



Artificial Intelligence and Semiotics: Using Semiotic Learning to Bolster AI

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Biographical Sketch



Dr. Joshua A. Sipper is Assistant Professor of Military and Security Studies at the US Air Force Air Command and Staff College (ACSC). He has over 25 years of experience in intelligence, surveillance, and reconnaissance (ISR), electromagnetic warfare (EW), and cyber operations. Dr. Sipper teaches Airpower Operations and Strategy and Contemporary and Emerging Warfare in the Airpower Department at ACSC and is the co-director of the Cyber Advanced Operations and Strategy Seminar (CAOSS), teaching ISR and Cyberspace and Cyber and Electromagnetic Warfare. Dr. Sipper has been featured as a keynote speaker at numerous conferences, lectured in several forums, and a guest on television and podcasts. Dr. Sipper is the author of numerous articles and book chapters concerning cyber operations, ISR, and EW. He also is the author of several books including his most recent title, *The Cyber Meta-reality: Beyond the Metaverse*. Dr. Sipper is a Fellow with the International Academy, Research, and Industry Association (IARIA) and a lifetime member and plank holder of the Military Cyber Professionals Association (MCPA) and lifetime member of the Association of Old Crows (AOC).

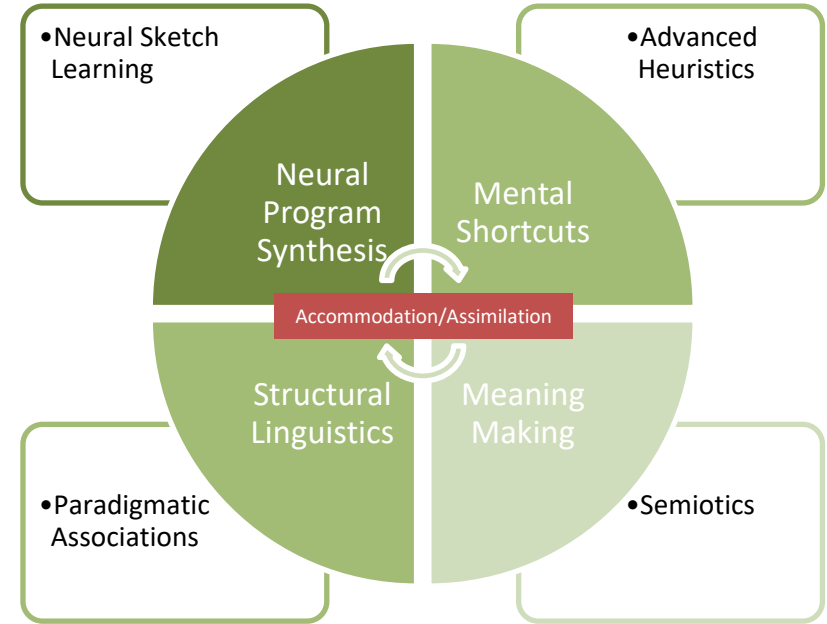




AI and Semiotics



- Three AI Concepts
- Computational Semiotics
- Neural Sketch Learning for Semiosis
- Paradigmatic Associations
- Advanced Heuristics
- AI Accommodation/Assimilation Model
- Cybersecurity Applications
- Conclusion

