

Active Inference Institute & Active Inference Ecosystem (2024, v2)

This is the home page for the [■ Active Inference Institute & Active Inference Ecosystem \(2024, v2\)](#).

We publish the work as a linear concatenated document. It will also be available as living document at <https://ecosystem.activeinference.institute/> in tree form.

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You can also have LLM-aided live chatting with the document via [this Perplexity link](#).

This document is structured according to the sections:

- Opening sections with information such as:
 - [🔥 Abstract](#), [📄 Authors](#)
 - [∞ Active Inference](#) for an overview on Active Inference.
- [🏠 The Active Inference Institute](#)
 - Pages related to the history, projects, productions, goals, organizational anatomy, values, and people of the Institute.
- [🌍 The Active Inference Ecosystem](#)
 - Pages related to activities and areas of attention in the broader Active Inference Ecosystem.
- [🕒 Discussion and Future Directions](#)

This structure initially came from the sections and contents of the [2023 paper](#) “The Active Inference Institute and Active Inference Ecosystem”. From that starting point, during September-November 2024, the [👥 Authors](#) made various contributions and additions to this living document.

This is a work in progress, and we will continue to update.

Get in touch with any comments, questions, or inclination to assist, for example with curating [🛡️ Domains of Application](#) or contributions to information about [🏠 The Active Inference Institute](#).

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Abstract

This document surveys the current state of 🧠 [The Active Inference Institute](#) and 🌱 [The Active Inference Ecosystem](#), in the context of our current and future directions. As embodied agents, we aim to update our decisions, goals and predictions as an institute by actively gathering (sampling) insights (observations) from our members. As Heraclitus once said “No one ever steps in the same river twice. For it’s never the same river and it’s never the same person”. In the same way, the Institute evolves with each new member, accumulating a variety of perspectives to drive improvement.

A Unifying Framework Across Disciplines

∞ [Active Inference](#) is a framework that emerges from studying how the interaction of living systems and their environment can be understood through the lens of information theory, drawing on important principles of thermodynamics — the science of energy and its transformations. With solid theoretical grounding, this allows Active Inference to be applied to many areas of human behavior and social interactions.

As a framework, Active Inference is a powerful tool for thinking about systems that ecologically evolve over time. By bridging connections across multiple disciplines, ranging from computational neuroscience to ecological psychology, there has been a growing list of 📖 [Domains of Application](#) relating to its implications that continues to grow and expand. These applications range across a multitude of fields such as artificial intelligence, economics, law, governance, resource management, risk management, finance, decision theory and physics, highlighting the versatility as well as the value of a unifying framework to understand human behavior and its adaptability across dynamic environments.

The Institute and You

The Active Inference Institute is an educational organization committed to promoting a better understanding of Active Inference and its potential benefits. Our goal is to build and provide a network of support to a wide audience of individuals interested in learning the foundational knowledge or practical applications of framework principles within civic, commercial, industrial and other domains. With a mixture of community initiatives, resources and collaborative learning, the Active Inference Institute aims to empower individuals and integrate framework principles into real-world problem solving. Due to its unifying nature, Active Inference has spawned a disparate and broad-reaching Ecosystem of researchers. 🧠 [The Active Inference Institute](#) aims to provide 🧠 [Ecosystem Support](#) through stewarding the information commons and infrastructure scaffolding.

Since its inception, the 📖 [History of The Institute](#) has been one of an evolving community driven by learners of all stages of experience, and from myriad backgrounds, who have worked individually and in various combinations to expand Active Inference across disciplines. We’ve understood from the outset that change is inevitable, that sustainability and growth are dependent on a willingness to take chances, and that building trust needs time. The community continues to grow and new members can get involved through participation in one of the many learning opportunities (e.g. courses, 📖 [Textbook Group](#), 📺 [Videos & Podcasts](#)), can advance Active Inference through research and development programs and collaborative research initiatives (e.g. Internship & Fellowship programs), and can engage with the community by contributing to the discourse.

Be part of a globally connected community of Active Inference practitioners and join us as we create this community and expand what is possible for the institute and the many parties, organizations and organisms that can potentially benefit from this work.

As you find your pace and balance, we hope you’ll find the Institute isn’t just a place of convergence so much as a portal through which new worlds of connections await. We hope to create a space together where we can pursue those opportunities from numerous directions, and where each person feels welcome to enter differently according to the paths which have led them here.

Authors

🇺🇸 [Authors](#) made various contributions to the 🇺🇸 [Active Inference Institute & Active Inference Ecosystem \(2024, v2\)](#) (backend [writing document](#) with full trace of edits).

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Active Inference

What is Active Inference?

∞ [Active Inference](#) is an integrated physics-based approach to modeling cognition and behavior as the active minimization of prediction error. Arising from the empirical study of cognitive systems (those involved in perception and action), Active Inference now is being explored across many [Domains of Application](#).

The formal aspects of the framework describe in mathematical terms the tendency of complex adaptive systems to self-organize as to maintain low-surprise states (formally, through minimization of Variational Free Energy). Active Inference treats this tendency as the basic process, enabling the modeling of perception and behavior in various kinds of cognitive agents, including but not limited to humans.

For those encountering this term for the first time, this can sound technical and obscure, but Active Inference can also be first understood more conceptually and practically as a framing for analysis that is broadly useful towards addressing or gaining perspective in a wide variety of fields that formerly seemed unconnected.

At its most basic level, Active Inference can be compared to the guessing game called “20 Questions,” a game in which one person is challenged to guess the identity of an object imagined by another person. In the game, each additional question asked is the “active” part of active inference, and the responses serially constrain the next question as the person guessing. Through this process surprise (bounded by “Variational Free Energy”) due to the differences of an observer’s “internal model” and the outside reality is reduced offering advantages to the cognitive/behavioral system, whether that system is a cell, an organism, a human organism, or an organization.

For example, Active Inference finds application as diverse as [mental health](#) and [ecology](#) (see [Domains of Application](#)). It is not surprising that Active Inference framing is broadly useful in structuring a deeper understanding of the information flows associated with human cognition and bio-social behaviors in a variety of interaction settings and contexts, since Active Inference first emerged from the study of information flows in nature, where the organizing effects of its thermodynamic underpinnings are expressed most freely.

When Active Inference analysis is directed toward human social and organizational structures and behaviors, it reveals how relevant these bio-physical imperatives are when reflected and expressed in our everyday world. Greater awareness of this foundation, both in individual and organizational contexts, could enhance the overall effectiveness of a variety of information and communication systems and structures, many of which have never enjoyed a “spring cleaning” since their respective historical inception.

We could, for example, define Active Inference in everyday language as an approach to understanding our interaction with the world and with those around us, how can we create some sort of model to understand how or why we behave as we behave and then apply this understanding to improve how we self-manage our shared models in a quickly changing reality. More formally, one could rather approach it through mathematics, and explore the foundational aspects of the operation of Active Inference.

The advice to new members of the community who are looking for the best way to begin interacting with the broad range of materials and use cases impacted by active inference analyses is to seek the papers, discussions, materials that present the most familiar vocabulary, narratives and metrics as the starting point, and then to explore from there. To look for terms and keywords across the Active Inference resources that appeal to you most readily and start your journey by following those threads. .

For background readings related to the theoretical basis of ∞ [Active Inference](#), see: The 2022 Textbook: “[Active Inference: The Free Energy Principle in Mind, Brain, and Behavior](#)” by Thomas Parr, Giovanni Pezzulo, Karl J. Friston (focus of the [Textbook Group](#)), “[The free energy principle—a precis](#)” by Maxwell Ramstead (October 2023), [Spinning Up in Active Inference and the Free Energy Principle](#)” by Jared Tumiel (October 2020), and “[Of woodlice and men: A Bayesian account of cognition, life and consciousness](#)” 2018 conversation-style interview with Karl Friston.

For seeing specific applications of Active Inference, see [📍 Domains of Application](#), as well as [🏢 Institute Projects & Ecosystem Projects](#). In short — read on!

What are key claims and aspects of Active Inference?

Active Inference is scale-free as both a theoretical framework and a modeling approach. It characterizes all [information processing?] systems [of interacting components?] as behaving in a way that satisfies a single, fundamental goal: every systems acts so as to maintain the distinction between it and its environment. It characterizes all systems as employing the same strategy to achieve this goal: maximizing their ability to predict how their environment will next impact them.

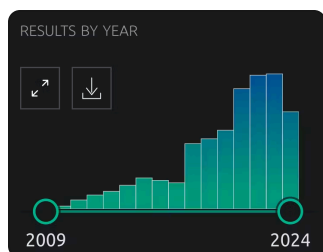
Active Inference thus characterizes all systems - from elementary particles to planetary ecosystems - as agents that both observe (accept input from) and act on (transfer output to) their environments. This information transfer is defined at the agent-environment boundary. For any agent, preserving its distinction from its environment is preserving its boundary, which preserves its identity. The Active-Inference process is, therefore, sometimes referred to as “self-evidencing”: any Active Inference agent continually provides its environment with evidence of its existence.

By treating all systems at all scales as agents, Active Inference embraces a minimal, physical definition of “freedom”: an Active Inference agent is “free” in the sense that its next action is not causally determined by its environment. One can also put this as: the current state of an Active Inference agent is not causally determined by any, or all, of its environment’s past actions on its boundary. Freedom in this sense - freedom from local, causal determinism - is guaranteed to all physical systems by the Conway-Kochen theorems (2006, 2009), which show that local, causal determinism is inconsistent with special relativity, which requires that causal processes take time, and quantum theory, which forbids the state of any system to be fully characterized by a single measurement. Hence Active Inference agents have internal states, and internal processes, that are “protected” from their environments by their boundaries. “Self-evidencing” is, therefore, also “maintaining one’s freedom of action”.

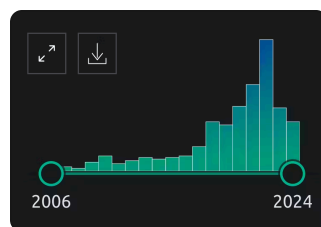
The generality and action orientation of Active Inference makes it a natural bridge between descriptive approaches to systems, and prescriptive approaches to implementation of artificial intelligence (e.g., machine learning) and design (e.g., user experience, communication, policies, [BOLTS](#), [requirements](#), etc.). Active Inference therefore enables a principled account of composition and decomposition, construction and de-construction, in complex adaptive systems. This generality provides a unified conceptual and pragmatic approach towards establishing a foundation for modeling, designing, and implementing various information processing systems across scales, disciplines, and settings. Active Inference is, therefore, intrinsically a trans-disciplinary framework both for theory and for modeling. As such, it provides a powerful common language into which discipline-specific languages can be translated.

Active Inference leverages Bayesian principles, coaching how systems perceive, learn, and act in their environments. It thus treats “knowledge” or “belief” as expectation or prior probability. It treats all agents as Bayesian satisficers, “doing the best they can do” in their environments given how they expect their environments to behave towards them.

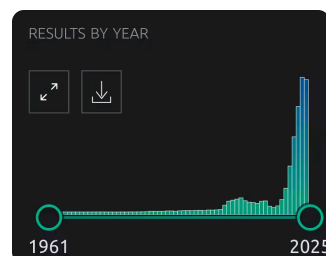
Over the last several decades, [∞ Active Inference](#) has been attracting increased attention as a quantitative and cognitive framework capable of acting as a common bridge, or Rosetta Stone, among various domains, and is gathering support across [📍 Domains of Application](#). Some citation search measures of this growth in popularity for “Active Inference” and “Free Energy Principle” are shown. Deeper [🧠 Knowledge Engineering](#) is needed to make stronger inferences about the growth and change of the ideas and their applications, in the research literature and beyond.



“Active Inference” on PubMed & arXiv



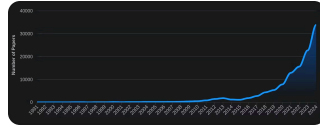
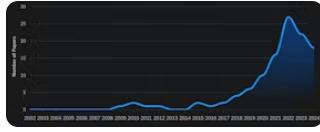
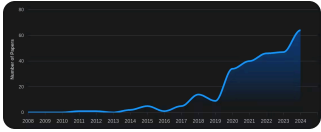
“Free Energy Principle” on PubMed & arXiv



“Artificial Intelligence” on PubMed & arXiv

What is this excitement and growth about?!











Read on to learn about the [🏢 The Active Inference Institute](#), the [🌱 The Active Inference Ecosystem](#), and explore the depth and

















breadth of the work ongoing.

The Active Inference Institute

The Active Inference Institute is a registered non-profit organization (Delaware, USA) which identifies, establishes, scaffolds, and supports the sustainable implementation of:

1. Education and Research services.
 - a. We learn and teach  [Active Inference](#)
 - b. We host  [Institute Programs](#) and  [Institute Projects](#)
 - c. We provide visibility and opportunities for  [Ecosystem Projects](#)
 2. Participation, communication, advisory, governance, and meta-governance affordances within the Institute and  [The Active Inference Ecosystem](#)
 3. Publishing, and licensing protocols that establish  [Open Source](#), fair use, and effective dissemination of community products within and beyond the Ecosystem.
 4.  [Ecosystem Support](#) services such as  [Communications](#),  [Applied Active Inference Symposium](#), and operation of cyber and cognitive security systems aligned with our  [Mission, Vision, Values, and Principles](#)
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The rest of this section covers:

-  [History of The Institute](#) since founding in 2021
-  [Mission, Vision, Values, and Principles](#)
-  [Focus Areas for the Institute](#) in terms of ongoing challenges (“*where you find the challenge is where the learning/solution is done!*”)
-  [Directions for the Institute](#) we are taking in light of the focus areas.
-  [Institute Organization](#), or morphology, in terms of roles and positions.
-  [Institute Programs](#) and avenues for participation, such as  [Volunteer](#),  [Internship](#),  [Fellows](#),  [Philanthropy](#),  [Grants](#),  [Partnerships](#)
-  [Institute Projects](#) hosted by the  [Organizational Units](#)

History of The Institute

2020

The 📖 [History of The Institute](#) begins in the co-founder team meeting in 2020 around a common interest in ∞ [Active Inference](#). This resulted in productive collaboration and the publication “Active Inference & Behavior Engineering for Teams” in September 2020 (Vyatkin et al. 2020). The group was then known as “Team Comm”. Check out [our first livestream, ActInf Livestream #001.1 ~ “Narrative as active inference”](#), on July 28, 2020.

Following the 2020 publication, discussions turned towards exploring approaches that could catalyze the accessibility, rigor, and applicability of Active Inference, and how to merge the developing framework with the 🧠 [Systems Approach](#) and 🌱 [Open Source](#). Out of these discussions an “Active Inference Lab” (or ActInfLab) was formed and began operations in 2021.

2021

Over the first year of our operations, dozens of individuals from around the world engaged with ActInfLab through various projects such as educational 📺 [Videos & Podcasts](#) , 🌱 [Open Source](#) publishing, collaborative research projects, focused learning groups, 📖 [Active Inference Journal](#), and initial developments of the 🗺️ [Active Inference Ontology](#).

Since the first quarter of operations in 2021, the ActInfLab hosted [Quarterly Roundtable livestreams](#) for communicating quarterly expectations and results to the community, a tradition that we continue to this day.

2022

Beginning in 2022, a cohort-based Ψ [Scientific Advisory Board](#) (SAB) was established to connect the ActInfLab to cutting-edge theoretical work as well as various domain-specific applications. As interest in both the ActInfLab's activities and Active Inference itself began to grow, ActInfLab soon emerged as a key facilitating organization in what was then a primarily academic community working on the underlying theory and potential implications for Active Inference.

The first Active Inference textbook comes out in 2022 (Parr, Pezzulo, Friston 2022), and the Institute begins hosting a 📖 [Textbook Group](#) (ongoing through 7 cohorts in 2024). The Textbook Group is an important ecosystem service, as there are few academic/institutional locations where learners can be supported through the curriculum of the textbook and beyond. Additionally, the Institute has curated and categorized learning materials that learners create while participating in the group, including questions and discourse.

The Institute begins the ✂️ [Internship](#) program to scaffold and support the learning journey of learners. Interns come from different backgrounds — including high school, college, and graduate students on academic tracks, as well as professionals and others outside of academia. Interns, with their mentors, develop a personalized education and research curriculum which lasts months-years.

In mid-2022, ActInfLab made the developmental leap to become 🏠 [The Active Inference Institute](#), a non-profit organization registered in Delaware, USA with the intention of making its facilitatory role in the community impactful and sustainable. As part of the requirements for a non-profit, we also laid out the 🏢 [Institute Organization](#), comprised of the 🧩 [Organizational Units](#): 🏠 [Administrative](#), 📖 [EduActive](#) (Education), and 🔍 [RelInference](#) (Research).

At the end of 2022, the 🌟 [Board of Directors](#) has its first meeting. The Board continues to meet on a quarterly basis.

2023

🧩 [Institute Projects](#) and 📖 [Institute Programs](#) continue, including the first two full course offerings: 🧠 [Physics course](#) and 🌱 [Social Science course](#). These courses span months, and include office hours with the lecturer and teaching assistants.

In addition to continuing livestream 📺 [Videos & Podcasts](#) on YouTube (GuestStream, ModelStream, PaperStream, etc), the Institute hosts the popular [Active Inference Insights](#) podcast.

During the year, we begin researching and applying for private and government [Grants](#).

2024

Organizationally, the Institute receives official recognition as a 501(c)(3) non-profit organization, supporting our [Philanthropy](#) efforts. We were able to achieve this milestone with the *pro bono* support of the [Fried Frank](#) law firm.

The largest cohort to date of the [Ψ Scientific Advisory Board](#) makes many diverse contributions across projects.

The [Fellows](#) program begins to highlight and scaffold the work of Ecosystem member. As of November 2024, there are 5 Research Fellows have joined. Fellows represent members of the Ecosystem who have contributed substantially to the ecosystem through publications and presentations.

To meet the needs of trainees and Interns for one-on-one guidance with projects, we introduced the [Mentorship](#) program. Members of the [Ψ Scientific Advisory Board](#) and select other individuals, volunteer to mentor and connect with individual trainees.

Following the [Physics course](#) from 2023 and first-principles approaches to [Broken link](#), we implemented a “[Prepare and Measure](#)” system for [Institute Projects](#) and [Ecosystem Projects](#). Prepare and Measure allows people to set goals and report back when they have reached them. This is a low stakes and always-open reporting system to gauge the ongoing projects and work done by community members, and provide visibility to these updates in the [newsletter](#).

Work during this year remains all-volunteer. [Philanthropy](#) support begins to come in, supporting some operational software costs. We applied for several [Grants](#) (such as [FarmWorks](#) and related to [AI safety](#) with the [RxInfer.jl Learning Group](#)).

The [Authors](#) collaborate on this [Active Inference Institute & Active Inference Ecosystem \(2024, v2\)](#) leading up to the 4th [Applied Active Inference Symposium](#) on November 13th, 2024.

Mission, Vision, Values, and Principles

Our Mission

To support the accessibility, rigor, and applicability of Active Inference.

Act. Infer. Serve.

The formal mission

The formal “mission statement” of the Institute only scratches the surface of the goals and aspirations of its members and the many parties in its broad ecosystem.

This is screenshot/text from our Form 1023 (this is from the IRS 501(c)(3) status application), submitted in 2023.




