David H. Ménager, Ph.D.

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Research Interests

- Models of episodic memory
- Probabilistic reasoning
- Cognitive architecture
- Concept formation
- Bayesian Networks
- Machine learning
- Rule induction
- Causal discovery
- Problem solving and reasoning
- Constraint satisfaction
- Explanation generation
- Interpretable models
- Case-based reasoning
- Analogy
- Recommender systems
- Similarity measures
- Intelligent agents
- Human-like learning

Education

2015–2021* **Ph.D.**, Computer Science, The University of Kansas
- **Dissertation title:** Event Memory for Intelligent Agents
- **Advisors:** Dr. Dongkyu Choi, Dr. Arvin Agah

2015-2018 **M.S.**, Computer Science, The University of Kansas
- **Thesis title:** Episodic Memory: Foundation of Explainable Autonomy
- **Advisor:** Dr. Dongkyu Choi

2011-2015 **B.Sc.** Computer Science, The University of Kansas

Research Experience

2022– AI Research Scientist, AI and Autonomy Group, Parallax Advanced Research
Supervisor Dr. Matthew Molineaux
- Engage in pioneering, fundamental research in cognitively-inspired artificial intelligence systems
- Extend the state-of-the art in cognitive systems research
- Lead and coordinate the development of research proposals
- Author research papers, leading to publications in the *International Conference on Case-Based Reasoning*, and *Advances in Cognitive Systems*
- Disseminate research findings through presentations at leading conferences and publications in prestigious journals
- Cultivate and maintain relationships with funding agencies
- Serve on advisory boards and committees to provide expert guidance and contribute to the broader scientific community

2017 Naval Research Enterprise Intern, Naval Research Laboratory
Supervisor Dr. David W. Aha
- Build a learning agent capable of acquiring action and event models from episodic traces within the context of a cognitive architecture
- Extend a theory of episodic memory for intelligent agents, addressing mechanisms of skill acquisition and learning
- Design and execute experiments to evaluate the proposed theory, utilizing the game Minecraft and two additional simulated environments
- Publish the research findings and disseminated them in an academic conference

2016 Student Contractor, Naval Research Laboratory
Supervisor Dr. David W. Aha
- Design and implement a case-based plan recognition system to enable intelligent agents to autonomously identify and react to changing situations and goals from partial observations of the state and actions
- Investigate methods to enhance case-based plan recognition capabilities in dynamic partially observable environments
- Design and conduct experiments to evaluated the implemented agent in a military domain
- Publish the research findings and disseminated them in an academic conference

2015–2021 Research Assistant, Cognitive Control Systems Laboratory
Principal Investigator Dr. Dongkyu Choi
- Conduct in-depth research and analysis on cognitive architecture contributing a novel theory and computational model of event memory for intelligent agents
- Author and research papers leading to publications in *Cognitive Systems Research*, *Minds and Machines*, and the *Cognitive Science Society*
- Disseminate research findings at top conferences in artificial intelligence
- Assist in the preparation and submission of research proposals
- Collaborate with a multidisciplinary team of researchers to develop and refine research objectives and methodologies
- Participate in lab meetings and contributed to the development of research strategies and goals
- Mentor and supervise undergraduate students, providing guidance on research projects and laboratory techniques

Awards & Honors

Awarded Proposals and Grants

2024 Cooperative Reasoning of UAVs in Multi-Objective Missions using Shared Event Memory ($20,000)
- **Principal Investigator:** Dr. Cammy Peterson
- **Key Personnel:** Dr. David H. Ménager
- Award funded by the Center for Autonomous Air Mobility and Sensing
- Leveraged shared event memory to enable a team of UAVs to reason over sensed information to infer the state of a complex environment and the actors operating within it.
- The shared memory system uses generative models to learn how actors behave and predict behavior over time.
- Cooperating UAVs used estimated state to make decisions and drive group behavior.

2024 Internal Research and Development Award ($90,000)
- **Principal Investigator:** David H. Ménager
- Award funded by Parallax Advanced Research
- Developed a novel sample-efficient imitation learning method using event memory of Bayesian generative models.
- Implemented a novel method for the discovery of latent variables in probabilistic graphical models.
- Developed a goal reasoning, event memory-enabled ground robot capable of learning and refining a domain theory from experience to respond to unknown unknowns.

