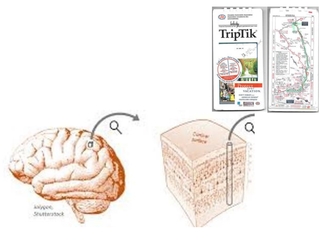
INTRODUCTION

•Premise: ~300 million years ago amniotic ancestors started duplicating their navigation circuitry into what would become the cerebral cortex in mammals

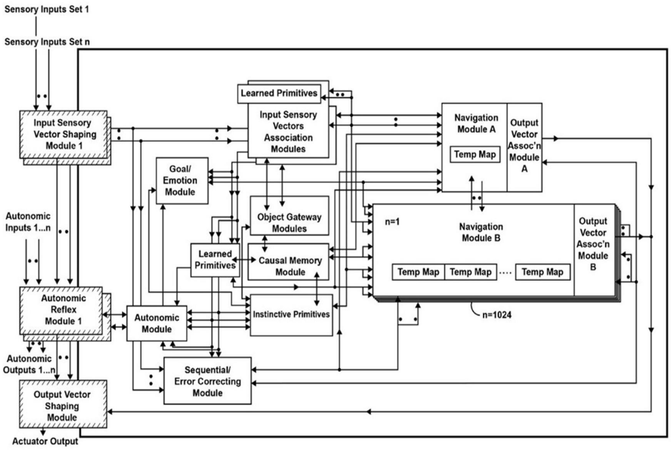
•Millions of neocortical minicolumns are essentially millions of "navigation maps"

•Navigation Map: modest-sized spatial map holding features, procedures ("primitives"), and links to other navigation maps

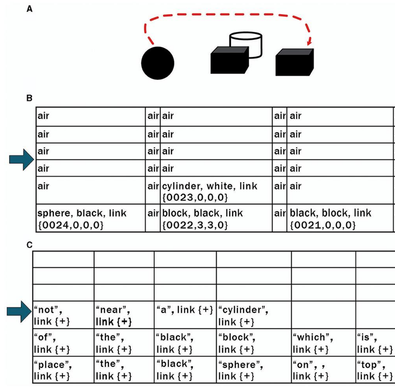
•Using a brain-inspired cognitive architecture (BICA) the mammalian brain was modeled and biologically evolved based on this premise




```
self.gb = np.empty((self.total_maps, 6, 6, 6, self.total
# self.gb = np.empty((1000,6,6,6,16,4), dtype=object) (a
# gb[n,x,y,z,s,a]
# 1000 maps each 6×6×6 cube with up to 9 mapped objects
```



CCA7: Hypothetical gene duplication resulting in duplication to over one-thousand Navigation Module B's. (Human cognitive properties like the previous CCA6 cognitive architecture but with superhuman planning/analysis abilities now.)



Compositional request to: "place the black sphere on top of the black block which is not near a cylinder" *(the arrow shows the correct solution to this problem, but of course, it is not shown to the system being asked to solve this problem)*. The sensory scene of **(A)** is loaded in Navigation Module A **(B)**. The language request associated with **(A)** *("place the black sphere on top of the black block which is not near a cylinder")* is loaded in Navigation Module B **(C)**. In subsequent cognitive cycles, the contents of Navigation Module B are processed against the contents of Navigation Module A via operations of various instinctive primitives discussed in the paper.

SIMULATIONS

Animal Group/Tech Selected	Properties of the CCA7 Architecture Used
Fish-like brain (i.e., fish-like AI)	reflexive and associative responses, navmaps mainly for actual navigation (illustrated by portions of CCA1 (Fig 2))
Reptilian-like (earlier diapsid-like) brain (i.e., reptilian-like AI)	above + limited number of navmaps with richer associations and aspects of pre-causal behavior emerging (by portions of CCA1 (Fig 2))
Mammalian-like brain (i.e., non-primate mammalian-like AI)	above + larger number of navmaps for all aspects of behavior, more sophisticated instinctive primitives, simple combinatorial language (illustrated by CCA1 (Fig 2))
Human-like brain (i.e., human-level AI (HLAI))	above + enhanced feedback, duplication of navigation modules into A and B, richer instinctive primitives, all resulting in full causality, analogical reasoning and compositional language (CCA6 (Fig 3))
Superhuman-like brain (i.e., superhuman AGI)	above + further duplication of Navigation Module B's, some improved instinctive primitives (illustrated by CCA7 (Fig 1))
Alien-like AGI (ChatGPT3.5 via API)	completely different architecture – large language model -via OpenAI API model "gpt-3.5-turbo" (April 5, 2024) [15]
Alien-like AGI (ChatGPT4) (nb. manual entry)	completely different architecture – large language model -via OpenAI ChatGTP4 (April 5, 2024) [15]

Subsets of features of the CCA7 Architecture are used to very roughly simulate a spectrum of animal-like intelligences. (Determined by the features available; not an accurate simulation of any animal.) An Alien AGI is an AGI which is not based/inspired by the mammalian brain. Figures and CCA Models noted above are found in the associated paper.

RESULTS

Simulated Animal/Tech Group Selected	Traveling Salesperson Problem			Compositionality Problem		
	n (trials)	ave distance	p (vs superhuman)	n (trials)	successful trials	p (vs superhuman)
Fish-like brain/AI	20	20,000.0 (n/c)	p<0.001	20	0%	p<0.001
Reptilian-like brain/AI	20	20,000.0 (n/c)	p<0.001	20	0%	p<0.001
Mammalian-like (non-primate) brain/AI	20	20,000.0 (n/c)	p<0.001	20	0%	p<0.001
Human-like brain/HLAI	20	8131.0	p<0.001	20	100%	--
Superhuman-like brain/AGI	20	7430.2	--	20	100%	--
Alien AGI (ChatGPT 3.5)	20	10221.3	p<0.001	20	3%	p<0.001
Alien AGI (ChatGPT4)	20	7899.6	p<0.001	20	55%	p<0.001

The above simulations were run (20 times each) on a 13-city travelling salesperson problem (shortest distance is the best result) and the compositionality problem shown above.

DISCUSSION

•CCA7 model (superhuman AGI simulation) despite being poorly developed (e.g., lack of instinctive primitives, data, etc.) had superior results in TSP and compositionality solutions, *but* there is an evaluation bias since these properties are intrinsic to the architecture.

CONCLUSION

•In developing AGI systems, consider implementing intrinsic compositional and planning abilities

•Useful properties emerge in the CCA7 model:

- Fully grounded
- Continuous lifetime learning
- Modest memory/compute requirements
- Causal reasoning with relatively small data
- Analogical reasoning with relatively small data
- Compositional language with small data

REFERENCES

For a list of references see:

Schneider, H. Simulation of Non-Primate Intelligence vs Human Intelligence vs Superhuman AGI vs Alien-like AGI. In: Thorisson, K.R., Isaev, P., Shekhlar, A. (eds) Artificial General Intelligence, AGI 2024, *Lecture Notes in Computer Science – LNCS* (14951), Springer Nature, 2024.

Schneider, H. The Emergence of an Enhanced Intelligence in a Brain-Inspired Cognitive Architecture, *Frontiers in Computational Neuroscience*, **18**, 1367712 (2024). doi: 10.3389/fncom.2024.1367712