The formal mission of the Institute, seen in the screenshot to the left, is:

Active Inference Institute, Inc. (the Institute) is dedicated to developing, supporting, and promoting open science and integrative frameworks such as active inference. In furtherance of its mission, the Institute will conduct the following activities: (1) education, (2) research, (3) grantmaking, and (4) administration.

-  **EduActive (Education)**
-  **RelInference (Research)**
-  **Grants**
-  **Administrative & Institute Organization**

Our Vision

The Active Inference Institute serves as a scaffold for stabilizing and connecting myriad fields around a central tradition and approach of  [Active Inference](#).



The Institute aims to make the Active Inference framework and the Ecosystem we serve more accessible, applicable, rigorous, and integrated.

We facilitate educational, theoretical, and applied engagement with Active Inference, promoting awareness of the field within the lay, academic, public-sector, and professional communities.

We envision a future in which the term “Active Inference” is used as widely as “Machine Learning”, as a result of its demonstrated utility and impact in a variety of domains.

Our Values and Principles

We are committed to fostering a culture of excellence, collaboration, and innovation. Our values and principles serve as the guiding principles that shape our work and define our organization's character.

-  **Active Inference and Exploration.** At The Institute, we embrace the principle of Active Inference,  [Systems Approach](#), and open-ended exploration as a fundamental driving force. We cultivate a culture of curiosity and continuous learning. Through engaging in endeavors across multiple scales (person, project, Institute, Ecosystem), we enrich our understanding and make relevant contributions to our niche.

- **Integrity.** We strive to uphold and promote honesty, accountability, professionalism, as well as responsible conduct in research, education, and facilitation among members of The Institute, Ecosystem, and communities we serve. We foster diversity, respect, and global inclusion through community engagement. We treat differences in perspective and understanding as a wellspring of valuable creative and productive potential, driving breakthroughs and strengthening collaborative research outcomes.
- **Towards Institute- and Ecosystem-Scale Generative Modeling:** At The Institute, we aim to use model-based approaches towards organizational design and operation. Informally we use the [Active Inference Ontology](#) where possible, and looking towards more sophisticated computational modeling in the future. We look support shared informational niches for different scales, spanning the Ecosystem, Institute, Organizational Units, and Projects. We continuously develop and refine hierarchical models, drawing on sensory information, exploiting data, and gathering feedback. Our dynamic self-modeling enables efficient resource allocation.
- **Anticipatory Behavior:** The Institute's commitment to anticipatory behavior equips us to excel in uncertain environments. Leveraging our internal models, we generate predictions at various scales and time horizons, empowering us to take initiative and adapt our policies accordingly. This forward-thinking approach enables us to plan strategically and make informed decisions, thus remaining at the forefront of our fields.
- **Continuous Development:** Embodying the ideas of open-endedness and techno-evolution, we wholeheartedly embrace the principle of continuous development at The Institute. Recognizing the dynamic nature of our environment and the constant advancements in science and technology, we continually evolve our internal models and approaches. This perpetual learning and evolution enable us to remain adaptive and at the cutting edge of our fields, driving impactful research that contributes significantly to the scientific community. In the spirit of action and perception, we encourage learners to produce and share artifacts, then receive feedback: informally and formally (through [Prepare and Measure](#)).
- **Participatory Engagement:** At the Institute, we encourage collaborative active learning through artifacts. Digital, stigmergic modifications of our online environment are the central method for engagement. Projects are enacted through preparation and periodic measurements that trace development through time. We support the accessibility, applicability, and inclusivity of Active Inference by seeking [Open Source](#) (and related: Open Science, [DeSci](#)) approaches where possible.

Focus Areas for the Institute


Below are some 📌 [Focus Areas for the Institute](#), and how those 📁 [Focus Areas](#) are addressed by 🗺️ [Directions for the Institute](#).

The Focus Areas were developed from feedback from participants, and presented here as a part of the overall milestones/snapshot.

Focus Areas

Focus Area	Area Description (why is it challenging, what are the risks?)	Related Directions & Steps
Research Advancement and Cross-disciplinary Expansion	Bridging diverse disciplines and translating Active Inference concepts across fields is complex. Without this, we risk siloed knowledge, missed opportunities for innovation, and limited real-world impact of Active Inference principles.	Research Advancement Cross-disciplinary Expansion
Educational Outreach and Resource Development	Active Inference involves abstract concepts and mathematical formalisms, making it difficult for newcomers to engage. Failure to address this could result in a limited pool of practitioners and researchers, slowing the field's growth and application.	Educational Outreach
Software Development and Practical Applications	Developing user-friendly, robust software tools for Active Inference is technically challenging. Without accessible tools, we risk limiting practical implementations and real-world testing of Active Inference models.	Software Development Practical Application
Community Growth and Engagement	Maintaining a cohesive, productive community across diverse backgrounds and interests is complex. Failing to do so could lead to fragmentation, reduced collaboration, and slower progress in advancing Active Inference.	Community Growth Public Engagement
Public Engagement and Ethical Considerations	Translating complex Active Inference concepts for broader public understanding while addressing ethical implications is challenging. Without this, we risk public misunderstanding, potential misuse of the framework, and missed opportunities for societal impact.	Public Engagement

Directions for the Institute

 [Directions for the Institute](#) describe ongoing areas of activity and development at the Institute scale.

The following table lists current developmental [Directions & Steps](#) and connections with [Focus Areas](#).

Directions & Steps

Direction	Method	Deliverables	Impact / Implication
Research Advancement	Support core Active Inference research; Explore theoretical implications in Philosophy ; Examine group cognition functionality	Research papers; Theoretical frameworks; Computational models	Deepened understanding of Active Inference; New insights at the intersection of multiple fields; Improved models of collective cognition
Software Development	Improve RxInfer.jl visualization capabilities; Enhance PyMDP usability; Develop and curate examples of Domains of Application	Updated Open Source software tools; User-friendly interfaces; Application case studies	More accessible and powerful Active Inference modeling; Increased adoption by researchers and practitioners; Practical demonstrations of Active Inference in action
Educational Outreach	Develop curricula for different languages and contexts; Provide courses and workshops; Increase Communications efforts	Comprehensive curriculum; Industry-focused courses; Educational materials for various skill levels	Wider accessibility of Active Inference concepts; Increased industry engagement; Growth of skilled Active Inference practitioners
Cross-disciplinary Expansion	Seek grants for cross-disciplinary AI research; Pursue features in popular science media; Focus outreach to social sciences	Grants and proposals; Media articles; Collaborative research projects	Broader adoption of Active Inference across disciplines; Increased public awareness; New applications in social sciences
Community Growth	Facilitate intern-mentor connections; Encourage SAB member interactions; Foster edge interactions within community	Mentorship program; Enhanced community engagement; Collaborative projects	Stronger, more connected Active Inference community; Knowledge transfer between experts and newcomers; Innovative cross-pollination of ideas
Public Engagement	Translate concepts for broader public; Address societal challenges through Active Inference; Provide foundations for trust and ethics in AI	Accessible content; Applied solutions to real-world problems; Ethical guidelines for AI development	Increased public understanding of Active Inference; Real-world impact on societal issues; Responsible AI development informed by Active Inference principles
Practical Application	Develop policy appraisal methodologies; Consider ethical and cognitive security aspects; Research capabilities in various domains	Policy frameworks; Ethical guidelines; Domain-specific applications	Informed decision-making in policy; Enhanced cognitive security measures; Demonstration of Active Inference's versatility across fields

Below, we revisit the [Focus Areas for the Institute](#) and outline some [Directions for the Institute](#) for 2025 and beyond

1. Research Advancement and Cross-disciplinary Expansion

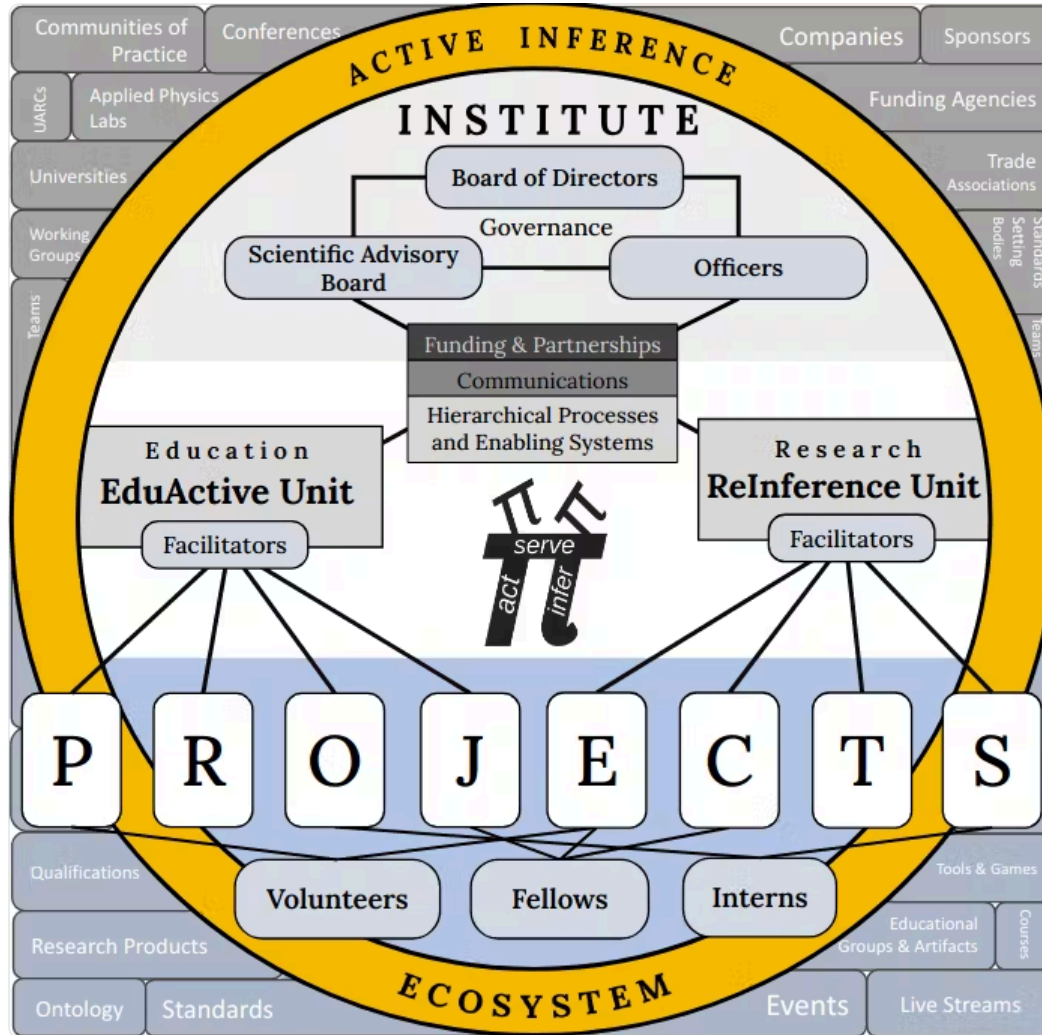
- Seek [Grants](#) for cross-disciplinary research
- Support core Active Inference research ([ReInference \(Research\)](#)) and educational ([EduActive \(Education\)](#)) development
- Explore implications in philosophy, social sciences, and other [Domains of Application](#)
- Facilitate collaboration with other cognitive models and research communities

- e. Develop new policy appraisal methodologies with focus on ethical and cognitive security considerations
2. Educational Outreach and Resource Development
 - a. Develop a full academic curriculum for interdisciplinary audiences
 - b. Create educational resources ([📖 Fundamentals of Active Inference and Beyond](#))
 - c. Provide courses on [📚 Implementations of Active Inference](#) for industry professionals
 - d. Increase learning resources for coding Active Inference agents/simulations
 - e. Develop foundations for trust, ethics, and education in the context of rapid AI advancement
 3. Software Development and Practical Applications
 - a. With [🌐 Open Source](#) development, Improve [📡 RxInfer.jl](#) and [🐍 PyMDP](#) visualization capabilities and overall usability
 - b. Develop real-world [📚 Implementations of Active Inference](#) across [🛡️ Domains of Application](#)
 - c. Support multi-agent workflows (e.g. using [≈ Active Entity Ontology for Science \(AEOS\)](#))
 - d. Create reliable and accurate models for engineers
 4. Community Growth and Engagement
 - a. Facilitate [🌱 Mentorship](#) connections with [✂️ Internship](#), [🌟 Fellows](#), and [🧠 Scientific Advisory Board](#) members
 - b. Foster edge interactions within the community and [🌱 The Active Inference Ecosystem](#)
 - c. Implement automated feedback mechanisms
 - d. Moderate community discourse to ensure compliance with culture and values
 - e. Improve onboarding experience for new users
 - f. Increase awareness and involvement from organizations outside the Institute
 5. Public Engagement and Knowledge Dissemination
 - a. Translate Active Inference concepts for broader public understanding
 - b. Develop [📝 Communications](#) strategies to disseminate knowledge to general public, and professional across areas
 - c. Explore the intersection of [∞ Active Inference](#) with current global issues (social, economic, geopolitical, technological, environmental)
 - d. Continue to develop [🌐 Open Source](#) publishing and licensing support systems for contributors

Institute Organization

The 🏠 Organizational Units host 🏠 Institute Programs and 🏠 Institute Projects

The below shows the overall 🏠 Institute Organizational morphology, in terms of internal structure and engagement interface with 🌱 The Active Inference Ecosystem.



Here is the working gSlide for this Figure

Scientific Advisory Board

The [Scientific Advisory Board](#) (SAB) comprises external experts in Active Inference and related research areas who provide guidance, review grant proposals, and offer advice on scientific integrity. The first Scientific Advisory Board was active during 2022, and currently we are engaged with the third cohort in 2024.

SAB participants offer expertise, advice, guidance, and recommendations to the Institute. They draw on their experience as executives from academia, private business, the public sector, not-for-profit organizations, and beyond. The Scientific Advisory Board acts in an 'advisory capacity' and is not a managing board.

[Complete this form](#) to be considered to join a future SAB cohort (selected annually at end of the year).

2024 Scientific Advisory Board

- [Mahault Albarracin](#)
- [Bradly Alicea](#)
- [Sebastian Alvarado](#)
- [John Boik](#)
- [Matt Brown](#)
- [John Cook](#)
- [Scott David](#)
- [Renée Davis](#)
- [Shanna Dobson](#)
- [Shady El Damaty](#)
- [Jeff Emmett](#)
- [Chris Fields](#)
- [Karl Friston](#)
- [Holly Grimm](#)
- [Avel GUÉNIN—CARLUT](#)
- [Sarah Hamburg](#)
- [Susan Hasty](#)
- [Conor Heins](#)
- [Susan Keen](#)
- [Thomas Kehler](#)
- [Héctor Manrique](#)
- [Alexandra Mikhailova](#)
- [Haris Neophytou](#)
- [Alexander Ororbia](#)
- [Sandeep Ramesh](#)
- [Maxwell J. D. Ramstead](#)
- [Adeel Razi](#)
- [Manuel Razo-Mejia](#)
- [Jakub Smekal](#)
- [Ian Tennant](#)
- [Mick Thacker](#)
- [Shingai Thornton](#)
- [Mark Wilcox](#)
- [Michael Zargham](#)

2023 Scientific Advisory Board

[Bradly Alicea](#), [John Boik](#), [Matt Brown](#), [Scott David](#), [Shady El Damaty](#), [Jeff Emmett](#), [Chris Fields](#), [Karl Friston](#), [Holly Grimm](#), [Sarah Hamburg](#), [Victor Kariuki](#), [Anatoly Levenchuk](#), [Maxwell J. D. Ramstead](#), [Adeel Razi](#), [Michael Zargham](#)

2022 Scientific Advisory Board

[Bradly Alicea](#), [John Boik](#), [Matt Brown](#), [John Clippinger](#), [Scott David](#), [Jeff Emmett](#), [Chris Fields](#), [Karl Friston](#), [Rafael Kaufmann](#), [Anatoly Levenchuk](#), [Rosalyn Moran](#), [Elba Serrano](#), [Charel van Hoof](#), [Tim Verbelen](#), [Swan Webb](#), [Michael Zargham](#)

Board of Directors

Board of Directors

The inaugural cohort of the [Board of Directors](#) has been in operation since the end of 2022. The Board of Directors is composed of individuals with expertise in Active Inference, governance, fundraising, and various other domains. They meet quarterly and are responsible for setting the organization's strategic goals, providing oversight, and ensuring compliance.

The second cohort of the Active Inference Institute Board of Directors was elected in December 2023.

The Board of Directors currently consists of:

- [John Clippinger](#) — “I want to bring Active Inference into a broad range of applications, specifically into a new model of the firm, markets and finance.”
- [Daniel Friedman](#) — “I expect and prefer to integrate the Institute’s daily operations with our broader vision.”
- [Rafael Kaufmann](#) — “I build adaptive sociotechnical systems that help human collectives, from teams to civilizations.”
- [Bleu Knight](#) — “I ensure that our actions align with our values and strategic objectives, thus generating the sensations we prefer.”
- [Mike Smith](#) — “I contribute to strategies for service and education, and facilitate epistemic foraging with active inference in commercial applications.”
- [Dean Tickle](#) — “I see my role as a supplier of blind spot remover and a suggester of “Escape Room” strategies as we open up active inferring.”

[Apply for the Board of Directors by completing this form.](#)

Officers

Officers

The first set of Officers was installed at the end of 2022 with the following positions:

- Daniel Friedman (President and Treasurer)
 - As President, responsible for overall leadership, direction, and activities of the organization. As Treasurer, responsible for managing the financial activities of The Institute.
- Alexander Vyatkin (Vice President)
 - Supports the objective of the President and assumes these responsibilities when necessary. Focused on defining and implementing effective ways of working for The Institute/Units/Project scales, integrating state of the art methods, practices, and technologies into operations. In charge of organizational design, ensuring continuous evolution of services and organizational functions.
- Bleu Knight (Secretary)
 - Supervises organizational processes such as official meetings and votes. Oversees efforts geared toward financial and HR compliance.

[Apply to be an Officer by completing this form.](#)

Members

The legal members of The Institute are Alexander Vyatkin, Virginia Bleu Knight, Ivan Metelkin, Daniel Friedman, and Karl Friston.

Organizational Units

The  Organizational Units of the Institute describe the main concentrations or nestings of

 **Administrative** for organizational and operational work

 **EduActive (Education)** for inquiry and learning

 **ReInference (Research)** for research and development

Administrative











The Institute 🧠 [Administrative](#) Unit performs various support tasks within 🏛️ [The Active Inference Institute](#) and the wider 🌱 [The Active Inference Ecosystem](#), such as project coordination, record keeping, graphic design, 📄 [Grants](#), project facilitation, preparation, 🗣️ [Communications](#) and compliance, and other activities.

Administrative activities contribute to the development of core infrastructure to provide such support and automate or systematize and standardize tasks, and become the organizational umbrella for financial, human resources, ✂️ [Internship](#), 🟡 [Volunteer](#), security, community moderation and management, and related activities and organizational components. These tasks are currently assumed by The Institute's 🏠 [Officers](#), who will continue to provide oversight as the unit develops to include more contributors.

EduActive (Education)

The Institute's Education Unit is named "EduActive" to highlight the active element of education.