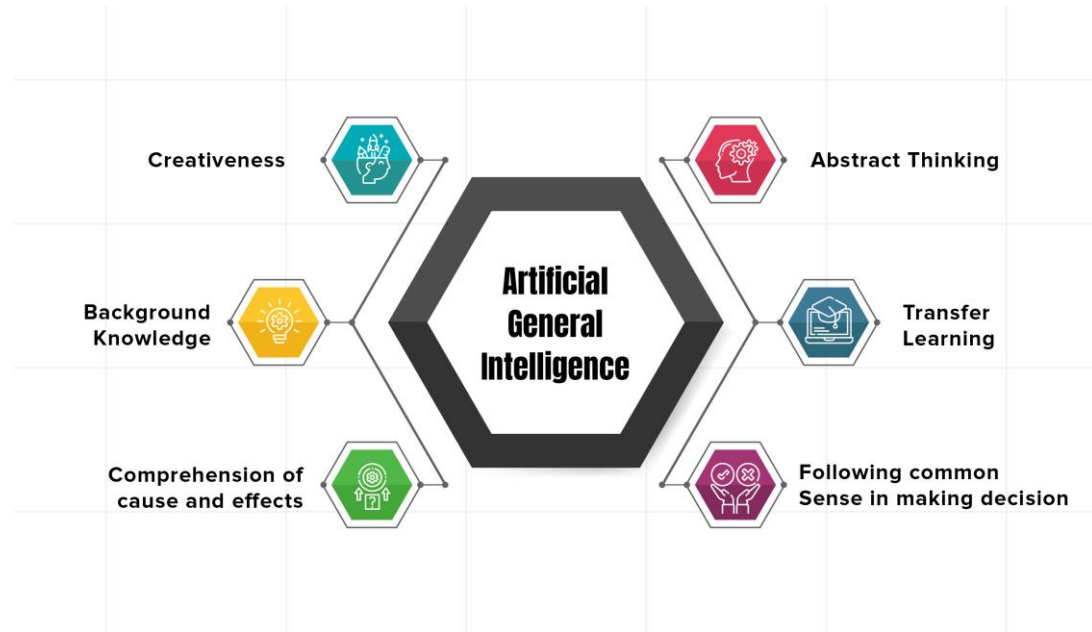




Three AI Concepts



- Narrow/Generative AI
- Artificial General Intelligence (AGI)/Semantic AI
- Semiotic AI

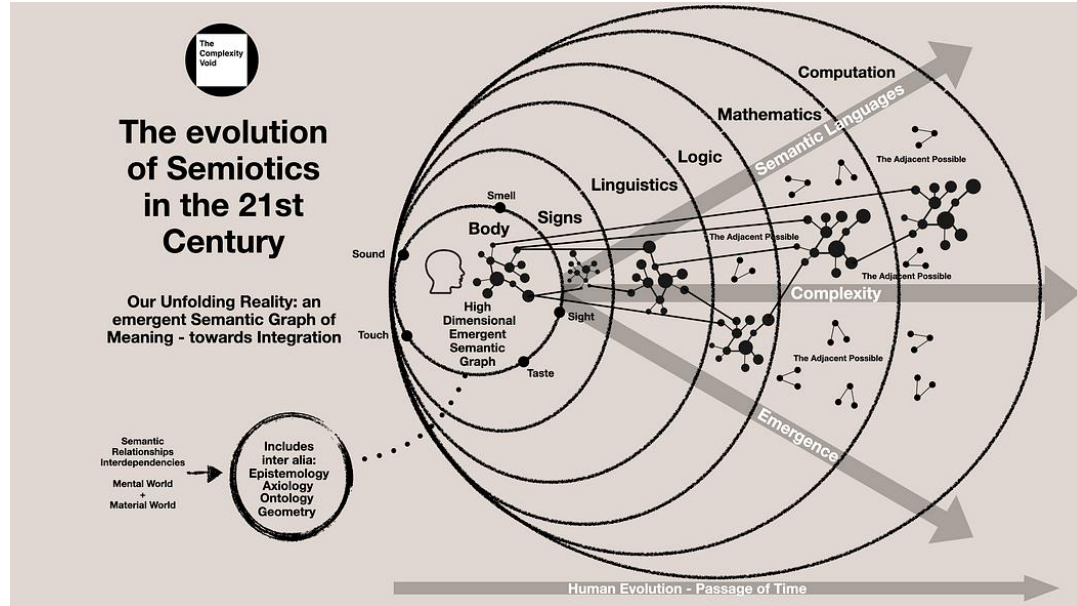




Computational Semiotics



- Semiosis is the “study of meaning and communication processes...from the point of view of formal sciences, linguistics, and philosophy” including the situational control of logical systems to produce automatic control of systems [1].
- Schemata
- Accommodation
- Assimilation
- Intuition – potential connection to quantum computing