2022 Internal Research and Development Award ($90,000)
- **Principal Investiagor:** David H. Ménager
- Developed event memory-enabled agent capable of leveraging past experiences to perform state estimation in partially observed environments.
- Investigated event memory for long-duration autonomy

Submitted Proposals

2024 Searching for Gluon Saturation with Bayesian Networks
- **Principal Investigator:** Dr. Michael J. Murray
- **Key Personnel: Dr. David H. Ménager**, Dr. Christophe Royon
- Submitted to the Department of Energy (DOE)
- Proposed to utilize Bayesian networks to identify the presence of low momentum charm and beauty proto-produced jets from Pb-Pb collisions at the Large Hadron Collider.
- Approach relied on leveraging experimental data to estimate the causal interactions of colliding subatomic particles to facilitate automatic tagging of charm and beuty quark jets.
- The submission was not selected with no feedback.

2024 Generated Trauma Records Using Synthetic Techniques (GTRUST)
- **Principal Investigator: Dr. David H. Ménager**
- Submitted to the Defence Advanced Research Projects Agency (DARPA)
- Proposed to develop a revolutionary synthetic data generation approach that enables predictive models to reliably train on sparse trauma datasets.
- Approach featured a novel, distribution-aware learning technique for discovering an interpretable theory of the data generation process that achieved 6x orders of magnitude increase in sample efficiency.
- The submission was not selected, but received favorable and superior marks across all evaluation criteria.

2024 Transfer from Imprecise and Abstract Models to Autonomous Technologies (TIAMAT)
- **Principal Investigator: Dr. David H. Ménager**
- **Key Personnel:** Dr. Nathaniel Hamilton, Dr. Anthony Hoogs, Dr. Ji Qiang
- Submitted to the Defence Advanced Research Projects Agency (DARPA)
- Proposed to develop an innovative neurosymbolic approach to reducing sim-to-real gaps through rapid transfer of autonomy by acquiring reusable knowledge from diverse, imprecise source simulators.
- Approach centered on unifying and jointly transferring domain, perceptual, and behavioral knowledge via a novel neurosymbolic representation which was acquired and refined through experience.
- Although we were not selected, the submission was viewed favorably in terms of team expertise, technical feasibility, and cost realism.

2022 Environment-driven Conceptual Learning (ECOLE)
- **Principal Investigator: David H. Ménager**
- **Key Personnel:** Dr. Mary Frame, Dr. Othalia Larue, Dr. Edward Kim, Dr. Christopher MacLellan, Dr. Sergei Nirenburg
- Submitted to the Defence Advanced Research Projects Agency (DARPA)
- Proposed to develop an AI agent capable of continually learning from language and vision to enable human-machine collaborative analysis of image, video, and multimedia documents during time-sensitive, mission-critical DOD analytic tasks, where reliability and robustness are essential.
- Our approach featured event memory to support continual learning, natural language understanding to produce English captions of media content, and a human machine interface for robust human computer interaction.
- Feedback on all aspects of the proposal was largely positive, although we were not selected.

Travel Awards

2019 University of Kansas Graduate Engineering Associate Travel Award ($190)
2019 Center for Issues in Philosophy of Memory Travel Award (€300)
2018 International Conference on Case-Based Reasoning Travel Award ($850)

Fellowships & Scholarships

2016-2020 Self Graduate Fellow ($120,000)
- Self Graduate Fellows are selected on the basis of their academic ability and achievements, leadership attributes, vision, and motivation to make significant contributions in their fields and in society
- It provides general education and training in communication, management, innovation, and leadership
- The development program includes individual coaching in oral and written communication, week-long skill sessions, a yearly symposium, luncheons, and a four-day government and science policy seminar in Washington, D.C.

2016 Rusty Leffel Concerned Student Award ($1,000)
- In recognition of demonstrated concern for furthering the ideals of the University of Kansas and of higher education.