Projects of  EduActive (Education) include:

-  Active Inference Journal
-  Active Inference Ontology
-  Active Entity Ontology for Science (AEOS)
-  Applied Active Inference Symposium
-  Educational Standards & Qualifications
-  Fundamentals of Active Inference
-  Physics course
-  Social Science course
-  Textbook Group
-  Videos & Podcasts

ReInference (Research)

The Research unit at the Institute is named “ReInference” to highlight the perspective on scientific research and inquiry more broadly in terms of [∞ Active Inference \(Pietarinen & Beni 2021, Balzan et al. 2023\)](#).



The Institute’s ReInference unit focuses on Research activities such as: (i) the forming of fit-for-function interdisciplinary research teams, (ii) the development and execution of research proposals and projects aligned with the mission of The Institute and challenges faced by The Institute and Ecosystem at large.

The ReInference unit is committed to hosting and sharing all relevant data, findings, publications, tools, and derivative artifacts under [🌐 Open Source](#) or similarly accessible licensing agreements wherever practicable and appropriate.






Projects of [🔍 ReInference \(Research\)](#) include:

- [👤 RxInfer.jl Learning Group](#)
- [🗃️ Active Blockference](#)
- [🌿 Active InferAnts](#)
- [🌳 Tech Tree](#)
- [🔗 Knowledge Engineering](#)
- [📄 Generalized Notation Notation](#)
- [🏠 FarmWorks](#)




Institute Programs

The  [Institute Programs](#) are the specific modes of active participation and engagement (beyond e.g. just watching  [Videos & Podcasts](#)).

For individuals:

-  [Volunteer](#) positions contribute to the Institute's work in specific ways.
-  [Internship](#) and  [Mentorship](#) provide structure for those looking to advance their learning and work.
-  [Fellows](#) provides the opportunity for committed individuals to be recognized as a leader in  [Active Inference](#) research and education.

For organizations:

- The  [Partnership](#),  [Philanthropy](#), and  [Grants](#) programs all provide channels of support and bi-directional learning with the Institute.

Volunteer

Operationally, all participants of the Institute are volunteers. Volunteers join the Institute by emailing project facilitators, or communications from [Discord](#). Communications such as the website <https://www.activeinference.institute/> and [Newsletter](#) also contain solicitations for signing up for general [Volunteer](#) lists, and specific [Institute Projects](#).

As a community-driven open science organization, there are multiple opportunities for contribution. All backgrounds, time zones, time availability, and levels of familiarity with Active Inference are welcome and encouraged. Volunteers are active learners who want to contribute to ongoing projects at The Institute. Volunteers have the opportunity to engage in and lead a wide array of projects without any constraints on their type or quantity. These projects encompass a range of activities such as study groups, livestreams, marketing initiatives, publications, symposiums, and applied research.

We look to develop and clarify how the [Volunteer](#) position will work in 2025. Current thinking is exploring ideas around:

- Official Recognition (via specific affordances and statuses such as: affiliation status for papers and communications, access to code repositories and digital resources, @activeinference.institute email address, letters of recognition, inclusion on [Grants](#), payment via [Philanthropy](#), etc).
- Role of [Mentorship](#) in [Volunteer](#) efforts and [Education](#) more broadly.
- Position and [Institute Projects](#)-specific Documentation, regular participation in prepare/measure cycles.
- Stewardship of specific [Domains of Application](#) paper sections
- Sampling among expertise areas to build Prediction Matter Expertise (PME), not just Subject Matter Expertise (SME). Facilitating discussions and answering basic questions.
- Contributing to [Open Source](#) projects.

The volunteer program aims to balance structure with flexibility, providing clear value while maintaining active inference principles in learning and contribution. This framework allows volunteers to grow within the Institute while contributing meaningfully to its mission.

Internship

The ✂ Internship program is customized to situation and timing of each person, and ranges in duration from several months-years. The internship activities are streamlined with the individuals other activities and aligned with their preferences. Interns are assigned an organizational point of contact, optional additional mentorship, and have periodic synchronous and asynchronous check-ins.

There are two primary components to the Internship:

1. Learning and Updating: self-guided as well as participation in ■ EduActive (Education) projects (e.g. 📖 Textbook Group)
2. Research and Development: private projects and/or 🔍 ReInference (Research) activities.

The ✂ Internship program benefits the intern by increasing their familiarity and expertise with Active Inference and associated areas, as well as offering practical experience with teamwork and project-specific skills. Upon completion, interns will receive acknowledgement and a certification of completion with the duration and focus specified. Letters of recommendation will be granted on a case-by-case basis.

Interns are responsible for active and documented participation in the Internships. It is critical that interns are open to adapting the internship plan and actively reduce uncertainties as needed.

<https://intern.activeinference.institute/>

Mentorship

The Mentorship program connects [Interns](#) with additional one-on-one support from a Mentor (a member of [Ψ Scientific Advisory Board](#) who assumes the role of sponsor for authentic learning exposures both in and beyond the Active Inference Institute).

Serving as a Mentor is a way to provide a unique contribution for our community, **through** engaging with the [Educational](#) space parameterized by Subject Matter Expertise and Prediction Matter Expertise (see the Education page for further details). This learning condition presents as a co-learning opportunity where the updating of ALL participant generative models, is expected and preferred. Here “what got you to a **new** Know” matters as much as “what you know already.”

Using the [Mentorship](#) form, individuals in the [Volunteer](#) and [Internship](#) program submit a personal statement and request for kind of advising that would best serve their learning trajectory. The Institute works to match up individuals on a rolling basis.

Fellows

Since 2024, the Active Inference Institute has hosted a 🌟 [Fellows](#) program, designed to support and advance research in Active Inference. This program provides a unique opportunity for exceptional individuals of different career stages to join the Institute's vibrant community and contribute to the development of Active Inference and its applications across domains.

Eventually we expect to have multiple kinds of 🌟 [Fellows](#), including Research, Education, and more. Initially we have begun with Research Fellows, conduct self-directed, innovative research projects that align with the Institute's research and education missions. Research Fellows have access to the Institute's facilities, computational resources, a network of leading experts in the field, and the ability to engage with 🏠 [Philanthropy](#) and 📄 [Grants](#) @ [Institute Programs](#). Fellows also benefit from professional development opportunities, including 🌱 [Mentorship](#), training workshops, and support for 🌐 [Open Source](#) practices.

The Research Fellow position is an unpaid non-employee position. The default term for a Research Fellow is 2 years, with the potential to renew. Applications are considered on a rolling basis. Eventually, we look forward to developing our collaborations, philanthropy, and partnerships at the Institute, in order to enable fellowships to be paid financially in some way.

Current Research Fellows 2

Name	ORCID	Livestreams	Overview	Project page
Anna Pereira	0009-0008-9049-0707	GuestStream #076.1 , #076.2	<p>Cultivating a grass roots impact project (initially through nonfiction literature) to explore rapid dissemination of Active Inference Principles. Active Inference is the key lens that then expands to include human physiology and "wellness" concepts in the hopes of enabling humans to live more fulfilling lives, respond to increased uncertainty, and foster mutualism. The project actively provides mutualistic opportunities for collaboration and seeks to build community.</p> <p>Say hello, collaborate, or discuss at via anna@activeinferencecycle.com</p>	
Jean-Francois Cloutier	0009-0001-1841-2279	2nd , 3rd Active Inference Symposium	<p>I seek to find out what it takes, at a minimum, for a robot to learn, on its own, how to survive in a world it knows initially almost nothing about. My research is the continuation of a project of many years in which I program simple autonomous robots to develop and ground my understanding of cognition.</p> <p>Looking for answers has already taken me on an unanticipated journey, both within and beyond Active Inference. I have been drawn into Active Inference of course but also Kantian epistemology, the issue of map vs territory, biosemiotics, mortal computing, collective intelligence, autopoiesis and constraint closure.</p>	Symbolic Cognitive Robotics

John Boik	0000-0003-1289-7997	Livestream #021 series: .01, .02, .03, .04, .1, .2	<p>As an Active Inference Institute Research Fellow, the research program I will pursue is a continuation of the work I describe in a book and in two series of concept papers. That program explores the science-driven, <i>de novo</i> development of new cognitive architectures that are, by design, fit for purpose.</p> <p>The first series describes how the approach can be applied to the creation of new societal systems (e.g., new economic and governance systems), which are viewed as components of a society's cognitive architecture.</p> <p>The second series describes how the approach can be applied to creation of an online ecosystem that facilitates cognition in the large-group setting.</p>	Cognitive Narrative Ecosystem
David Bloomin		GuestStream 085.1	<p>I am investigating how the principles of Active Inference, combined with social dynamics akin to kinship and mate selection, can foster cooperation and alignment in multi-agent environments. My main focus is Metta AI, which uses a novel reward-sharing mechanism in gridworld simulations. The project aims to study the emergence of complex social behaviors among AI agents that minimize free energy. Through an open-source model organism, Metta AI, we seek to demonstrate how shared incentives can lead to aligned cooperative intelligence, informing the path towards safe and beneficial AGI.</p> <p>You can follow my progress at http://daveey.github.io</p>	Metta AI
Robert Worden	0000-0001-7304-2752	GuestStream #082 series: .1, .2, .3, .4	<p>I have two main research interests: 3-D spatial cognition, and language.</p> <p>All animals need to understand the local 3-D space around them, building a Bayesian model of space. I propose that they do this not by neural computing alone, but using a wave in the brain (in the mammalian thalamus, or the insect central body). This leads to a novel theory of consciousness – that it arises not from neural firing, but from the wave. I would like to model this collaboratively, using active inference. See <i>Frontiers</i> article on the thalamus, and Gueststreams 082.2,3,4.</p> <p>I also work on language – how it evolved, how we learn it, how it works in the brain. See <i>Frontiers</i> article on language evolution, and a demonstration of language learning.</p>	Wave Hypothesis

Philanthropy

The Institute is a 501(c)(3) educational non-profit, registered in Delaware, USA.

Small private donations, though PayPal, [📧 Newsletter](#) subscriptions on [Substack](#), and [YouTube](#) support, to date in November 2024, have totaled less than \$5,000 (all work is done by [👤 Volunteers](#)).

Over the coming years we hope to develop a meaningful, relational, synergistic, compliant, modern, visionary, responsive [🏠 Philanthropy](#) program.

<https://donate.activeinference.institute/>

Grants

The Institute is currently all volunteer organization, and is increasingly looking for support through 📄 [Grants](#) and 🏠 [Philanthropy](#).

As part of the commitment to 🌱 [Open Source](#), submitted grants are made public whenever possible, by uploading to a preprint server (such as Zenodo) as a publication. We leave a stigmergic trace on the ecosystem reflecting our plans and assembled teams to tackle new areas of research.

📄 [Grants](#) applied for:

- In 2023, we applied for (and did not receive) an NSF Pathways to Enable Open-Source Ecosystems ([POSE](#)) grant. Along the way, we collaboratively wrote the [2023 paper](#) “The Active Inference Institute and Active Inference Ecosystem” — the structure and text of which, was the initial conditions (prior) for this November 2024 second versioning.
- In September 2024, the 🤖 [RxInfer.jl Learning Group](#) applied for an [FLI](#) grant “FarmWorks: Decentralized AI Agents for Personalized Solutions” ([Zenodo link](#)).
- In September 2024, the 🤖 [RxInfer.jl Learning Group](#) applied for a [Foresight Institute](#) grant “VILLAGE (Validating Inference for Large-scale Agent Governance Ecosystems)” ([document link](#)).

We have also written several letters of support, collaboration, and 🤝 [Partnership](#) for others in their applications and 📄 [Grants](#).

Partnership

The [Partnership](#) program fosters collaboration with organizations aligned with our mission of learning, researching, and applying Active Inference. Through this program, we aim to create mutually beneficial relationships that advance the understanding and impact of Active Inference across diverse domains.

Partnering organizations have the opportunity to participate in coordinated activities around Active Inference and preferred domains, disciplines, regions or languages of interest. The institute works with partners to assess the optimal level of engagement, from informal 1:1 connections to funding accelerated training or policy programs. Partners are expected to provide input and feedback to help shape the Institute's priorities and programs. These insights will inform our planning and focus from the start of the relationship.

Benefit of [Partnership](#) :

- Partners will be publicly recognized on our website and materials as agreed upon.
- Point of contact and regular meetings with Institute personnel.
- Having access the Institute's network of researchers, contributors and interns to build reputation and positive context.
- Potentially collaborate on augmenting or spinning up programs in areas of shared interest, such as disciplinary courses, region-specific work, internships, fellowships, and symposium themes. The scope will depend on the level of partner commitment and alignment with the Institute's capacities.

In turn, partnering organizations commit to:



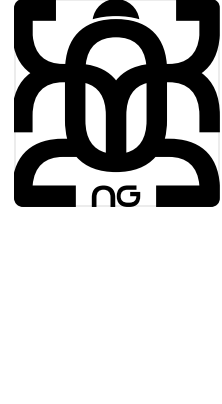

- Completing an application demonstrating alignment with the Institute's goals, such as applying Active Inference and broadening scientific participation.
- Dedicating time and attention at an agreed upon level, from casual participation in projects to more formal involvement like facilitating projects.
- Making a financial or in-kind contribution to support the Institute's work. The exact arrangement will be negotiated to create a meaningful, mutually agreeable outcome.
- Designating a reliable point of contact for communications with the Institute.

How the Partnership Program Works

1. Interested organizations complete an application expressing their desired level of involvement and alignment with the Institute's mission.
2. The Institute reviews applications and selects partners based on potential for impact and fit with current priorities. Diversity across geographies, languages and domains is a key consideration.
3. The Institute and partner sign an agreement formalizing the relationship, including the agreed upon commitments, contributions, designated points of contacts, and Terms on both sides.
4. The partnership kicks off with a planning session to map out shared goals and an action plan for the first 6-12 months. Regular check-ins monitor progress and make adjustments as needed.
5. Partners receive curated updates and opportunities to provide input. Collaborative activities proceed as planned, with flexibility to evolve the relationship over time.

Current Institute Partners 2

Name	Description	Image	Link	Partnership description
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First Principles First	Towards a Science of Mindful Agents, Societies and Observer Languages		 <p>The Active Inference Institute has a rich ecosystem of research scientists, developers, and thought leaders that FP1 can draw upon. In turn, FP1 is committed to spawning and undertaking projects to expand the awareness and application of active inference.</p>
Numen Games	We are building a Gamify Structural Framework for Organization an Open Metaverse RPG, Numinia is game to work better.		 <p>Through our partnership with the Active Inference Institute, Numinia seeks to combine its expertise in gamified, immersive 3D environments with the Institute's scientific approach to Active Inference. Together, we will enhance learning experiences by embedding these scientific principles into our open metaverse RPG, providing a research-driven framework for organizations to innovate and thrive.</p> <p>Our 3D educational gamified experiences will foster interactive learning in real-world organizational settings, while the Institute will guide us with scientific methodologies that deepen our understanding of cognitive and organizational dynamics.</p>

<https://partnerships.activeinference.institute/>

Open Source

The default [Open Source](#) licence information for all Institute materials is described below. Check with specific products and collaborators for more information

CC BY-NC-SA 4.0

Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International

This license requires that reusers give credit to the creator. It allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, for noncommercial purposes only. If others modify or adapt the material, they must license the modified material under identical terms.

- **BY:** Credit must be given to the creator(s) of the work, the specific people where know & [The Active Inference Institute](#) as hosting or publishing entity.
- **NC:** Only noncommercial use of your work is permitted. **Noncommercial means not primarily intended for or directed towards commercial advantage or monetary compensation.**
- **SA:** Adaptations must be shared under the same terms (unless otherwise specified and agreed upon by creators).

Some of our main [Open Source Repositories](#) are listed in the table below, nested within the [Institute Github](#).







Open Source Repositories

Name	URL	Description
Biofirm	🌐	Active Inference 🔗 PyMDP agents for 🌱 Bioregional Modeling
PyDMB	🌐	Dysfunctional Markov Blanket package to accompany research paper
GEN24	🌐	Generative AI experiments and deployments as part of 📖 Active Blockference (here)
ActiveInferAnts	🌐	Active Inference Ant simulations, and much much more
Journal-Utilities	🌐	Utilities for 📖 Active Inference Journal
ActiveInferenceJournal	🌐	Primary repository for the 📖 Active Inference Journal, with transcripts from 📺 Videos & Podcasts
ActiveInferenceCategoryTheory	🌐	🔄 Category Theory curriculum and materials
ActiveBlockference	🌐	📖 Active Blockference repository for integrating ∞ Active Inference with cadCAD and more
Active_Inference_Ontology	🌐	Snapshots of 🌱 Active Inference Ontology
GeneralizedNotationNotation	🌐	Information on 📖 Generalized Notation Notation
Textbook	🌐	Repository for 📖 Textbook Group
AEOS	🌐	Snapshots of ≈ Active Entity Ontology for Science (AEOS)
Symposium	🌐	Synthetic intelligence methods for 🗨️ Applied Active Inference Symposium









Ecosystem Support

Activities at the Institute offer resources and participation opportunities for individuals and organizations. These epistemic and pragmatic services include:

Informational Commons

-  **Videos & Podcasts** &  **Active Inference Journal**
 - Largest corpus of  **Open Source** Active Inference education materials available to date.
- **Common Forum.** Providing  **Institute Projects**, hosting online forums,  **Applied Active Inference Symposium**, discussion groups, and  **Communications** channels where learners, researchers, and practitioners can connect, ask questions, and share insights. Fostering a community that helps individuals overcome challenges, exchange ideas, connect on collaborations, and receive support from peers and experts.
- **Opportunities to Share and Present Work.** Provide myriad opportunities to share and present relevant work on Active Inference, offering opportunities for unique collaborations and new knowledge discovery catalyzed by Active Inference and the consequent amplified leveraging of expertise and practices across disciplines, domains, and paradigms.

Infrastructural and Administration directions

- **Infrastructure.** Maintaining and developing information systems to support The Institute's activities, iteratively improving usability and efficacy. Pending funding, working with requirements engineering and user experience professionals to overhaul existing systems.
 - Improve provisioning and access to e.g.  **Implementations of Active Inference**,  **Active Inference Ontology**,  **Textbook Group** materials,  **Videos & Podcasts**, etc.
-  **Partnership**
 - Managing and growing relationships with  **Education**, research, application, and service partners.
-  **Philanthropy**
 - Development relationships with potential donors and sponsors, and, pending funding, developing the necessary infrastructure (e.g., accounting, legal, digital affordances, materials) to request and receive donor and sponsor support, and to offer and dispense micro-grants and financial support to researchers.
- **Funding Discovery &  Grants Support.** Providing a variety of support mechanisms for participants to search for and submit to grant and funding opportunities, as well as assist them in forming partnerships (e.g., with other researchers, companies, and universities).
- **Professionalization.** Developing a curriculum of training programs for Officers and Directors of commercial entities and officials of governmental and civil society organizations to enhance their understanding of sentient behavior (as described by Active Inference) and its implications for organizational interactions in the areas of Business, Operations, Legal, Technical, and Social.