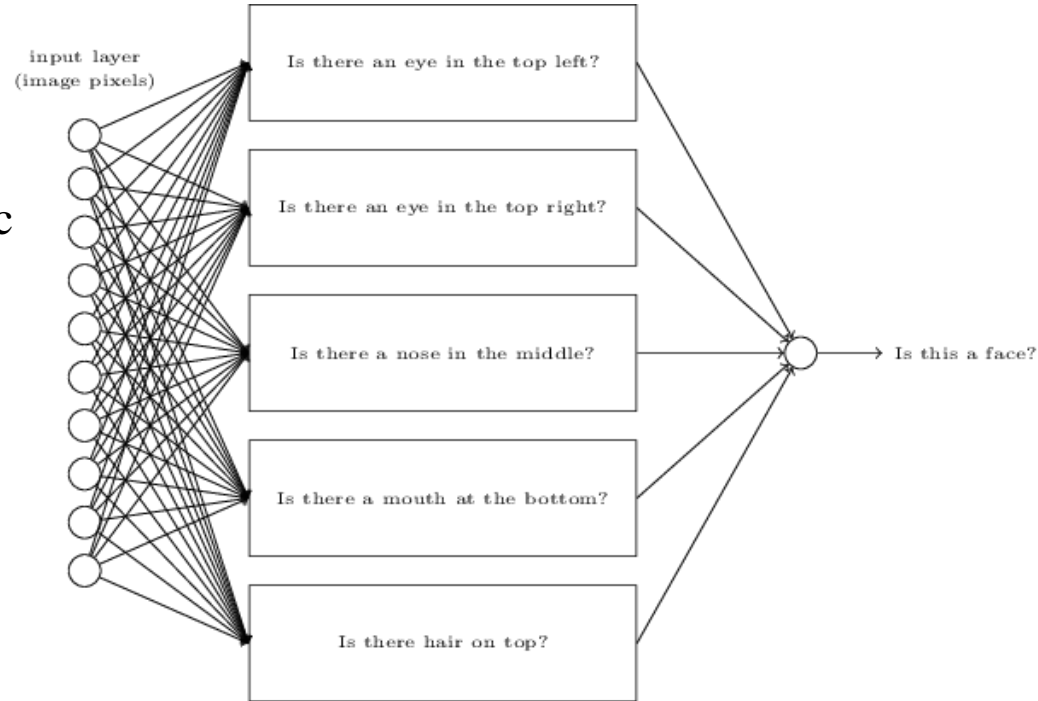
[1] R. Gudwin and J. Queiroz, "Towards an introduction to computational semiotics," International Conference on Integration of Knowledge Intensive Multi-Agent Systems, 2005., Waltham, MA, USA, 2005, pp. 393-398, doi: 10.1109/KIMAS.2005.1427113.



Neural Sketch Learning for Semiosis



- If computational semiotics are the connection between human schematic symbolic understanding, neural sketch learning is the network of pathways mapped out in the most anthropomorphic sense
- Meta-learning and Meta-grammar
- Idioms
- Synthesis and translation of large, complex, and esoteric datasets