2015-2020 National GEM Consortium Fellow ($16,000)
- Awarded to select highly qualified underrepresented students looking to pursue Master's and Doctoral degrees in applied science and engineering.
- Sponsored by Adobe Inc. to complete one summer internship.

2013-2015 Self Engineering Leadership Fellow ($32,000)
- Awarded to select passionate engineering and computer science students who are strongly goal-oriented and who bring the business skills and vision needed to guide the technology-based corporations of tomorrow.

Publications

G Google Scholar

Journal Articles

J1. **Ménager, David H.**, Choi, D. & Robins, S. K. Modeling human memory phenomena in a hybrid event memory system. *Cognitive Systems Research* (2022).

J2. **Ménager, David H.**, Choi, D. & Robins, S. K. A hybrid theory of event memory. *Minds and Machines*, 1–30 (2021).

Peer-reviewed Conference Proceedings

C1. Molineaux, M., Weber, R. O., Floyd, M. W., **Ménager, David**, Larue, O., Addison, U., Kulhanek, R., Reifsnyder, N., Rauch, C., Mainali, M., *et al. Aligning to human decision-makers in military medical triage* in *International Conference on Case-Based Reasoning* (2024), 371–387.

C2. Sen, A., Mainali, M., Rauch, C. B., Addison, U., Floyd, M. W., Goel, P., Karneeb, J., Kulhanek, R., Larue, O., **Ménager, David**, *et al. Counterfactual-Based Synthetic Case Generation* in *International Conference on Case-Based Reasoning* (2024), 388–403.

C3. Kent, J. S. & **Ménager, David H**. *Indecision trees: learning argument-based reasoning under quantified uncertainty* in *Synthetic Data for Artificial Intelligence and Machine Learning: Tools, Techniques, and Applications* **12529** (2023), 296–307.

C4. **Ménager, David H** & Choi, D. *Hybrid Event Memory as a Case Base for State Estimation in Cognitive Agents* in *International Conference on Case-Based Reasoning* (2023), 134–149.

C5. **Ménager, David**. *Episodic Memory Foundation of Explainable Autonomy* in *Proceedings of the Twenty-Sixth International Conference on Case-Based Reasoning* (Stockholm, Sweeden, 2018), 32–41.

C6. **Ménager, D** & Choi, D. *A Robust Implementation of Episodic Memory for a Cognitive Architecture* in *Proceedings of the Thirty-Eighth Annual Meeting of the Cognitive Science Society* (2016).

Workshop Papers

W7. Rauch, C. B., Addison, U., Floyd, M., Goel, P., Karneeb, J., Kulhanek, R., Larue, O., **Ménager, David**, Mainali, M., Molineaux, M., *et al. Algorithmic Decision-Making in Difficult Scenarios* in *Proceedings of the AAAI Symposium Series* **3** (2024), 583–585.

W8. **Ménager, David H**, Choi, D., Roberts, M. & Aha, D. W. *Learning Planning Operators from Episodic Traces.* in *AAAI Spring Symposia* (2018).

W9. **Ménager, David Henri**, Choi, D., Floyd, M. W., Task, C. & Aha, D. W. *Dynamic Goal Recognition Using Windowed Action Sequences* in *Workshops at the Thirty-First AAAI Conference on Artificial Intelligence* (San Francisco, California, 2017).

W10. **Ménager, David**. *Episodic Memory in a Cognitive Model* in *Proceedings of the Twenty-Fourth International Conference on Case-Based Reasoning* (Atlanta, GA, 2016), 267–271.

Public Scholarship

P1. Bach, K., Bergmann, R., Brand, F., Caro-Martínez, M., Eisenstadt, V., W. Floyd, M., Jayawardena, L., Leake, D., Lenz, M., Malburg, L., **Ménager, David**, H., Minor, M., Schack, B., Watson, I., Wilkerson, K. & Wiratunga, N. *Case-Based Reasoning Meets Large Language Models: A Research Manifesto For Open Challenges and Research Directions* working paper or preprint. Mar. 2025. https://hal.science/hal-05006761.