Communications

Internal Communications Plan

Institute participants, 🏠 [Officers](#), 🧑 [Volunteers](#), and other roles communicate with one another and with members of the community as follows:

- Email serves as the primary means of communication for internal announcements, updates, sharing important documents, and any other professional communications where record keeping is of interest.
- Regular Synchronous Officer Meetings are held to keep communication lines open, address questions, and discuss progress on projects. The [Ψ Scientific Advisory Board](#) meets regularly in an open discussion format. The [🌟 Board of Directors](#) meets quarterly to respond to the quarterly roundtable update and address any other issues or concerns.
- Shared Calendars are used to schedule meetings, appointments, and events, ensuring everyone is aware of each other's availability.
- The Institute-operated [💬 Discord Server](#) is the primary location for asynchronous discussion and synchronous project meetings. Currently there are over 1000 people in the server, and we strive to keep it an accessible entry point for learning and applying Active Inference.

Organizational Communication

The Institute communicates with potential partners, sponsors, and relevant constituencies through channels including:

- Livestreams and [📺 Videos & Podcasts](#) provide exciting avenues for live community engagement.
- Content Announcements via X [@inferenceactive](#), [💬 Discord](#), [Facebook](#), [📧 Newsletter](#), [LinkedIn](#), Bluesky [@actinfinstitute](#)
 - [Measurements](#) come from [🌱 The Active Inference Ecosystem](#) and reflect: completed projects, recent publications, collaboration and other project opportunities, new releases of educational materials and tools, etc

Target Audiences



- Curious and exploratory learners from all backgrounds and levels of familiar with different subjects/skills.
- Professionals and Academics: Individuals with an interest in cognitive science, machine learning, philosophy, physics, linguistics, computer science, and related areas.
- Potential Partners: Government agencies, funding organizations, academic institutions, and other research-focused organizations.
- Active Inference Community: Researchers, academics and professionals who use and reference Active Inference and related approaches in their daily work.
- Broader Scientific Community: Researchers, academics, and professionals in compatible fields.
- Social Change Organisations: International Organisations, NGOs, civil society
- General Public: Individuals who may have a personal interest in cognitive science, machine learning, philosophy, physics, linguistics, computer science, and related areas.
- Research and Educational: Universities and academic institutions.
- Trade Associations and Think Tanks. Organizations which perform research about future industry trends, in addition to other communities of practice.
- Corporate: Companies with employees who would benefit from knowing Active Inference related approaches to business organization and operations.
- Government: Government agencies and funding vehicles.

- Private Donors: Individuals who understand the value and potential impact of this community of practice and its subject matter, and would be willing to help support it.
- Social Change Organisations: Taking basic underlying concepts and translating them into non-technical language and frameworks for organisations involved in change around large scale social issues (e.g., climate change, peace building)

Approach

The goal of our organizational communications plan is to provide the foundation for sustainable and accessible funding, and to work toward making Active Inference a household term, used as widely as “Machine Learning”, reflecting its demonstrable utility and impact in implementation. An ideal next step toward this goal is the professionalization of Active Inference core competencies and techniques and related competency and qualification standards.

Quality, Performance, and Growth Evaluation

The Institute intends to evaluate quality, performance, and growth within community development at three scales, listed below, based on best practices within the  [Open Source](#) community and adapted for our use-cases which include  [Software](#) and other products.



Participant scale

Evaluation at the level of individuals, with consideration for a plurality of individual priors (i.e., diversity in perspective, experience, culture, language, preferences, discipline, and level of expertise) and a focus on accessibility and onboarding. Objectives include quality of participant and user experience, plurality of educational mediums and formats (i.e., accessibility), networking and collaboration opportunities, and professional development. Pending grant or donor funding, The Institute will work with user experience, communications, and requirements engineering professionals to improve current and establish new feedback mechanisms and implement best practices for aforementioned evaluations. The following tools serve as a basis for evaluation:

- Individual feedback forms and surveys
- Participation (e.g., number of projects completed and contributed to)
- Continuing Professional Development (e.g., courses completed, certifications)




Institute scale

Evaluation at the level of The Institute will consider various areas such as sustainability of personal and collective efforts, support reliability, and user experience quality, and Institute quality control and improvement. Objectives include increasing collaboration opportunities, ensuring consistency and rapid handling of inconsistency in documentation, and supporting and facilitating projects. Specific metrics of quality, performance, and growth at The Institute scale may include:

- Number of participants and commits in open source projects
- Number of responses to our  [Volunteer](#) and Internship forms
- Number of  [Newsletter](#) signups
- Statistics on projects facilitated by The Institute (e.g., total completed, ongoing, and dissolved)
- Offered and completed Internships
- Frequency of discovery and resolution of inconsistencies in research, documentation, tools.
- Frequency of discovery and resolution of gaps in implementation (i.e., frequently questioned answers and frequently asked questions)
- Number of facilitators, stewards, and volunteers and related turnover and activity
- Aggregation of individual feedback forms and surveys

Ecosystem scale

Evaluation at the level of the Ecosystem and community scale with consideration for impact and relationship management, and a focus on impact. Objectives include minimizing turnover rate in educational courses, increasing the number of participants, and maintaining and adding partnerships. Metrics of quality, performance, and growth at the community scale may include:

- Quality and quantity of  [Ecosystem Projects](#), connected with  [The Active Inference Institute](#) or not.
- Frequency and number of edits and engagements with Coda pages
- Number of participants in  [Discord](#) General Channel
- Number of participants contributing to facilitated projects

- Turnover rate in engagement and participation (e.g., direct participant engagement with Institute releases and material, and annual involvement in collaborative activities)
- Number of individuals enrolled in educational courses
- Turnover and completion rate in educational courses
- Turnover rate in partnerships (e.g., research and education partnership decisions to renew, maintain, or dissolve)
- Social media analytics (e.g., views, watch time, audience diversity)

Information Management

The Institute hosts and disseminates information using [Coda](#), [YouTube](#), [Discord](#), [Github](#), [Newsletter](#) and other platforms as needed. This stack of platforms streamlines specific levels of access to shared resources, and enhances overall productivity within the organization. We aim to ensure that participants are aware of the platforms being used and understand their purposes and functionalities. We regularly evaluate, communicate, and reinforce best practices for information storage, access, and organization. We implement security measures, such as strong passwords, 2-factor authentication, and appropriate access permission in order to protect sensitive information. We back up important data regularly to prevent loss due to technical issues or accidental deletion. We conduct periodic reviews and audits of the information storage systems to identify areas for improvement and optimization. The specific use of each platform is described below.

YouTube (Live Streaming and Video Hosting)


YouTube is the primary platform for storing audiovisual content created for and by The Institute. Our designated YouTube Channel holds distinct playlists for courses, live streams, symposia, and other content that we host. We share and embed links within internal and external communication channels to provide easy access to relevant content. The content on YouTube is also backed up in a personal cloud storage service as well as in offline hard drives.

Discord (Forum and Instant Messaging)

Discord is our primary platform for engaging with the Active Inference Ecosystem and broader community. We use Discord for real-time communication, informal discussions, and team collaboration. Dedicated channels are used within Discord to categorize discussions based on topics or projects. Participants are encouraged to share relevant files, documents, or links within Discord channels, fostering easy access to shared resources. We regularly monitor and moderate Discord channels to maintain professionalism, and eagerly look to improve our protocols and guidelines here and elsewhere.

Discord

Join the  [Discord: https://discord.activeinference.institute/](https://discord.activeinference.institute/)

The Active Inference Institute (All) maintains a  [Discord](#) server as its primary communication hub where all meetings, discussions, and collaborative activities take place. This digital workspace serves as the central nexus for the institute's diverse community of researchers, practitioners, and enthusiasts interested in active inference.

Server Structure

Main Categories

- Research and education activities
- Project coordination
- Community discussions
- Voice chat rooms for meetings and livestreams


Key Features

The Discord server facilitates:

- Live voice meetings and discussions
- Project collaboration and coordination
- Access to educational resources
- Community engagement and networking

Participation

As with the Institute overall, the Discord server welcomes participants from:

- All backgrounds and experience levels
- Different time zones
- Various levels of familiarity with  [Active Inference](#)

The server can be accessed through the link <https://discord.activeinference.institute/> . It serves as the primary venue for all institute meetings and collaborative activities, making it an essential platform for anyone interested in engaging with the Active Inference community.

Coda

Essentially all [AI Institute Projects](#) use Coda as a document system.

Clicking through links and documentation of [AI Institute Projects](#) you will find many examples of links within and across documents — this [AI Active Inference Institute & Active Inference Ecosystem \(2024, v2\)](#) was written collaboratively in Coda, and then exported for snapshot (whereas in 2023 version 1 we used a Google Document linear manuscript co-editing style).

Coda is the primary platform for knowledge and project management at The Institute, Ecosystem, community, and individual scale. It organizes all information and content related to each project (or sub-project). Coda is version-controlled and access-restricted, ensuring that all of our data is protected against accidental deletion and inappropriate user access. We use Coda for storing and organizing important documents, such as policies, procedures, project plans, and meeting notes.

We follow best practices for Coda, including: (1) creating dedicated Coda “documents”, or work areas, for different departments or projects to ensure easy access and organization of relevant information, (2) implementing a clear folder and file structure within Coda to maintain document organization and version control, (3) archiving unnecessary and irrelevant pages, files, and folders, and (4) granting appropriate access permissions to users, allowing them to view, edit, or comment on documents as required.

With adequate future support, Coda will be upgraded to an Enterprise License and consultants will assist in development of templates and low-code applications for streamlining support, records and knowledge management, and project management functions. Further, an Enterprise License will allow for a variety of new mechanisms for user-access control and permissioning, and for tracking of work activity and community engagement with hosted content.

Newsletter



Since the initial activities of the Institute ([📖 History of The Institute](#)), we have written a monthly [📧 Newsletter](#).

See the archives <https://activeinferenceinstitute.substack.com/>

<https://newsletter.activeinference.institute/>









Institute Projects

<https://projects.activeinference.institute/>

 **Institute Projects** are the primary means of official participation with  **The Active Inference Institute**.

To date, The Institute has hosted or facilitated the development of hundreds of open-source licensed products which serve various functions in the Ecosystem including Awareness, Education, Commons, Support, and Governance.

Institute projects ~ 2024

Organizational Unit	Project	Documentation	Mission & Objectives	Ex
▼ EduActive 4	Active Inference Ontology		Maintain, improve, elaborate, extend, translate, educate, document, and apply the Active Inference Ontology as core infrastructure for the Active Inference Institute & Ecosystem.	Pl O
	Audio-Visual Production		Produce accessible, rigorous, informative (epistemic value) and useful (pragmatic value) audio-visual content, for example through Livestreams, Podcasts, and other formats.	T ar O
	Textbook Group (Parr, Pezzulo, Friston 2022)		Improve the accessibility, rigor, applicability, and impact of the 2022 Active textbook by Parr, Pezzulo, and Friston.	5. si
	Active Inference Journal		To develop evolving hybrid (AI+people) project architecture and enabling volunteers team	Se
▼ ReInference 4	RxInfer.jl learning and development group		Learn and apply RxInfer.jl in 2024 — building out multiscale selves and capacities for generative modeling.	Se
	Knowledge Engineering		This project seeks to alleviate the information burden in the Active Inference Institute & Ecosystem through information curation, organization, and condensation- i.e. providing summaries of institute productions (courses, livestreams, etc), enhancing the CRM, etc	Pl Li fr
	Active Blockference		We are applying Active Inference by building capacities & creating examples of generative models.	Gi ov
	Active InferAnts		Develop integrative and applicable methods for Ants and Beyond.	Gi de Ac m

Project Rhythm Through **Prepare and Measure**

The Institute implements a unique "Prepare and Measure" system that structures project work through alternating phases of preparation and measurement.

To complete a **preparation**, participants propose a phase of activity — their “packed backpack” and intention for developing artifacts, research, or create educational materials while receiving ongoing feedback.


This is followed by making a **measurement**, where the participant documents their reports and reflections. Following the measurement, next steps are explored. This rhythmic approach creates natural checkpoints for reflection while maintaining

momentum




Benefits and Implementation

The prepare-measure cycle embodies active inference principles by balancing exploration with evaluation. Rather than following rigid schedules or purely passive learning, participants actively sample their environment through concrete project work, while regular measurements provide the feedback needed for learning and course correction. This system helps cultivate a culture of active sensemaking, where putting work out for feedback is encouraged over passive consumption. The flexibility of this approach allows it to scale from individual contributors to large collaborative projects, while maintaining rigor through consistent documentation and assessment.

Towards a Systems Approach Project Framework

In the final months of 2024, we will look to review the  Institute Projects Prepare/Measure results of 2024, and think about how we will update the project approach in 2024. Current thinking on this is considering updates in the area of:

Project Structure

- Stronger connection with  EduActive (Education) or  ReInference (Research)  Organizational Units.
- Each project will have a clearer standardized public profile featuring:
 - Clear mission statement and objectives
 - Timeline with key milestones and deadlines
 - Contribution pathways and skill requirements
 - Active measurement cycles and preparation phases

Project Management Approach

Time Management



- Dedicated work blocks outside of meetings
- Regular preparation and measurement cycles
- Minimal reliance on email/Discord for core work


Task Organization

- Public task tracker with clear ownership
- Regular progress updates and milestone reviews
- Documentation of both successes and learning opportunities
- Integration with prepare/measure cycles

The Institute aims to implement these projects using active inference principles, ensuring each initiative contributes to our mission of making active inference more accessible, rigorous, and applicable while serving our growing global community.

Active Inference Journal

The  **Active Inference Journal** is an  **Open Source** project launched in 2021 to create a comprehensive, accessible repository of Active Inference knowledge through automated transcription and processing of educational content. The project combines sophisticated language processing pipelines, collaborative editing workflows, and decentralized storage solutions to transform video lectures, discussions, and presentations into richly indexed, searchable, and citable content.

The Journal serves as a crucial bridge between traditional academic publishing and emerging Decentralized Science ( **DeSci**) approaches, enabling broad participation in Active Inference scholarship through several key innovations: automated speech-to-text transcription reducing manual effort, standardized editorial practices for community contribution, version control through GitHub, and integration with knowledge engineering projects. This infrastructure allows researchers, practitioners, and learners worldwide to not only access but actively contribute to the development and documentation of Active Inference theory and applications through open-source collaboration, while maintaining academic rigor through systematic processing pipelines and metadata management.

Core **Open Source Journal Repositories**

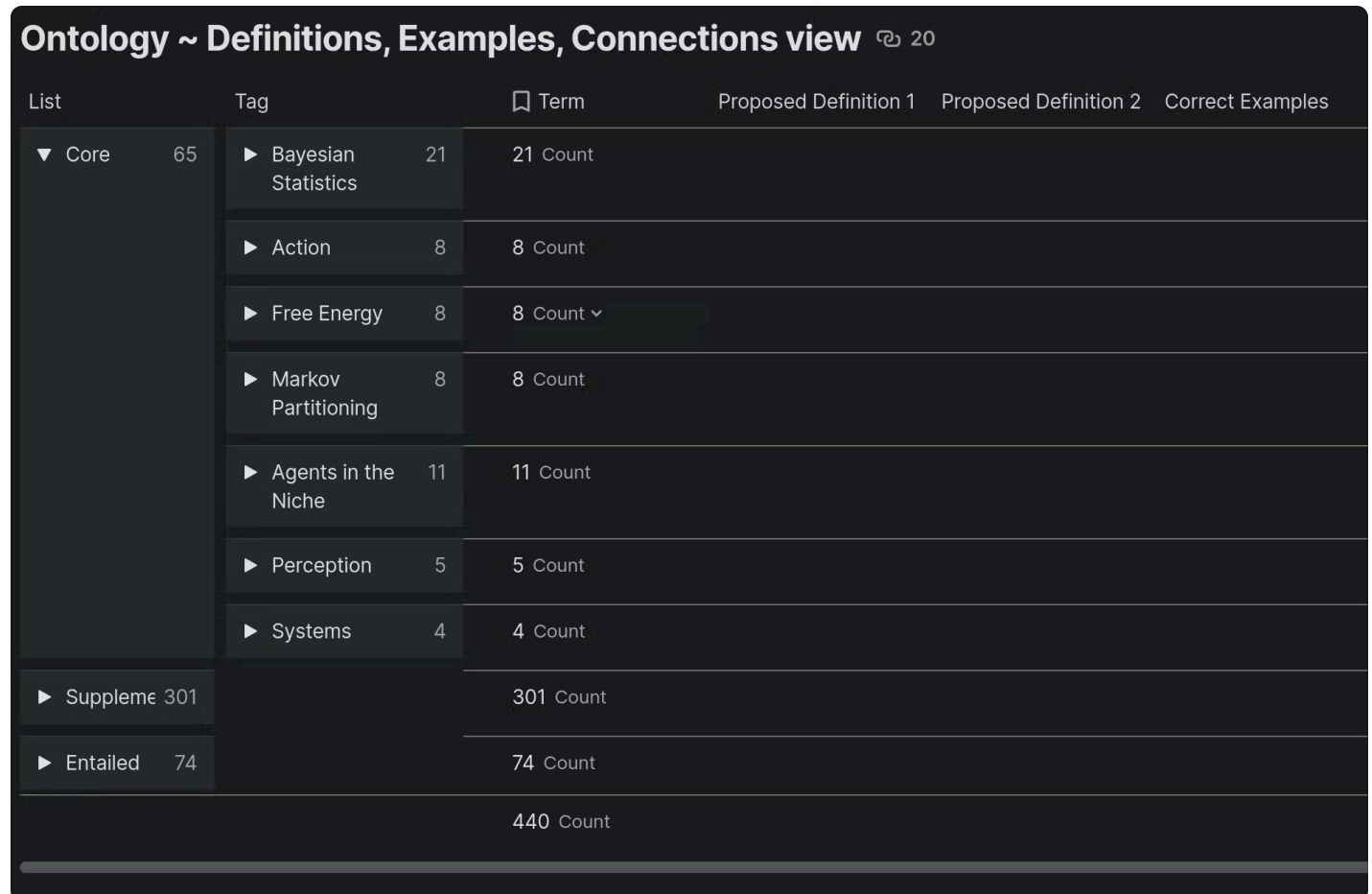
- **ActiveInferenceJournal**: Main content repository containing transcripts, translations, and published materials:
<https://github.com/ActiveInferenceInstitute/ActiveInferenceJournal>
- **Journal-Utilities**: Technical infrastructure for automated processing, including speech-to-text, translation, and knowledge extraction tools
<https://github.com/ActiveInferenceInstitute/Journal-Utilities>

Active Inference Ontology

The [Active Inference Ontology](#) has been a core Institute project since 2021.

- [Home page of the Ontology documentation](#)
- [Github repository](#) of Ontology snapshots

The [screenshot below represents the table](#) with current version of ontology, here groups into the list of 65 Core terms (central terms for learning and applying [Active Inference](#)), 301 Supplemental terms (possibly useful terms to know for some situations or models), and 74 entailed terms (common words that may have specific relevance for the topics discussed in other terms lists).



Ontology ~ Definitions, Examples, Connections view 🔗 20

List	Tag	Term	Proposed Definition 1	Proposed Definition 2	Correct Examples
▼ Core 65	▶ Bayesian Statistics	21	21	Count	
	▶ Action	8	8	Count	
	▶ Free Energy	8	8	Count	▼
	▶ Markov Partitioning	8	8	Count	
	▶ Agents in the Niche	11	11	Count	
	▶ Perception	5	5	Count	
	▶ Systems	4	4	Count	
▶ Suppleme 301			301	Count	
▶ Entailed 74			74	Count	
			440	Count	

During 2024 we have continued to have [amazing discussions](#), add examples/counterexamples, add connections, add [translations](#), and more

The Active Inference Ontology project is a core initiative of the Active Inference Institute that aims to develop and maintain a structured framework for understanding key concepts, terminology, and relationships within Active Inference theory. Started in 2021, this open-source ontology serves multiple purposes - from supporting education and research to enabling computational applications and cross-domain translation of Active Inference concepts.