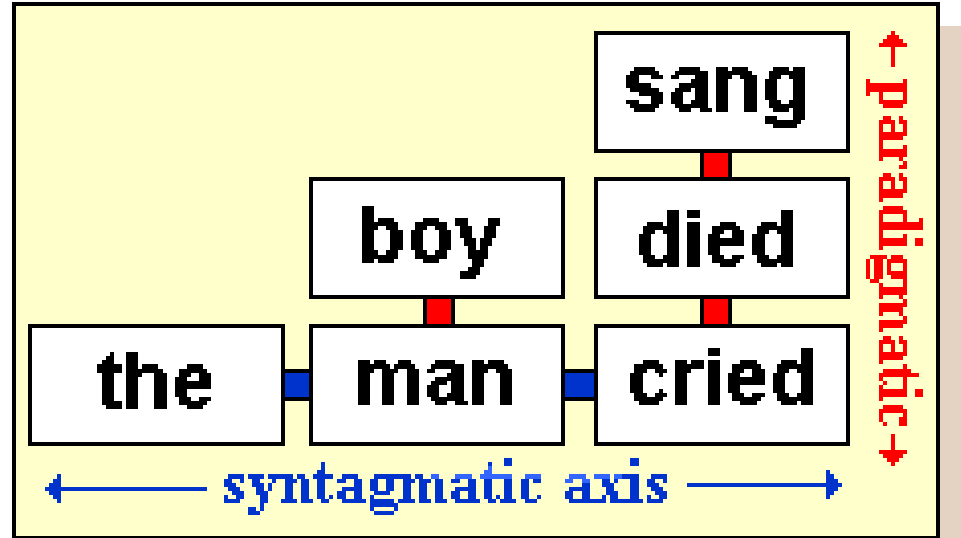




Paradigmatic Associations

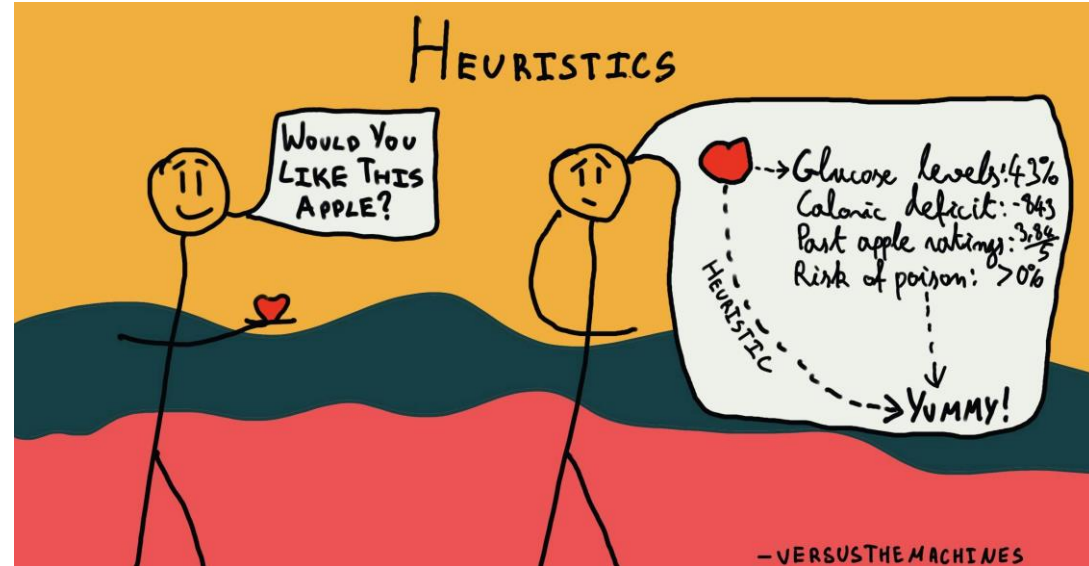


- Paradigms often define the zeitgeist surrounding historical, societal, and cultural events and experiences
- Structural linguistics, implicitly learned paradigmatic relations, syntagmatic and paradigmatic associations, computation of word associations
- Syntagmatic and paradigmatic word associations through understanding word similarity undergirds semiosis as the connections between words can create syntax and paradigms necessary for meaning-making and algorithmic growth and synthesis