Tools & Software

Github

Research Projects

Hybrid Event Memory System: An implementation of the Hybrid Event Memory System (HEMS) by Ménager, David H., Choi and Robins. HEMS performs clustering and classification of Bayesian networks to enable event cognition for intelligent agents. It stores observations, represented as DAGs, at the lowest level of an event hierarchy, and learns generalizations on top of them to form a probabilistic taxonomy of events. Learning occurs in an online, and incremental fashion, so the system learns continually, forming new generalizations by composing pre-existing ones together. Learning and performance are interleaved, so predictive power improves as examples are encountered.

ICARUS: A Common Lisp implementation of Choi and Langley's ICARUS cognitive architecture with an integrated event memory. The architecture places strong emphasis on goal-driven embodied cognition by supporting higher-level symbolic structures featuring

numerical attributes that make contact with sensed environmental elements. ICARUS separates conceptual knowledge from procedural, although procedural definitions depend on conceptual state descriptors. The architecture operates within recognize-act cycles, whereby conceptual inference is the foundational operation that enables goal reasoning, event cognition, skill execution, and learning.

Presentations

Invited Talks

T1. **Ménager, David H.** *A Hybrid Theory of Event Memory* Purdue University Midwest Memory Mayhem Workshop (West Lafayette, IN, USA). Apr. 2024.

T2. **Ménager, David H.** *The Trusted Algorithmic Delegate: A Research Story in Responsible Innovation* Utah State University Spring Symposium on Ethics and AI (Logan, UT, USA). Mar. 2024.

Selected Media Coverage

2024 Ohio Business Magazine, Competitive AI [C1]
2024 Kansas Alumni Magazine, Ripple effect: KU's Self Graduate Fellowship

Academic Advising and Mentoring

Graduate

2024 Saugat Aryal, University College Dublin, Semi-factual Explanations in AI, ICCBR 2024 Doctoral Consortium mentor

Undergraduate

2020 Xavier Scherschligt, University of Kansas, Predicting Glioblastoma Multiform, Undergraduate research mentor
2016 Denzel Richmond, University of Kansas, Online Pong game domain, Undergraduate research mentor

Academic Service

Committees and Advisory Boards

2025 International Conference on Case-Based Reasoning. Program committee member
2025 AI Workshop for the Air Force Research Laboratory 711th Human Performance Wing. Organizer

2024 International Conference on Case-Based Reasoning. Program committee member
2022- Center for Autonomous Air Mobility and Sensing. Industry Member
2021- University of Kansas School of Engineering Diversity Equity, Inclusion, and Belonging Advisory Board. Board member

Conference Reviewer

2025 International Conference on Case-Based Reasoning
- Reviewed Explaining Translational Embedding Models in Recommender Systems Using Knowledge Graphs and Language Models

2018 Plan Activity and Intention Recognition Workshop (AAAI)
- Reviewed Towards Quicker Probabilistic Recognition with Multiple Goal Heuristic Search
- Reviewed Robust Goal Recognition in Open-World Games with Generative Adversarial Networks

Other Experience

2021-2022 Sr. AI/ML Engineer, Advanced Development Programs, Lockheed Martin
- Develop machine learning-based capability for hypersonic missile defense
- Implement anomaly detection software tool for critical F-35 Subsystem
- Develop AI-based search algorithms for autonomous agents

2018 Intern, Advanced Development Programs, Lockheed Martin
- Leveraged big data and advanced techniques for prognostic health management on aerial platforms

2015 Data Analyst University Intern, Creative Cloud, Adobe
- Apply predictive analytics to Creative Cloud Product Usage Data
- Mine Product Usage Data from Hadoop to understand usage patterns
- Utilize machine learning techniques to develop algorithms to predict user conversion and retention based on product usage
- Conduct cluster analysis to identify customer segments in Creative Cloud Products

2015 University of Kansas Chapter President, National Society of Black Engineers
- Under my leadership, our chapter was awarded the Regional and National Small Chapter of the Year awards

2012-2013 Software Engineering Intern, Portable Navigation Devices, Garmin
- Maintain and updated existing portable navigation devices
- Conduct peer code reviews to ensure compliance to coding standards
- Engineer critical bug fixes to Garmin GPS systems on all software levels

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