The ontology is publicly hosted and continuously updated through a living document system ([public Coda](#), [Github](#)) with stable versions released periodically. It contains curated definitions, examples, translations across languages, and steps towards formal logical relationships among terms.

Core Functions

- Reduces uncertainty around fundamental Active Inference concepts and terminology
- Facilitates coherent, rigorous, inclusive research and applications across domains
- Enables effective onboarding of new learners
- Supports automated inference and computation
- Provides translation capabilities across languages and fields

Development Areas

The project focuses on several key development tracks:

- Definition refinement and example curation
- Applied usage in building [computational generative models](#) for Active Inference
- Multi-language translations
- Formal logical expressions ([SUMO](#) and other systems)
- Literature analysis and knowledge engineering
- Application testing across different use cases

Contribution Methods

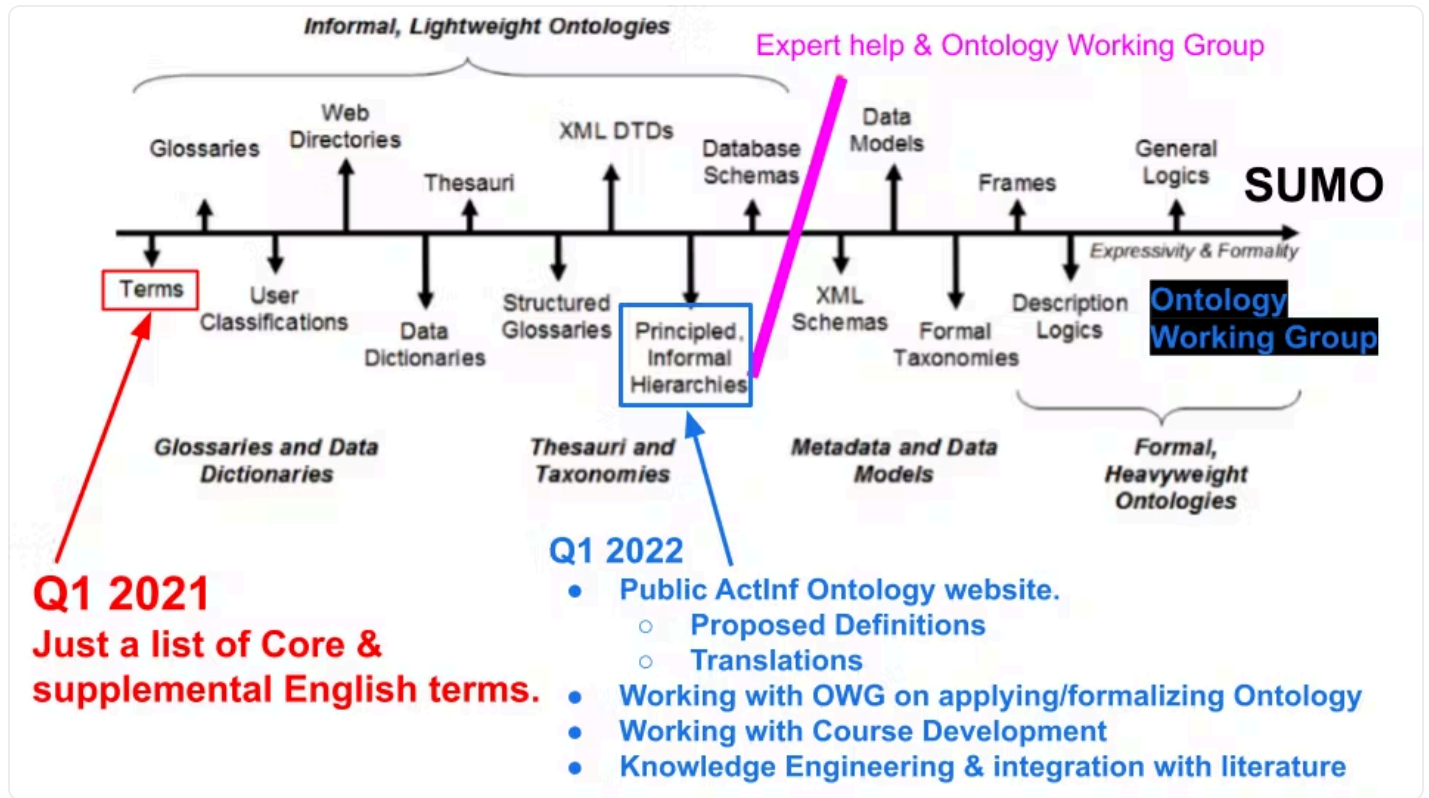
The ontology welcomes contributions through multiple pathways:

- Adding/reviewing definitions and examples
- Contributing translations
- Developing formal logical expressions
- Testing applications in research and education
- Participating in discussion and refinement

Rather than being a static reference, the Active Inference Ontology functions as a living knowledge system that evolves with the field while maintaining rigor and accessibility. It serves as both a practical tool for working with Active Inference concepts and a scaffold for developing deeper understanding across the Active Inference ecosystem.

The project exemplifies Active Inference principles in its own design - it actively reduces uncertainty about core concepts while enabling generative exploration and application across domains. This makes it a crucial resource for researchers, educators, practitioners and learners engaging with Active Inference theory and applications.

The [below image](#) describes some of the work we have done across a continuum of levels/types of formalization. As with all products, this is a work in progress where [🔗 Open Source](#) contributions will be welcome.

















Active Entity Ontology for Science (AEOS)

≈ [Active Entity Ontology for Science \(AEOS\)](#) represents a key framework developed by a 2022 🏢 [Institute Projects](#), created to bridge centralized and decentralized approaches to scientific organization.

The work was published as “An Active Inference Ontology for Decentralized Science: from Situated Sensemaking to the Epistemic Commons” ([link](#)), and is also available on [Github](#) and in an [interactive Coda format](#).

An Active Inference Ontology for Decentralized Science: from Situated Sensemaking to the Epistemic Commons

Friedman, Daniel¹ ; Applegate-Swanson, Shaun¹ ; Balbuena, Jessica Angeli¹ ;
Choudhury, Arhan² ; Cordes, RJ¹ ; El Damaty, Shady³ ; Guénin—Carlut, Avel⁴ ;
Knight, V. Bleu¹ ; Metelkin, Ivan² ; Shrivastava, Siddhant⁵ ; Singh, Amit Kumar² ;
Smékal, Jakub⁶ ; Tuttle, Caleb³ ; Vyatkin, Alexander² 

Show affiliations

In this work, we examine science from the vantage points of blockchain technology and its connection to decentralized science (DeSci). We consider science as a collective process using Active Inference, an integrative framework that models the cognitive processes of perception, planning, and action selection in terms of Bayesian probabilities and updating. We present the Active Entity Ontology for Science (AEOS, available at coda.io/@active-inference-institute/active-entity-ontology-for-science-aeos) as a composable and versionable system for modeling various science systems, using the Active Inference entity partitioning. Such DeSci systems are considered from the perspective of BOLTS (Business, Operations, Legal, Technical, Social). Further steps for developing and utilizing AEOS in the context of scientific ecosystems are provided.

Here are the key aspects of AEOS:

Core Components

Framework Structure

- Uses Active Inference principles to model different forms of scientific activity as a collective cognitive process occurring in a niche.
- Provides a composable and versionable system for modeling various scientific systems
- Integrates BOLTS perspective (Business, Operations, Legal, Technical, Social) for comprehensive analysis

Key Functions

- Maps relationships between different scientific entities and processes using Active Inference entity partitioning
- Enables modeling of both traditional institutional science (CeSci) and decentralized science (DeSci) approaches
- Facilitates bottom-up sensemaking while maintaining systematic organization

Implementation Goals

Scientific Organization

- Supports emergence of epistemic communities through organic collaboration
- Enables transparent resource allocation and knowledge sharing
- Provides tools and analytic methods for decentralized scientific governance

Practical Applications

- Guides development of tools for scientific collaboration, Web3 or otherwise.
- Helps structure new kinds of organizations for research purposes
- Supports integration of blockchain and other technologies into scientific workflows

The AEOS serves as a bridge or blanket between:

- **In theory** and in terms of generalities: [Active Inference Ontology](#)
- **In practice**: Existing and emerging decentralized approaches, providing a structured way to understand and implement new forms of scientific organization while maintaining rigor and effectiveness in [DeSci](#) and traditional scientific settings.

Applied Active Inference Symposium

The annual Symposium hosted by the [@Active Inference Institute](#) aims to highlight the current applications of Active Inference across disciplines and industries. It serves as a repeated response and re-exploration of the enduring fundamental question: *“what can active inference be used for?”*

The years and topics of each [Applied Active Inference Symposium](#) are as follows:

- 1st in 2021 — Karl Friston ([transcript](#), [video part 1](#), [2](#), [3](#))
- 2nd in 2022 — Robotics
- 3rd in 2023 — Enacting Ecosystems of Shared Intelligence
- 4th on November 13-15, 2024 — 25+ Presenters, Bioregional theme, [Github](#), [interactive program](#), published [Abstract Book](#).

<https://symposium.activeinference.institute/>

Cognitive Narrative (CogNarr) Ecosystem

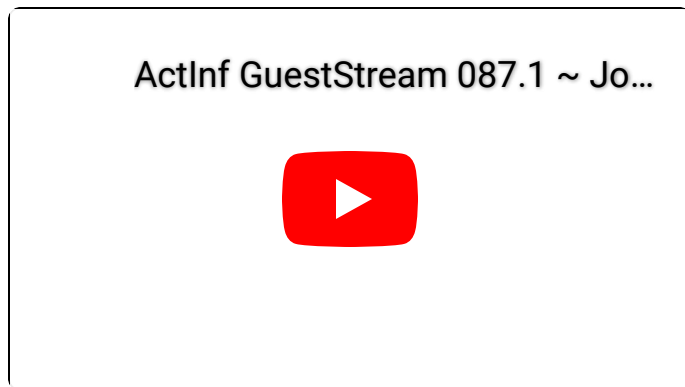
See live [project page here](#).

As an Active Inference Institute Research Fellow, the research program that John Boik pursues is a continuation of the work described in a book and in two series of concept papers. That program explores the science-driven, *de novo* development of new cognitive architectures that are, by design, fit for purpose.

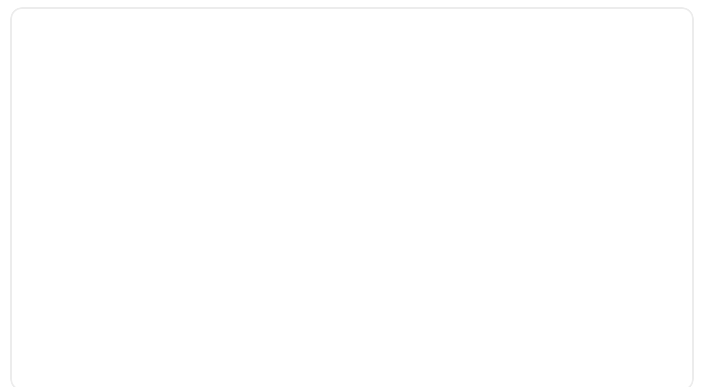
The first series describes how the approach can be applied to the creation of new societal systems (e.g., new economic and governance systems), which are viewed as components of a society's cognitive architecture.

The second series describes how the approach can be applied to creation of an online ecosystem that facilitates cognition in the large-group setting.

CogNarr ~ GuestStream #087 series (September 2024)

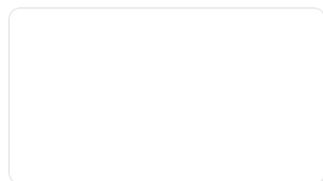


[GuestStream #087.1](#)

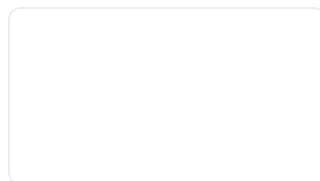


[GuestStream #087.2](#)

Livestream #021 series (during 2021)



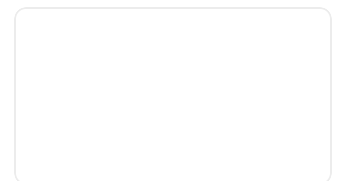
[01](#)



[02](#)



[03](#)



[04](#)

Educational Standards & Qualifications

Engagement Pathways at the Active Inference Institute

Learning Paths, Modes, and Seasons

- **Browser:** Discovers active inference through key word searches, algorithmic recommendations, bibliographic tracing, or word-of-mouth, engaging with occasional content such as [📺 Videos & Podcasts](#)
- **Regular Consumer:** Follows dedicated channels and educational content about active inference and related topics
- **Active Learner:** Independently seeks out technical materials, research papers, and in-depth resources. Taking notes, making personal synthesis artifacts, engaging in solo or group [👉 Ecosystem Projects](#).
- **Institute 🏠 Volunteer:** Participates in [👨🎓 Institute Projects](#) with a defined role (e.g. [🗣️ Textbook Group](#) facilitator, [📺 Videos & Podcasts](#) .0 video preparation collaborator).
- [✂️ Internship:](#) Engages in focused project work while receiving mentored guidance and education.
- [🌟 Fellows:](#) Dedicated, possibly funded, focus on larger scale initiatives.
- [🧠 Scientific Advisory Board](#), [🌟 Board of Directors](#), [👤 Officers](#)

The Active Inference Institute aims to make these learning pathways accessible to a global audience, meeting learners wherever they are in their journey. Through a multi-tiered approach, we aim to create entry points and paths for everyone from casual browsers to researchers and practitioners.

2025 Learning Initiatives

The Institute is enthusiastically preparing for expanded [📺 Education](#) offerings in 2025. We recognize the growing interest in active inference across disciplines and are looking to develop new [👯 Partnerships](#) and [@ Institute Programs](#) to support learning needs and our [🌟 Mission, Vision, Values, and Principles](#).

We will focus on building collaborative learning environments that bridge theoretical foundations with practical applications, while fostering a meaningful and productive community of practice that spans academic, industry, and independent researchers.

FarmWorks

<https://zenodo.org/records/13754586>










FarmWorks: Decentralized AI Agents for Personalized Solutions.

FarmWorks is the name of a project to develop a platform for human-AI interaction in agriculture, enabling personalized, farm-scale solutions that resist power concentrations associated with centralized AI systems.

A  Grants submitted in September 2024.

Work continues in the  [RxInfer,JI Learning Group](#) page at [this link](#).

FarmWorks: Decentralized AI Agents for Personalized Solutions

Baulin, Vladimir¹ ; Vyatkin, Alex² ; GUÉNIN—CARLUT, Ave^{3,2} ; Friedman, Daniel² ;
Bolt, John² ; Falkenstein, Stefan⁴ ; Jassal, Parishrut⁵ ; Trois, Celio^{1,6} ;
Minchin, Jonathan⁷ 

Show affiliations

Project description submitted as part of application to [Future of Life Institute - How to mitigate AI-driven power concentration](#)

Climate change intensifies agricultural challenges, requiring more and more advanced technological solutions. Small farmers increasingly rely on technical assistance, which is becoming centralized, dominated by large agricultural corporations and governments imposing sophisticated pre-designated solutions. As AI proliferates within these centralized solutions, diseases mitigation methods, climate credits, government subsidies, and regulations risk monopolizing farmers' activities. This tendency, amplified by AI development, threatens to undermine farmers' autonomy and limit their ability to make independent decisions, converting them into consumers of centralized technological solutions.

We propose to develop FarmWorks — a platform for human-AI interaction in agriculture that enables personalized, farm-scale solutions while resisting power concentration associated with centralized AI systems. FarmWorks addresses the above challenges by providing an open source decentralized AI-powered agricultural platform that empowers individual farmers with cutting-edge technology while preserving their autonomy and promoting sustainable practices. By integrating real-time data collection, edge computing, and Active Inference models, FarmWorks enables farmers to make informed decisions tailored to their specific contexts (for example, integrating humidity data and epidemiological models to assist farmers with remediative and anticipatory treatments for mold).

Fundamentals of Active Inference

We worked with [Sanjeev Namjoshi](#) during 2023-2024 to support development of a textbook (expected public release in 2025). We look to share more information about future [Fundamentals of Active Inference](#) as we can.

For more on the book & Sanjeev's project, see:

Sanjeev Namjoshi ~ Active Infe...



Sanjeev Namjoshi ~ [Active Inference Insights 018](#) ~
Education, Expectation-Maximisation, Evolution

<https://www.youtube.com/watch?v=sAwPXw-WNg4>

The Hidden Math Behind All Livi...



The Hidden Math Behind All Living Systems (on
[Machine Learning Street Talk](#))

<https://youtu.be/hf18w6CuY8o?>

Generalized Notation Notation

📖 [Generalized Notation Notation](#) (GNN) is a novel approach to cognitive model representation, which aims to facilitate communication and understanding of Active Inference models across domains.

Original publication: Smékal, J., & Friedman, D. A. (2023). Generalized Notation Notation for Active Inference Models. Active Inference Journal. <https://doi.org/10.5281/zenodo.7803328>

Github link: <https://github.com/ActiveInferenceInstitute/GeneralizedNotationNotation>

More information about the project can be found at the [public link](#).

<https://coda.io/@active-inference-institute/generalized-notation-notation>

📖 [Generalized Notation Notation](#) has been explored recently in: [Active InferAnt Stream 007.1](#) "GNN for AgentMaker for PyMDP for Active Inference Biofirms for Bioregionalism... for Ants?!?!?". Code is available at a [PyMDP](#) fork: <https://github.com/ActiveInferenceInstitute/pymdp> .

Knowledge Engineering

As of the end of 2022, [Knowledge Engineering](#) is an ongoing project (code repository) at the [The Active Inference Institute](#) that analyzes the literature related to Active Inference and Free Energy Principle, published as: *The Free Energy Principle & Active Inference: a Systematic Literature Analysis* <https://zenodo.org/record/7449368>

We performed a literature analysis of publications in scientific literature using the term “Free Energy Principle” or “Active Inference”, with an emphasis on works written by Karl J Friston. For a subset of papers with accessible full texts, we performed manual annotation (related to structural, visual, and mathematical features) and automated analyses (related to the terms in the Active Inference Institute’s Active Inference Ontology). The initial analysis here, at the scale of thousands of citations and hundreds of annotated papers, is presented as a first step towards the development of systems which could:


- Encompass increased scope of relevant works, including non-textual
- Integrate multiple forms of annotation and participation
- Facilitate integration of manual and artificial contributions
- Feature richer interfaces for use in learning & research
- Address field-specific local questions and provide transferable approaches
- Speak to broader questions in the history and philosophy of science

The paper is pre-printed at: <https://zenodo.org/record/7449368>

This project has an [interactive Coda site](#) and a [Github repository](#).

The initial work was done in 2022 and we look forward to revisiting and improving this work in the years to come.