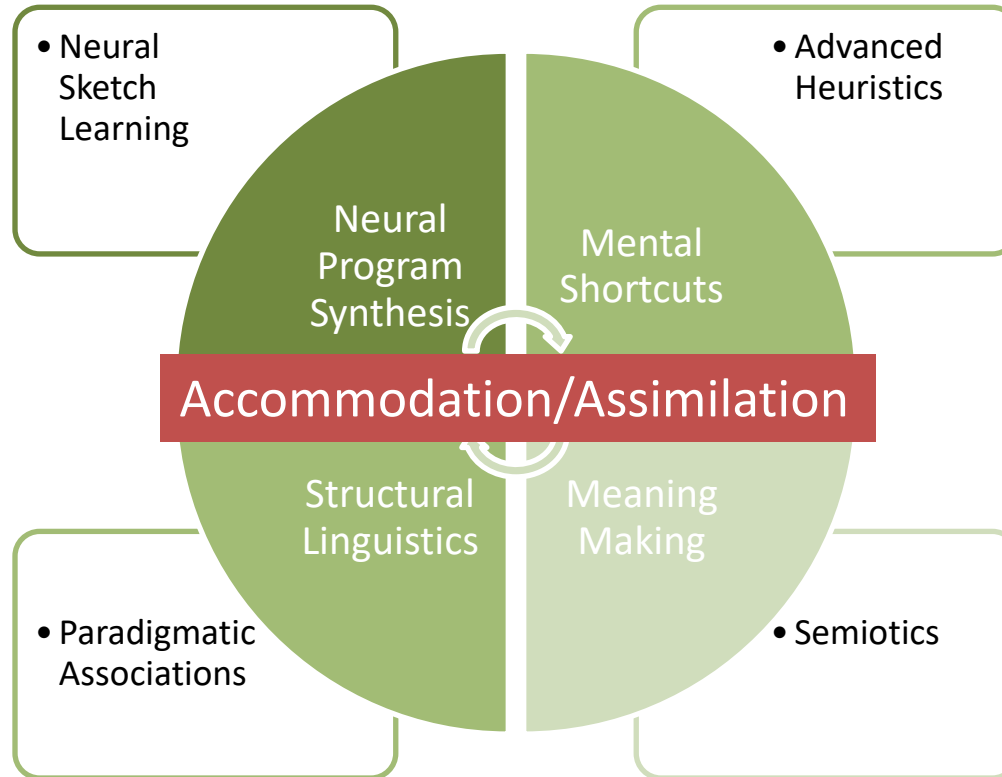
Advanced Heuristics

- Heuristics are mental shortcuts
- Directly related to the abstract symbolic thought necessary for the synthesis of meaning
- Heuristic frameworks operate on the premise of providing efficient, direct correlation of data within specific scaffolds to build schemas capable of assimilating and accommodating various types of information
- Metaheuristics exploit not only the problem characteristics but also ideas based on artificial intelligence methodologies, such as different types of memory structures and learning mechanisms, as well as analogies with optimization methods found in nature





AI Assimilation / Accommodation Model





Cybersecurity Applications



- Useful for defensive cyber operations and offensive cyber operations using semiotic context matching to improve defensive and offensive strategies
- Predictive algorithms create more rapid decision-making for cyber offense and defense increasing rapidity, accuracy, and utility
- Large datasets bolster cyber defense and offense through the rapid association of threats and vulnerabilities to identify and assess cyber risks and offensive cyber opportunities
- Scaffolds and schemata associations allow cyber defense systems such as intrusion prevention systems (IPS) to make informed and accurate predictions concerning malicious programs, supporting precognitive protections to networks, databases, and critical information
- Predictive decision support to ensure advanced risk avoidance and mitigation



Conclusion

- Semiotic AI, is the next level of artificial intelligence following the semantic AGI
- Several types of programming, learning theories, and linguistic structures must first be understood and modeled
- Neural sketches must be considered as they provide components of information that can be leveraged across neural networks
- Paradigmatic associations necessary for understanding the paradigmatic, syntagmatic, and idiomatic language and components are necessary for semiosis
- Heuristics
- AI Assimilation/Accommodation Model
- Cybersecurity