Physics course

In 2023, the  [The Active Inference Institute](#) hosted a course titled “Physics as Information Processing”, taught by Chris Fields. The six-week course introduces participants to formal Quantum Information Theory as a concept and tool for understanding physical interaction as communication. Recorded lectures and course materials are available at the [public link](#), and [here is the YouTube playlist](#) of all videos.

<https://coda.io/@active-inference-institute/fields-physics-2023>

RxInfer.jl Learning Group

Documentation for the 🦊 [RxInfer.jl Learning Group](#) can be found [at this link](#).

The RxInfer project at the Active Inference Institute represents a vibrant 🌱 [Open Source](#) collaboration focused on learning and applying 🦊 [RxInfer.jl](#), a cutting-edge Julia package for automated Bayesian inference and active inference modeling

Community Structure

The project maintains regular synchronous meetings every Thursday at 13 UTC in the Institute 🗨️ [Discord](#), bringing together a diverse group of participants including developers, researchers, and educators. See [all meetings here](#). Over 2024, the meetings included over 20 active contributors with varying backgrounds and expertise levels in Julia programming and Bayesian modeling. The community is working on [many innovative applications](#).

Educational Resources

The project emphasizes knowledge sharing through:

- Comprehensive documentation and examples
- Regular meetings featuring technical presentations
- Hands-on tutorials and code workshops (also see [LearnableLoop](#))

Development Roadmap

Key technical advances planned for 2024-2025 include:

- Improved scaffolding of educational examples for training and learning use
- Nested models with GraphPPL.jl
- Enhanced graph structure visualization
- Automated inference with ExponentialFamilyProjection.jl
- Implementation of stochastic processes
- Improvements in robustness and memory efficiency

The 🦊 [RxInfer.jl Learning Group](#) project exemplifies open-source scientific software development, combining rigorous technical advancement with inclusive community participation in learning and 📄 [Grants](#). Through its regular meetings, diverse project portfolio, and commitment to education, it continues to push the boundaries of active inference implementation while maintaining accessibility to newcomers in the field

Social Science course

In 2023, [The Active Inference Institute](#) hosted a course titled “Constructing cultural landscapes: Active Inference for the Social Sciences”, organized by Avel Guenin-Carlut, Ben White, Mahault Albarracin, Lorena Sganzerla and Daniel Friedman. The twelve-week course introduced participants to conceptual tools to understand the relation between social and cognitive sciences. Recordings of the talks, and more information are available at the [public link](#).

<https://coda.io/@active-inference-institute/active-inference-social-science-aii-2023>

Software

Active Blockference

Much information is contained in the [📖 Active Blockference project documentation](#).

Active Blockference is an open-source project developed by the [🏛️ The Active Inference Institute](#) that aims to create a comprehensive cognitive modeling framework for complex systems. The project combines two powerful technologies: [cadCAD](#) (Complex Adaptive Dynamics Computer-Aided Design) and [📦 Implementations of Active Inference](#).

Project Overview

The primary goal of Active Blockference is to develop a simulation environment that can model the cognitive processes and goal-directed behavior of agents within various complex systems across [👉 Domains of Application](#). This framework is designed to:

1. Facilitate rigorous analysis of multi-agent systems and their emergent behaviors
2. Serve as a sandbox for exploring cognitive, micro-economic, behavioral, and decision-making processes
3. Enable cognitive audits of protocols and systems across multiple domains

Key Components

- **Open-source package:** Integrates cadCAD and Active Inference implementations for theoretical and applied studies
- **Multi-agent simulation:** Expands from single-agent to multi-agent models to explore cognition and behavior in various settings
- **Educational resources:** Develops materials to onboard new users to the Active Blockference community

Rationale for Combining cadCAD and Active Inference

The integration of cadCAD with an Active Inference kernel provides a powerful synergy for modeling complex systems:

1. **cadCAD:** Offers a robust framework for simulating complex adaptive systems, allowing for the modeling of multi-agent interactions and system-level dynamics.
2. **Active Inference:** Provides a principled approach to modeling goal-directed behavior and decision-making processes of individual agents.

By combining these technologies, Active Blockference can model both the macro-level system dynamics and the micro-level cognitive processes of agents within those systems. **Project Status and Development**

As of October 2024, Active Blockference is in active development. The project welcomes participants from various backgrounds to contribute to the growing codebase on [GitHub](#).

Get Involved

Interested individuals can participate in Active Blockference through:

1. Joining ongoing discussions on the [Active Inference Institute's Discord server](#)
2. Contributing to the [Coda document](#) for asynchronous collaboration
3. Exploring and contributing to the [GitHub repository](#)

By developing this cognitive layer for complex systems modeling, Active Blockference aims to enhance our understanding of multi-agent dynamics and decision-making processes across a wide range of applications.

Active InferAnts

The 🌿 [Active InferAnts](#) project works towards integrated modeling of Ants and Environments.

Working [documentation page](#).

<https://github.com/ActiveInferenceInstitute/ActiveInferAnts>

Project abstract

The Active InferAnts project is an ambitious computational modeling initiative that aims to implement ∞ [Active Inference](#) principles and 🧱 [Implementations of Active Inference](#) for ant colony simulations. The project refactors existing ant simulation code to use the Active Blockference package, enabling more flexible and scalable multi-agent modeling of ant behavior through stigmergic interactions and simultaneous localization and mapping (SLAM).

At its core, the project models individual ants (Nestmates) as active inference agents that interact with their environment through pheromone trails and other nestmates, while incorporating both low-level movement decisions and higher-level task selection behaviors like foraging, nursing, midden work, and nest architecture.

The simulation captures the complex interplay between individual ant cognition and colony-level emergence through a hierarchical generative model framework that includes pheromone-based communication, spatial navigation, and task switching dynamics.

As [the project Github attests to](#), software development efforts have also woven together elements related to [P3IF](#), William Blake, Large Language Models (LLM), and more.

Systems Approach

A modern third-generation systems approach is essential for managing today's complex adaptive systems. This approach transcends traditional linear models, embracing continuous evolution, interactivity across scales, and the dynamic, constructivist perspective where systems actively reshape themselves in response to changing conditions. Combining active inference principles with a systems approach provides a pathway to designing resilient, self-organizing systems that are responsive to diverse environments.

Evolving systems approach

Classical systems approach focused on structured relationships within defined boundaries, effective for static and predictable systems. However, with the growing complexity of modern systems like cyber-physical networks and adaptive ecosystems — a more dynamic approach is needed. Third-generation systems approach builds on these foundations to handle layered, open-ended development and real-time adaptability. A systems approach today emphasizes flexible frameworks that enable continuous learning and adaptation across varied contexts, positioning systems to better navigate and anticipate change.

∞ [Active Inference](#) provides a foundation for adaptive systems by defining systems as (nested, interacting) agents. This aligns with a systems approach by enabling systems to organize themselves dynamically in response to environmental changes. Key characteristics of this model include:

- Continuous adaptation: Systems evolve iteratively, continuously integrating new information rather than following a rigid lifecycle.
- Anticipatory action: Systems use predictive models to take preemptive actions, reducing disruptions before they occur.
- Interactions within and across scales: Systems function cohesively across micro and macro levels, preserving stability and coherence regardless of scale.

These qualities position active inference as a crucial tool for developing systems that are resilient, responsive, and able to self-correct in changing environments.



Systems as Constructors

A modern systems approach treats systems as constructors, entities that not only adapt but also actively build and modify their environments. Systems continuously refine their models based on feedback, supporting informed decision-making and efficient resource allocation. This constructivist perspective emphasizes:

- Dynamic modeling: Systems adjust internal models based on ongoing sensory input, which helps them make real-time, informed decisions.
- Open-ended development: Systems remain open to generating novel solutions and can reorganize to meet emerging challenges, enhancing robustness and resilience.

This approach is especially applicable in fields requiring systems to maintain functionality amid complex, changing conditions, like AI and distributed cybersecurity. Systems built on this constructivist foundation are inherently flexible, robust, and capable of evolving independently.

Collaborative ecosystems and community-driven development

The active inference framework is built within a collaborative,  [Open Source](#) development model ( [The Active Inference Ecosystem](#)) that aligns with third-generation systems approach. This community-driven ecosystem encourages knowledge sharing and real-time updates, ensuring that systems evolve alongside technological and societal needs. Collaborative development fosters rapid adaptation and inclusivity, allowing systems to better meet diverse user requirements. An open-source model also supports common standards, providing a strong foundation for sustainable and accessible system design across interconnected fields.

Adaptive systems approach

Integrating active inference within a modern systems approach offers a robust, adaptive model for managing complexity. This combination encourages resilient, coherent, and evolving systems that can operate autonomously and flexibly across scales. By embracing dynamic modeling, constructivist principles, and active inference, this approach provides a foundation for systems that not only withstand change but actively respond to it, supporting a broad range of applications in both technical and social domains.

Reference [“Toward an Ontology for Third Generation Systems Thinking”](#) by Anatoly Levenchuk

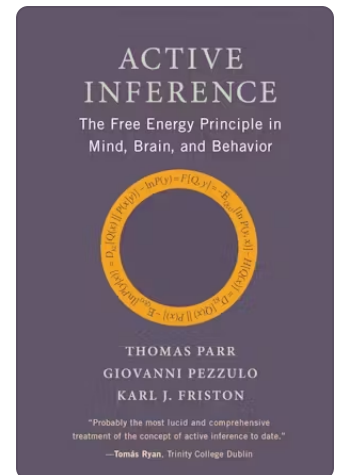
Textbook Group

We organize and scaffold a Textbook Group to work through the 2022 textbook **“Active Inference: The Free Energy Principle in Mind, Brain, and Behavior”** by Thomas Parr, Giovanni Pezzulo and Karl J. Friston ([link](#)).

The textbook came out in March 2022, and we have had 7 cohorts since then, constituting hundreds of learners at different levels of synchronous and asynchronous engagement.

Cohorts of learners meet weekly to talk about Chapters of the Textbook with a Facilitator. Learners also submit and answer [questions](#) throughout the process, which helps clarify fundamental concepts of Active Inference.

<https://textbook-group.activeinference.institute/>



Tech Tree

A [current area of interest](#) for us is creating an Active Inference 🌱 [Tech Tree](#) (a “tool to map science and tech”) to guide [Open Source](#) development.

For now, work on this can be found within the [RxInfer.jl Learning Group](#) documentation document [here](#), and in the Github repository here <https://github.com/ActiveInferenceInstitute/Symposium/tree/main/output> , where we are processing public participant information for the [Applied Active Inference Symposium](#) and applying LLM methods to this.

Videos & Podcasts

We produce educational content in the form of 📺 [Videos & Podcasts on YouTube](#), [Podcasts on Podbean](#), and replication across other platforms.

We have multiple kinds of formats for the content, and we add new ones as availability/capacity arises.

Some current formats and area of focus for 📺 [Videos & Podcasts](#) are:

- [Livestream](#) (focused on specific papers, 58 papers discussed since 2020).
- 90+ [GuestStreams](#), highlighting a wide range of work in ∞ [Active Inference](#) and related fields.
- [ModelStream](#) (), [OrgStream](#) (social and organizational topics), [MathStream](#) (formalisms and math), [MathArt](#) streams in 2024, [ArtStreams](#) (art and aesthetics), [InferAnt Streams](#) (coding, modeling, synthetic intelligence), [Roundtables](#) (organizational updates), Courses (📌 [Social Science course](#), 📌 [Physics course](#)), 📖 [Textbook Groups](#), and more
- One of the highlights of 2024 was **Active Inference Insights (Podbean, YouTube)**, hosted by Darius Parvizi-Wayne.
 - Active Inference Insights is a podcast which introduces listeners to the wondrous land of Active Inference. Guided by our diverse array of guests, from physicists and mathematicians to cognitive scientists and philosophers, you will not only learn about cutting-edge theory, but also come to see the world in a whole new way, in which all things can be tied together by a single imperative: the minimisation of free energy.

To date, we have released over 500 videos.

<https://video.activeinference.institute/>

The Active Inference Ecosystem

The 🌱 [The Active Inference Ecosystem](#) is a vibrant, global community of researchers, practitioners, and enthusiasts united by their interest in ∞ [Active Inference](#) — a powerful framework for understanding cognition, behavior, and complex adaptive systems. The ecosystem extends far beyond the formal boundaries of the 🏠 [The Active Inference Institute](#), encompassing a wide array of individuals, organizations, and projects that contribute to the development and application of Active Inference across 🛡️ [Domains of Application](#).

At its core, the Active Inference Ecosystem is characterized by its open, collaborative nature. It brings together experts from fields as varied as neuroscience, artificial intelligence, philosophy, physics, and social sciences, fostering cross-pollination of ideas and innovative approaches to complex problems. The ecosystem thrives on the collective efforts of its participants, who engage in research, education, software development, and practical applications of Active Inference principles.

The ecosystem is not just an academic or theoretical construct; it is a living, evolving network of interactions and initiatives. It includes 🤝 [Partnership](#) among organizations, educational programs, 🌐 [Open Source](#) product, events, and various community-driven efforts. The Active Inference Institute serves as a hub within this ecosystem, providing infrastructure, coordination, and support to facilitate the growth and impact of Active Inference across disciplines and sectors.

As the document transitions into detailing the Active Inference Ecosystem, readers can expect to explore the 📌 [Ecosystem Priorities and Challenge Areas](#), 🏗️ [Ecosystem Development: Structure and Growth](#), and 🚀 [Ecosystem Projects](#) across 🛡️ [Domains of Application](#).

Ecosystem Priorities and Challenge Areas

We look to continued engagement with the Ecosystem, to better curate and refine the

 [Ecosystem Priorities and Challenge Areas](#).

Education: Scientific Literacy and Workforce Development

Active Inference relies on mathematical formalisms and is loaded with abstract conceptual challenges that transcend disciplinary boundaries. We hope to model educational processes such as pedagogy, competency evaluation, and professionalization in Active Inference. Thus, the Institute catalyzes workforce development, seeks to stabilize the "research to practice" gap, and contributes to the broader project of participation in scientific ecosystems.

Research: Grounding the Cognitive Sciences in Physics

Research across the natural sciences suffers from a lack of theoretical integration and practical collaborations. Active Inference is gaining traction as a rigorous attempt at a unifying first-principles accounts of vital features of biological systems, transcending disciplinary boundaries. At The Institute we promote this theoretical integration through various educational programs, supporting learners of all backgrounds.

Information Science and Diverse Intelligences

The interaction frequencies of modern information environments are higher and more complex than ever. At The Institute we apply Active Inference to understanding, monitoring, evaluating, refining, and developing artificial and synthetic (e.g., human-machine interface, organizational, crowd) intelligence systems. In this way, active inference helps to identify, analyze and optimize various forms of "interoperability" across various forms of intelligent system, making possible a form of "mutual socialization" among such systems. This work is enacted by projects currently related to information science, ontology, data quality control, artificial intelligence explainability, and knowledge engineering.

User Experience, Accessibility, and Sociotechnical Design

It remains an open challenge how to most effectively, efficiently and fairly enable sustainable engagement in digital systems consistent with all parties expectations and needs. At The Institute we map cognitive frameworks as a framing for design, user experience, ergonomics, and requirements engineering, as well as implementation and operational guidance, to offer new methods and tools to a wider community of professionals and scholars.

Business Applications

Business and commercial interactions are typically characterized by party attention to reduced set of abstracted variables as compared with biological and social systems. Notwithstanding the "management" and regulation or variables, active inference can still help to improve the competitive insights and risk mitigation strategies and other variables that are the focus of business and commercial parties. Active inference research and analysis promises to substantially enhance and improve critical business elements such as risk strategies, insurance markets, banking (lending criteria), identity authentication, and authorization and a host of other business interaction decisions.

Social Welfare

The scale independence of active inference analysis causes it to be well suited to framing issues in settings where different parties experience different levels of information and resources. This includes various programs of local and global social welfare that seeks to enhance the local and global fairness of resource allocations of various kinds and to offer a pathway to easing the consequent burdens that unbalanced resource related interactions place on precarious populations.

Cyber and Cognitive Security

Individuals and organizations today are confronted with a rapidly-evolving landscape of threats to digital and cognitive security. At The Institute we work to unify cognitive frameworks with existing cyber security and emerging cognitive security concepts and frameworks, to understand, measure, and address local and global information technology risks and impacts more effectively at multiple scales.


Scaling the Active Inference Ecosystem

The nascency of the Active Inference Ecosystem enables us to take a proactive approach towards various areas of consideration. At The Institute we create synergy among the efforts applied to the above challenge areas, and emerging needs of the Active Inference Ecosystem. This approach creates an opportunity to learn by doing and to embrace convergence research, where implementations are developed in parallel with theory, supported by regular information sharing and collaboration among practitioners and researchers.

Applying Active Inference

The Institute brings insights from empirical and theoretical Active Inference research into practice by designing new projects or communicating with existing projects that design and implement social system infrastructure, such as health infrastructure and cultural technologies that support human well-being. We also support [Ecosystem Projects](#) that design and implement solutions to various collective problems, such as climate change, threats to democracy, armed conflict, or overall polycrisis.

Additional Focus Areas

-  [Software](#) usability
- Information system optimization and efficiency (operating)
- Cultural heritage and progress
- Legal and regulatory consistency and compliance

Ecosystem Development: Structure and Growth

Community Growth and Development

Here, we present the community growth and development model for 🌱 [The Active Inference Ecosystem](#), built on the following 5 core components:

1. **Awareness.** Promoting and fostering awareness and use of Active Inference, and developing partnerships with well-aligned organizations and communities.
2. 📖 **Education.** Developing and disseminating educational materials, contributing to competency, capability, and common language within the community.
3. **Common Forum.** Offering and maintaining an inclusive and accessible common forum for discussing, sharing, and hosting relevant work and opportunities, finding collaborators, and networking (i.e., an informational commons).
4. **Support.** Providing support for emergent teams and projects which align with The Institute's mission, in the interest of innovation and impact
5. **Governance.** Maintaining stable governance for cultivating and sustaining partnerships, technical infrastructure, and sponsors.

Ecosystem Structure

The Institute cultivates an active and engaged ecosystem around the scientific modeling framework of Active Inference. This vibrant Ecosystem and community drives innovation on the research front and makes significant strides in providing accessible education. The Institute ensures that efforts are well-aligned, impact-focused, relevant, and meaningful in advancing research and education for the betterment of society by forming partnerships and by engaging with and growing the Active Inference community. Our community development model emphasizes facilitation over management, and distributed as opposed to command-and-control strategies. More importantly, our model moves beyond the provision of networking and discussion space to support emergent, collaborative work.

In these regards, the Institute functions as a seed crystal that can help to foster phase changes across a variety of information system domains and applications. The Institute does not directly manage all of the systems upon which it has an influence, but instead seeks to leverage its influence by providing coherent multiple tools and practices from which communities of shared interest can optimize their local information system dependencies for active inference efficiencies.

As opposed to a linear “funnel” growth model, The Institute will implement a cyclical model of organic growth pursued through the incubation among participants of (i) self-efficacy, or a sense of personal capability, (ii) a sense of support and safety, and (iii) a sense of investment and impact in participants, as a basis for forming a sense of community and providing the foundation for development of relationships within the community through positive, repeated contact. The support of these senses leads to productive, emergent collaboration, which in turn leads to emergent community narrative, norms, roles, and “scripts”. Participants are reinforced in their feelings of capability as a part of a team, assured that they will be provided with support in a reasonably safe environment, and that results will have a lasting, positive impact on their community. Resulting research and educational artifacts and documentation constitute shareable content which can then be used to bring awareness about Active Inference and The Institute to non-community members.

Where a “funnel growth” model focuses on awareness alone as a basis for developing a user-base, our model's focus on education, knowledge sharing and presentation of work, and support for teams allows for non-community members of all backgrounds and interests to engage with and contribute to the community, thus affirming membership through a sense of shared investment, impact, and competency. Further, where online learning communities anticipate members terminating participation following completion of coursework (or after achieving feelings of self-efficacy in the material), our model's provision of support and opportunities for sharing of work with professionals and academics provides incentives for continued engagement and participation to those who feel they have already become reasonably familiar with all available educational material.

Below, background is provided on the (i) structure of the community (i.e., user segmentation), (ii) our information storage and dissemination technology (“tech”) stack, (iii) our communications plan, (iv) the education, support, and infrastructure and governance functions we provide and/or intend to provide as a part of this model, and (v) our intended approach toward evaluating quality control and growth.

Community Participants

The Institute is a formal organization that has been constituted to serve some of the organizational and operational needs of the expanding active inference ecosystem. The Institute and its staff recognize that the energy and knowledge value relating to the further understanding and development of active inference resides in the broad active inference community, which is supported, fostered, convened and cross fertilized through the activities of The Institute. The reach and potential implications of active inference across domains and sectors is sufficiently broad that parties can choose from among many different ways to engage. A partial list of categories of participation is presented below to provide a sense of the variety of participants.

Direct Institute Participants (Members and Learners)

Many individual participants interact directly with The Institute and its resources and programs. Participants include members of the Active Inference Ecosystem, or those who engage directly with and contribute to [@ Institute Programs](#). These participants include students, educators, researchers, and professionals from around the world who may benefit either from awareness of Active Inference and its implications, developing related competencies and having opportunities to network and collaborate with individuals who do, or from opportunities to collaborate and share work and insights which would be valuable to the Active Inference Ecosystem.

Participants also include *learners* at various levels of involvement and expertise that engage directly with The Institute as part of their learning process. The Institute seeks to support all learners, from the academic expert to those individuals who are not, and everyone in between. The Institute seeks to facilitate access by all learners to tools and materials and narratives that can help people at all levels access information that can help them to enjoy the direct and indirect benefits of active inference thinking and approaches.

Users (Adopters and Beneficiaries)

For individual and organizational users that explicitly adopt Active Inference-based [organization and operation] of their information processing and synthetic intelligence practices, policies and tasks, the Institute's productive outputs provide support and opportunities for engagement with a broader community. The Institute maintains an online resource center that includes software, tools, and materials that convey methodologies and practical pathways for instantiating Active Inference-derived structures in a variety of community settings and institutional contexts, and includes [practical suggestions for] the facilitation of Active Inference itself as an open source and open standards set of products and practices. As such, the community using Active Inference and related [Open Source](#) products requires documentation, clear messaging regarding updates, and guidelines on fair and best practices. By considering such beneficiaries of Active Inference as “users,” The Institute may leverage existing best practices from other domains, such as user experience, requirements engineering, and software engineering. Potential users include professionals, researchers, educators, and engineers.

Beyond direct “users” of active inference, there are many groups of parties that benefit from the use of active inference who won't interact directly with such systems, nor be aware of it. Comparison is made to people who fly in airplanes, but haven't studied Bernoulli's hydrodynamics principles.

Research Partners (External Research Organizations and Working Groups)


The Institute's ReInference unit collaborates with external research partners, universities, institutions, and subject matter experts. These partnerships involve joint research projects, data sharing, and knowledge exchange to enhance the depth and breadth of research efforts. Collaborations with research partners create an opportunity to enrich The Institute's research capabilities and resource access, thereby accelerating the generation of new knowledge and helping us to address complex research questions, validate findings, and extend the reach of our research impact. Potential research partners include

organizations working on or faced with problems that may be solved by Active Inference, and organizations which are working on or have solutions to problems which The Institute and the community are facing.

Educational Partners (Universities and Educators)

The Institute's EduActive Unit collaborates with educational partners to influence, instantiate, share, and get access to educational programs, teacher training, and learning resources. By partnering with educational institutions, The Institute extends its educational reach and impact and fosters effective delivery and dissemination of its educational content. Potential educational partners include universities, tutors, educational institutions, and educators.










Funders (Donors, Supporters, Grants, and Funding Agencies)






The Institute requires  **Philanthropy** in order to keep pace with community needs, maintain information infrastructure, and assist researchers in finding their own financial support for relevant research initiatives. Potential donors and funders include generous community members and beneficiaries, government funding agencies, private philanthropic donors, and sponsors of events, programs, and initiatives.

Ecosystem Projects

There are many [Ecosystem Projects](#) — here we include the subset which have completed a form at <https://projects.activeinference.institute/> to increase their visibility and participation.

Projects in the Active Inference Ecosystem 2

Project	Documentation	Mission & Objectives	Facilitator
Symbolic cognitive robotics		Explore the joint problem space of “symbolic active inference”, “societies of mind” and “mortal computing”, with an emphasis on unsupervised learning.	Jean-François Cloutier
Active Inference Account of Belief Updating in PTSD		Write a theoretical paper in the style of Parr et al. chapter 6	Jeremy Cooper
Humanity’s Story of an Uncertain Self		Producing an academic paper or blog that contains a set of equations, computer simulations, and ultimately a framework that explains the core components of humanity’s sociological-narrative framework. Specifically, breaking down a few pieces of say, ancient epics, along with an set of economic and civic institutions, would allow us to model to simulate, predict, and give mastery over the otherwise seemingly intractable world of humanity’s cultural niche.	Shagor (Shaggy) Rahman
Action Research on Collective Foraging (Negotiation Affordances)		The mission of the Collective Foraging Lab is to improve collective sustainability and individual well-being through the praxis of team formation and deployment for value co-creation and capture. Phase I will focus on the effects of negotiation affordances on predictive processing and value exchange.	Susan Hasty
Project Development for “Solving the Tower of Babel Problem: UniFysica Philo-sophia”		To outline, draft, a collection of papers with the title “An Inclusive System of Communication for Sapiens’ Shared Meanings and Cognition: From Blombos to Friston and Fields”	Ana Magdalena Hurtado
Numinia		First mission would be to make sure we are implementing Active Inference in the game properly and is well explained, another mission would be to ensure that the design of the incentives aligned with the values of <i>Numinia</i> and the All.	pablofm@numengames.com
An Active Inference Agent for Modeling Human Translation Processes		To model human translation processes through an Active Inference Agent	Michael Carl
MathArt Conversations		Our mission is to illuminate mathart as a synesthesia and to highlight the profound connections between mathematics, active inference formalism, and the arts. Moreover, our objective is to amplify the variations in mathematical and artistic thinking, by working major concepts and theorems cross-disciplinarily.	Shanna Dobson
Neurodivergent Learning Sessions		Neurodivergent learning is focused on outreach and spreading awareness geared towards those who struggle with standardized curriculum environments when it comes to public and higher education milestones... as a number of people with neurological conditions not limited to autism spectrum disorder can struggle in varying ways with learning and being in the right environment in which information is presented to them in a manner which is coherent.	Jesse G, c4tm4nd00

Improving RxInfer.jl's Model Visualization Capabilities		Our mission is to equip RxInfer.jl - and its relevant component libraries - with a host of model visualization modalities that prove useful to those who wish to use, and/or to develop RxInfer.jl. To that end, we anticipate measuring the initial quality of our contribution/s by their reception from RxInfer.jl's core developers: TU/e's BIASlab. All our objectives must therefore take the approval of the BIASlab as their proverbial North Star.	Fraser Paterson
Draft Book Title: The Physics of a Fulfilling Life: Principles for Cultivating Your Potential		Perform a meta analysis of the "wellness" space through the lens of active inference highlighting the most impactful points for the larger population in an easily digestible format. Use this work to kick off a longer term collaboration and contribution to the larger All community.	Anna Pereira
CogNarr Ecosystem: Facilitating Group Cognition at Scale		The initial mission is to advance the CogNarr project from its current incubation phase into a proof-of-concept demonstration, followed by a minimal viable product.	john.boik@activeinference.institute
The Universal Basic Income Experiment		Mission: To solve the Economic long tail problem of Universal Basic Income via bleeding edge technologies like AI and crypto, preferably using the blockchain. Objective: To attempt to solve the economic long tail problem with a blend of tokenomics, math, jurisdictional and currency-based variables. To attempt prototype models that can be replicated in engineering, economics, crypto and legal alike.	Die Schwarze Katze
Clinical Waveform Data based Agent		Mission is to establish proof-of-concept that an active inference system at the bedside of a critically ill patient (pediatric ICU), using waveforms in real time, could enhance better response from the medical team.	Franklin Ducatez

Domains of Application

The sub-sections of [👉 Domains of Application](#) reflect some early collaborative efforts towards curating [📚 Implementations of Active Inference](#) across different sectors and systems of interest. This section of the document is not presented as a comprehensive or exhaustive survey in any way, rather more of an invitation to those who would like to steward a section (keeping it updated and relevant) as we develop these synoptic capacities together. Later updates will more deeply reference [📺 Videos & Podcasts](#) and other resources where [∞ Active Inference](#) has been demonstrated across systems.

Along with other modern technical fields, Active Inference faces and addresses challenges of broad relevance such as (i) remote education, workforce development, and competency evaluation, (ii) user experience, ergonomics, and accessibility in a modern global context, (iii) [🌱 Open Source](#) availability, utility, reliability, and safety, (iv) participation in research and practice-oriented activities (v) cyber- and cognitive-security, (vi) theoretical and practical aspects of artificial intelligence explainability and safety, (vii) social and economic policy integration and management.

Integrations featuring Active Inference are increasingly being found across public and private sectors. These applications are enabled through common education around Active Inference themes, concepts, skills, practices, and tools. As such, there is potential for The Institute to facilitate both the study (theory and research) and professionalization (practice and implementation) of Active Inference within and across myriad sectors and disciplines, and to grow the incipient Active Inference Ecosystem and awareness of Active Inference by facing such challenges proactively and in a fashion aligned with our vision, values, and principles. We hope to achieve this through developing coordinated resources that are accessible to users at all backgrounds and levels of familiarity. Moreover, we aim to develop this nascent research arena by facilitating and/or mediating access to resources for an array of independent projects.

A core reason why [∞ Active Inference](#) is being adopted so rapidly is that it provides a flexible, agent- and action-oriented ontology which describes a great array of complex adaptive systems, up to and including human social cognition. The Active Inference framework can be used to describe systems at different nested scales. The applicability of Active Inference to multi-scale complex adaptive systems is a source of great explanatory power, and it is also a challenge for the framework's coherence. Scholars from different disciplines or fields may read Active Inference concepts or constructs differently, and unknowingly build an error into their research ecology which is then propagated forward, thereby hampering progress in the field at large. To our knowledge, the Active Inference Institute is the first scaled attempt at directly tackling that risk by offering Active Inference education to learners of all backgrounds, and by working to specify an ontology that is both particular to Active Inference and broadly accessible. Furthermore, the institute offers accessible onboarding to current best practices in Active Inference research as well as the ability to drill down into specific topics across the broad array of disciplines that are implementing the framework.

Biology

Chris Fields and Michael Levin (2020) posit that Active Inference “provide(s) conceptual tools for reconceptualizing biology as the study of a unified, multiscale dynamical system”.

Ramstead et. al (2019) have leveraged active inference and the underlying free energy principle to characterize *variational neuroethology*, a theoretical ontology for living systems based on a recursively nested formulation of Markov blankets.

Friston et. al (2023) introduce a variational formulation of natural selection to explain how slow phylogenetic processes constrain—and are constrained by—fast, phenotypic processes.

Neuroscience

Active Inference emerged from the field of theoretical neurobiology (Friston, 2005), where it was “first used to model the function, structure, and dynamics of the human brain” (Ramstead, 2024). It built upon foundational work in predictive coding (Rao and Ballard, 1999) and the Helmholtzian concept of perception as “unconscious inference” (Helmholtz, 1867).

Active Inference’s central premise that “all neuronal processing (and action selection) can be explained by maximizing Bayesian model evidence — or minimizing variational free energy” (Friston 2017) provides a unifying theory to explain and predict myriad aspects of brain function and behavior (Friston, 2010). As such, it has been applied to many areas of neuroscientific research.

Active Inference models are used to provide parsimonious explanations for neural mechanisms and motifs, such as canonical microcircuits and neural networks (Bastos et al 2012, Isomura et al 2022).

Researchers have furnished Active Inference models for phenomena including motivated control (Pezzulo et al 2018), sense of agency (Friston et al 2013), modulation of uncertainty by the dopaminergic system (Friston et al 2012), and the computational relationship between interoceptive and exteroceptive neural systems (Allen, 2022).

Active Inference frameworks have also been used to explain the dynamics of a variety of neurological and psychiatric conditions, including depression (Barrett et al 2016) and schizophrenia (Limongi et al 2023).

Recent studies have shown that in-vitro neuronal networks self-organize in response to stimuli in ways that are consistent with, and predicted by, the Free Energy Principle (Isomura et al 2023). The FEP also provides theoretical commitments towards testable theories of consciousness (Whyte et al, 2024).

As a multi-scale theory, Active Inference aims to ground neurobiology in [physics-as-information-processing](#), and links it to other domains of inquiry, including diverse intelligence (Levin 2023) and artificial intelligence (Friston et al 2024).

Mental Health

Being a theory of embodied and sentient behavior, Active Inference can contribute in knowledge sharing to better understand the intrapersonal and interpersonal dynamics involved in or implicated in mental health (Pezzulo et al, 2024). Computational psychiatry (Friston 2022) serves to utilize models of cognition and behavior to predict and account for the above-mentioned dynamics. Being a model constrained by Bayesian principles and the free energy principle, Active Inference allows for one such attempt at better predicting treatment outcomes, nosology, and fundamental principles of cognition.

The Institute supports individual thoughts and projects designed to inquire on topics related to social sciences, psychology, and mental health. Such projects have included attempts at classifying and clarifying Active Inference ontology to better fit the lived experience of individuals with posttraumatic stress disorder.


Active Inference is a systems approach to psychological constructivism that offers a trans-diagnostic perspective to readers. One such benefit of a trans-diagnostic approach is that it identifies connections between different processes without the strict adherence to philosophical requirements. Areas of the theory that can be beneficial to mental health research include:

- Experiential quality of prediction error for patients (i.e., as a mismatch of one's generative model) (defining "surprise" in therapy practice, Holmes & Nolte 2019)
- Homeostasis and role of consciousness as allostatic control (Krupnik 2024); as well as the dynamic interplay between these processes and mental health symptoms (cultural identity, Ramstead et al 2016; social conformity, Constant et al 2019)
- Mental health symptoms as under/over-reliances on a generative model (apathy, Hezemans et al. 2020)
- Requirement of interoceptive processes (body-based) and the roles these have in the make up of a Bayesian brain (Duquette 2016)
- Role of affect and ascribing confidence to one's generative model (Hesp et al. 2021)
- Equal treatment of action policies as being direct manipulations of one's environment (decrease free energy now) versus epistemic transformations (change your beliefs about the world to decrease free energy in the future) (PTSD & explore-exploit dynamics, Linson et al 2020; social cognition, Gallagher & Allen 2018)
- Hierarchical models of cognition that outline the dynamic interplay of predictions, actions, habituation, and environmental feedback (theory of constructed emotion, Barrett 2017; cognitivism versus autopoiesis, Allen & Friston 2016)

Conceptualizations are being offered that describe the experience of those with particular mental health symptoms (Parr et al. 2022, p. 186). Active Inference has also been applied to the study of depression (Barrett et al 2016), psychosis (Knolle 2023), schizophrenia (Jeganathan 2021), anorexia (Barca et al 2020), functional neurological disorder (Jungilligens et al 2022), and interoceptive dimensions of psychopathology (Paulus et al 2019; Barrett 2016). Conversely, Active Inference also provides a framework for understanding constructs of mental wellness, including subjective well-being (Smith et al 2022).

Chamberlin (2023) illustrates how Active Inference can be applied directly to one psychotherapy model, Coherence Therapy. This type of dialogue allows readers to see the neurological mechanisms and meaningful narratives at play in a framework that treats both equally. It is also good for readers to note that Active Inference offers a framework to reformulate agents as being cognitive, emotional, and embedded without adding other philosophical requirements. It can be beneficial to engage existing psychological theories [of cognition, emotion, personhood, agency, social relations] in order to emphasize constituent processes that Active Inference gives language for. For instance, the focus on sense making in the life of an individual highlights the existence of an agent's generative model that has been determined within and a part from the generative process. In parallel, sense making can speak to themes of agency and emotional expression.

Bioregional Modeling

An ongoing project, [Biofirm](#) currently consists of two main components in support of  [Bioregional Modeling](#):

1. Ecosystem Control System

- Active Inference-based multi-agent control framework
- Homeostatic regulation of ecological parameters
- Comparative analysis between random and controlled dynamics

2. BioPerplexity Analysis

- California county-level bioregion research using Perplexity.ai API
- Business case generation and pitch development
- Cross-document visualization and analysis

Category Theory

Active Inference, through the Free Energy Principle (FEP), provides a framework for understanding how systems make predictions and update their models based on sensory evidence. Category Theory, meanwhile, offers a formal mathematical language to describe the transformational processes that occur during these updates (see: [Chris Fields 2024](#), "What is the Identity operator?").

Mathematical Bridge

Where Active Inference describes the necessity of prediction and error minimization, Category Theory provides the precise mathematical tools to track how these predictions and updates flow through a system. The power of this combination lies in Category Theory's ability to formalize the very transformations that Active Inference predicts must occur.

Creative Processes

This relationship becomes particularly relevant when examining creative processes. Active Inference explains why systems must make predictions and learn from surprises, while Category Theory's operators can formally map out the transformational paths taken - even in cases where the end state wasn't predictable from the initial conditions. The identity operator, in particular, helps us understand how systems maintain coherence while undergoing these creative transformations.

Practical Implementation

This growing theoretical bridge between [Category Theory](#) and [Active Inference](#) has practical implications for:

- Modeling learning processes
- Understanding system adaptation
- Tracking creative development
- Formalizing prediction errors and updates
- Maintaining system identity through change

The synthesis of these approaches provides a more complete picture of how systems learn, adapt, and create while maintaining their essential identity through transformative processes.

Computational

Implementations of Active Inference

In the [Active Blockference](#) project, we have curated dozens of [Open Source](#) [Implementations of Active Inference](#) at [this link](#).

The sub-pages here go into more detail on several different toolkits for applying [Active Inference](#), including in Python ([PyMDP](#)), Julia ([RxInfer.jl](#)), Matlab ([SPM \(Statistical Parametric Mapping\)](#)), and Prolog ([Symbolic Active Inference](#)).

RxInfer.jl

RxInfer.jl (<https://rxinfer.ml/>) is a programming package of functions developed at [BIASlab](#) in Eindhoven, Netherlands. It attempts to commoditize [∞ Active Inference](#), making it suitable for engineering applications. Compared to existing [📊 Implementations of Active Inference](#) like [🐍 PyMDP](#), RxInfer is unique in the sense that it draws upon reactive message passing on Forney Factor Graphs (FFG). Whereas 'traditional' implementations rely on Bayes graphs in the form of Partially Observable Markov Decision Processes (POMDP). FFG's using reactive message passing only perform calculations when necessary, hence there is no underlying clock which schedules calculations. The reactive paradigm thus may offer computational benefits in certain situations, and enable favorable scaling properties for Active Inference models.




The [👥 RxInfer.jl Learning Group](#) at the Institute collaborates with with the developers of [🐍 RxInfer.jl](#) in [🌱 Open Source](#) development, such as developing visualisation techniques of the FFGs within the code editor.

Core Capabilities

RxInfer.jl provides powerful features for probabilistic modeling, including:

- Streaming dataset processing through reactive message passing
- Hybrid models combining discrete and continuous latent variables
- Scalable inference for large models with millions of parameters
- Automatic differentiation support for parameter tuning

PyMDP

The  PyMDP package <https://github.com/infer-actively/pymdp> is an  Open Source  Implementations of Active Inference, specifically “A Python package for simulating Active Inference agents in Markov Decision Process environments.”

Active Inference ModelStream ...



Active Inference ModelStream 007.1 ~ Conor Heins & Daphne Demekas ~ pymdp

<https://www.youtube.com/watch?v=skf3sOM-7WI>

Active Inference ModelStream ...



Active Inference ModelStream 007.2 ~ pymdp

<https://www.youtube.com/watch?v=uX8iSoDR83g>


SPM (Statistical Parametric Mapping)

Statistical Parametric Mapping (SPM, [homepage](#)) represents a pivotal development in the history of active inference and computational neuroscience. Created by Karl Friston at the MRC Cyclotron Unit in the late 1980s, SPM began as a statistical technique for analyzing brain imaging data, particularly fMRI, PET, and EEG data ([Wikipedia](#) and [History](#)).

The development of SPM marked a crucial shift from simple region-of-interest analyses to whole-brain statistical approaches. Originally written in MATLAB, SPM91 (also known as SPMclassic) became the community standard for analyzing neuroimaging studies within a few years of its release. The software's success stemmed from its rigorous approach to making valid statistical inferences about brain responses without prior knowledge of where those responses would occur.

SPM's theoretical framework evolved to incorporate increasingly sophisticated statistical methods, including the general linear model (GLM) and Gaussian field theory. This evolution paralleled and supported the development of active inference theory, as many of the mathematical principles underlying SPM - particularly those involving free energy minimization and Bayesian inference - became foundational to active inference. Today, while dedicated [Implementations of Active Inference](#) toolboxes exist in various programming languages (like [PyMDP](#) in Python, [RxInfer.jl](#) in Julia), SPM remains significant as both a historical cornerstone and practical tool in the field.

Symbolic Active Inference

Symbolic Active Inference, developed by Research  [Fellows](#) Jean-François Cloutier, represents an innovative approach to combining symbolic reasoning with active inference principles. The framework aims to bridge the gap between traditional symbolic AI and the free energy principle by implementing active inference using symbolic representations and logical reasoning. This implementation allows for explicit modeling of beliefs, goals, and actions using symbolic structures while maintaining the core mathematical principles of active inference - namely the minimization of variational free energy and expected free energy.

The approach enables systems to perform goal-directed reasoning and planning through symbolic manipulation while grounding these processes in the formal theory of active inference. Key aspects include the representation of generative models using symbolic structures, belief updating through logical inference, and action selection based on expected free energy minimization. This synthesis provides several advantages: it makes active inference more interpretable through explicit symbolic representations, enables complex reasoning about abstract concepts and relations, and allows for more efficient computation compared to purely numerical implementations. The framework has been demonstrated through implementations in domains like robotic planning and symbolic problem-solving, showing how symbolic representations can be effectively integrated with active inference's information-theoretic principles. This work represents an important step in developing hybrid AI systems that combine the strengths of both symbolic and probabilistic approaches to intelligence.

All  [Open Source](#) information on  [Symbolic Active Inference](https://github.com/jfcloutier/karma_system) can be found at https://github.com/jfcloutier/karma_system

Economics

Economics is a very broad field. From macro policy to econometric micro optimization. Here the focus is on conceptualizing the decision maker as it is relevant for deciding a relevant policy alternative from a potential set. Undoubtedly future work and potential authors will expand this section greatly.

The foundation of economics is to scale decision making to collective systems. Traditionally, decision makers are seen as utility maximizers (or regret minimizers). With the underlying assumption of full information and (bounded) rationality.

However, active inference nuances this view by positing that rational choice is a limit case of decision making. Only occurring during absolute certainty of observing one's preferences ([Friston et al., 2013](#)). Instead a pragmatic turn entails information seeking as part of the decision process such that actions are both pragmatically and epistemically informed ([Schwartenbeck et al., 2015](#)).

Such a shift in perspective - all the way up to perspective swaps - may not be limited to traditional economics by expanding existing frameworks with new methodologies. Instead, this shift from viewing choice as static towards a dynamic process, means that multiple economic approaches to collective policy selection become feasible.

One such alternative economic approach is broad prosperity. It involves taking inventory of a set of value-neutral indicators, of which gross domestic product is just one. Unfortunately, it is very difficult to express the causal relationships between these indicators as these span a variety of domains like social, environmental and economic concerns. Additionally, what occurs locally has impacts globally and vice versa ([TNO, 2024](#)).

Active inference is poised to address these limitations. Given the nature of scale-free action perception loops; any self-organising system may be described as a sense-maker. In doing so solve the issue of not being able to sum free energy across agents. For example when planning a new public transport line. One could calculate the total utility obtained via preference elicitation (willingness to pay, stated and revealed choice experiments). Or one could instantiate a niche constructing digital twin. The entire urban region which is assumed to itself be a scale-free niche constructor will then have to share its niche with a synthetic artifact.

Evaluating the potential of a policy alternative, like building a tram or bus line, becomes a practice of understanding the generative model of the digital twin. Which is assumed to approximate a real niche constructor.

Education

The transdisciplinary nature and flexibility of Active Inference makes the framework ideal for practical, theoretical, and interoperable work across myriad use-cases. In the use case of learning in systematized settings (i.e. 🏫 Education) the conventional planning frames take on *wheels* (π , as in policy selection) in order to function as a platform enabling translational “spinning” (i.e. helicity) across contexts of greater scale (learning generalization as **transfer**). With the inertia from the spin as your **stability** mechanism, the addition of policy selection by the learner as a self-organizing system (i.e. learning agent) within larger variability retained settings, introduces *uncertainties* to test the *which* and the *where* of when **trans-disciplinary** experience (i.e. real world experience, real dynamism, real problems) requires practical/pragmatic (i.e. action) solution(s). Comparatively speaking, conventional frame containment as stabilizer, only provides a variability reduced-reductionism environment ubiquitously held up as **constructing** learning where the product is a wide base as “foundational” retentions, and relatively smaller “crowning” states, as in Maslow’s Hierarchy.

Before describing what the mechanics of this inclusion of policy selection is, and can look like for you, it is best to point out that going forward, the acceptance that policy selection plays a role in how we learn, is not necessarily easy to incorporate as strategy applied. “*I find this policy selection part hard to understand*” is often heard when something new and/or unfamiliar is introduced into a messaging exercise. This is understandable when a proposal uses terminology that isn’t part of the newcomer’s current lexicon (and sometimes even when the term is already used). To take up new labels (and the ideas behind them) requires taking a step **back** from centuries of the accepted definition of what providing an *education*...is: define and refine via a process of packaging and delivery of information (so deliver to me, the learner, what I can recognize). Sustainers and defenders of that (status quo) strategy will argue (correctly) there is much more going on than that minimum of two of **define and refine**, and the Active Institute’s argument would be...maybe, possibly, but not certainly.

There too many examples, practiced both currently and historically in academia, to deny that at the core of educational practice, there is a reinforcement and incentivisation firmly established around practices focused on defining (i.e. agreement around an external ontology/standards) and refining (i.e. moving to smaller and smaller divergence(s) from what we see/do, and what we think we’re doing/seeing). That being the case, new terminology like **Prediction Matter Expert** is the **surprise** given that phrase’s like this that are introduced, lack consensus around meaning and precision. Time is then spent working through where the introduced term/label/idea can fit (appropriately) within contexts of particular study/focus/research. This is an effortful exercise, that can often lead people new to Active Inference and the FEP, to wonder “*where exactly is the Institute going with this idea/terminology/set of formalisms?*” That’s a fair question, and in asking, we open a portal to the navigational aspects of resolving the “where” of **learning as orientation process**. This is the “where am I?” **action** - not just wonder - as Active Inference.

Applying Active Inference and the FEP to educational programming - “*you are now here, but you’re not staying here, you’re going back out there*” - has thus far struggled to gain much traction in many legacy (read hierarchical Pyramid Model) educational systems. Given most education systems’ tendencies to want to place the *certainty* of keeping systems accountable ahead of determining how agents learn when **prediction-as-skill** under **uncertainty** is given equal priority with subject matter expertise (as skill), we continue to find that active inference as functional **compliment** needs time for mass academic uptake (to scale). One of the core differences between subject matters and prediction matters exists at the waypoint called **Updating**. Currently, legacy education systems interpret “updating” as a cumulative-constructive-classical exercise, and therefore it is **surprising** for those vested in that method, when someone with formal active inference priors, proclaims the need to incorporate statistical and probability functions into the praxis and pedagogy design. This non-binary nature of probability (i.e. could be zero, or one, or something **between**) aspect dependent on “what I as agent...*thinks* will happen,” does exist as a teaching strategy, but is only applied within **the variability reduced frame**, pre-selected by the course/activity/lesson plan designer who is the subject matter expert.

And, active inference prediction modelling begins with the concept that the learning agent is first and foremost a self-organizer, self-designer who wants (self-identifies) minimization of any divergence between their own model and what the niche continually signals. Under this circumstance, updating as a process may take on constructive attributes, but it will also require some exposure to de-constructing processes (i.e. the most basic being, when change in the situation is apparent, will the agent 1) accept that change and 2a) either modify their surroundings or 2b) modify their model?). This is a fundamentally different type of branching - change the model, change the environment, change **both** - to pass/fail or even rubric induced accounts.

This then necessitates a different (second) definition of “updating” as a result of starting with a predictive probability of achieving an *ad hoc* **and** *post hoc* processing threshold (could be described as ALL moves cardinal vs. NEXT moves ordinal/sequential), *before* “right and wrong” or even “75% correct” as assessed (as the 25% “wrong” usually doesn’t carry forward past the filters of **constructive** practices).

So why does this difference matter? In arriving at a threshold minimum, the active inference learning agent needs to **reconcile** while also keeping records. That “25% wrong” for example, is actually valuable information (not to be discarded) if **divergence minimization** is one of the stated goals. Now the question becomes “*do I let go of what I predicted wrong because it didn’t affect my pass/fail status, do I let what I got wrong change my aspirations because I haven’t achieved perfection, or, do I look at Right-Wrong as a **proportional measure** from which to make future decisions?*” (more on this shortly). Taking accounts and making reconciliations, is the process of modifications **by and to** which the **updating** of the active inference generative model, evolves. The conventional view of update as build-up, build-forth (Subject Matter Expertise, SME), is now complimented with a Prediction Matter Expert (PME) view of “*what can I as learning agent let go, in order to arrive at a new know?*” as policy selection **to be determined**. Borrowing from Chris Fields’ [Identity Operator presentation](#), PME’s cope better with the undecideability in the frame problem - *what **doesn’t** change as a **result of an action***. Using Chris’ terminology, “circumscribing what I don’t have to worry about”...means “I” can now take my “eye(s)” off of certain contents so as to increase availability for new [to me as agent] contents. Under this condition, the forensics come before, and not just after, a learning episode, making policy selection (π) now one part agent domain, one part external plan designer/niche reducer domain - with All Moves now meaning all of the puzzle pieces are present, and each is connected **regardless** of order application.

Of course, once the differences between legacy systems perspectives and active inference perspectives are held up as the parameterized space, the ability for the learning agent to oscillate between perspectives (i.e. perspective swap as action) becomes available. This oscillating process - first **back**, then forth...and never forth-only - is not uncommon. Agents swap perspectives when pairing science with fiction, active with inference, math with art as **comparative with collective proportional measuring** (as minimum) processing (unit of) analysis.

Which leaves the Institute with a challenge: how do we continue to attract Subject Matter Experts **and** point to the fact that Subject Matter Expertise alone can only take one so far as a navigator in variability retained settings? Another way of putting this could be stated as, as an institute, can we afford to not talk about the gorilla in the room: how we learn (define and refine...and retain) needs a **co-pilot** (what can I let go...to arrive at a new know?). This being asked as AI and LLM’s train on far more information than humans can, to derive that synthesis (here’s your answer!) that defining and refining puts out (outputs).

Let’s look at a real world example already introduced to the officers of the Institute where subject matter expertise attracted agents to the institute, and, the institute had to find a way to help the “experts” let go of what they already know. In this case example, Active Inference has been linked to the process of early childhood education (Montessori programming). Under Montessori philosophy, teacher’s are described as “directors” with a focus on “independent learning.” Comparisons can then be made to other early childhood education approaches. The [Reggio Emilia](#) early learning method holds up their philosophy of teachers roles as “partners” and “guides.”

The question then becomes one of: as the learning agent ages - enters different “grades”, stages and phases of *Updating* as a result of predictive processing (probability now based on **increased temporal depth**) - does the teacher **as** multi-hat wearing director/partner/guide/coach/facilitator still fit the needs of the self-organizing learner going forward? Perhaps, if the learning is organized as an *adventure* as a proxy for **authentic** - where once again authentic is trans-disciplinary *real world experience, real dynamism, real problems*) requiring *practical/pragmatic* (i.e. *action*) *solution(s)*, while **an adventure is a simulation**.

Or, as a PME enabler (**Not** trainer), does the teacher SWAP titles - by **subjecting themselves** to the Identity Operator process - of Teacher **with** Way Finder (navigator), initiating their own perspective exchanging process of self-identifying (minimizer of divergence between their own model, now as minimum(2) dual-state swap able [i.e. Gripper & Gripped - **BY and TO** - simultaneously], with what the niche continually signals) resulting in an SME + PME hybrid triangulating with ANY niche (not just *their subject* specialty)? This would require teachers to both teach and co-learn interchangeably.

As the reader can appreciate, this is a different condition than teachers staying close (closed) to what they know (SME dilemma) and thus self-selecting away from “*what can I let go, in order to arrive at a new know?*” This is where the Institute’s

role as director/partner/guide/coach/facilitator ends, and a co-piloting triangulation exercise (i.e. simulations to actualizations and **Back**) begins.

Going forward, it is the Institute's ambition to make clear that the channel (i.e. gap) between legacy systems developing subject matter experts **and** what we view as new affordances that can be realized when *uncertainty-as-learning-tool* is perceived as a feature - as prediction matter expertise - is a potential *exponentiator* of a learner's predictive capacities within **and beyond** systematized and variability reduced settings. We choose to be partners in this enterprise, as we feel serving in that capacity is closer to co-piloting than co-hosting in a flight simulator. Every organization wonders where the "stay afloat" energy will come from. In our case, we policy select to work with people vested in research with a specialty focus who also want to be able to *generalize* (play in "Scale Free") with higher degrees of confidence when necessary (be a trans-disciplinarian when the niche is open, and variability retained).

Philosophy

Active inference provides a mathematical model of sense-making. Philosophy is the study the components and dynamics captured by these mathematical models. It comprises of a broad literature in philosophy of mind spanning history. As such active inference is not an island but densely connected to other descriptions and mathematical models of sense-making. Each with their own components and dynamics. One such advancement is within the field of neurophenomenology that seeks to build a dialogue between neuronal processes and philosophical constructs as experienced ([Sandved-Smith et al. 2021](#)).

Developing new implementations and applications of active inference benefits greatly from its philosophical context. Theoretical advancement of how to interpret existing phenomena through the lens of active inference is not just to fill shelves with studies. Advancement is essential to improve algorithms and inform applications across domains. After all, there are many domains which have mathematical and conceptual models of sense-making. Each of which could potentially be evaluated through an active inference lens.

Physics

See [🔗 Physics course](#) by Chris Fields, and more references to come.

Robotics

- See 🌟 [Fellows JF Cloutier's project](#), 📄 [Symbolic Active Inference \(project documentation\)](#)
- Second 🕒 [Applied Active Inference Symposium](#) in 2022 had a focus on Robotics, [see program](#).

Legal

Cases mentioning active inference

Patents mentioning active inference

Social

Active inference research in the social domain tends to focus on modeling communication and the sharing of belief models within groups. Such topics can be understood as pertaining to normative processes of group cognition. Over time, we can expect research to extend further to pathological examples of group cognition, assessment of group cognition quality, steering of group cognition to improve quality, evaluation of the cognitive architectures used during group cognition (e.g., rules, policies, computational tools, communication tools, attention mechanisms), and evaluation of group cognition where the group is a political body (such as a city or nation).

Group cognition rests on the communication of (potentially dynamic and evolving) belief models—the internal generative models that individuals use to predict and explain their world—and consensus building with respect to beliefs. As described by [Albarracin et al., 2024](#) for a generic group in the normative setting, “group members can be seen as actively and implicitly aligning their beliefs and expectations through dialogue and interactions, thereby enhancing their ability to predict each other’s actions and intentions, and thereby coming to perceive and act in the world in similar ways.”

Most humans do not conceive of their own beliefs in terms of models, however. Rather, humans tend to experience their beliefs and make sense of the world in part through narratives ([Bietti, Tilston, and Bangerter 2019](#); [Turner et al. 2023](#); [Fanti Rovetta 2023](#); [Cordes et al. 2021](#)). These can be internal narratives that a person constructs, adjusts, and recites to himself or herself, or social narratives that are shared within a group. In the active inference context, [Albarracin et al. \(2021\)](#) consider social scripts, which are widely-supported prescriptions about how one is to behave in various social settings, or what is important in those settings. [Bouizegarene et al. \(2020\)](#) consider shared narratives conceived of more broadly. Social scripts and shared narratives help humans to generate more accurate predictions about the world and to coordinate social behavior.

The [CogNarr Ecosystem](#), an Active Inference Institute project, has as a goal the facilitation of group cognition at scale, through sharing of belief models ([Boik, 2024a](#), [Boik, 2024b](#)). This is an extension of previous work that viewed core societal systems (e.g., economic, financial, and governance systems) as part of the cognitive architecture of political bodies ([Boik, 2020a](#), [Boik, 2020b](#), [Boik, 2021](#))

A large body of active inference research, perhaps thousands of papers, at least mentions the social setting. In addition to some articles already cited, articles in which the phrases “active inference” and “social” appear in the title include the following:

- [Gallagher and Allen, 2018](#). Active inference, enactivism and the hermeneutics of social cognition.
- [Hipólito and van Es, 2022](#). Enactive-Dynamic Social Cognition and Active Inference.
- [Constant et al., 2019](#). Regimes of Expectations: An Active Inference Model of Social Conformity and Human Decision Making.
- [Cheadle et al., 2024](#). Active Inference and Social Actors: Towards a Neuro-Bio-Social Theory of Brains and Bodies in Their Worlds.
- [Kirchner et al., 2022](#). Better Safe than Sorry?-An Active Inference Approach to Biased Social Inference in Depression.
- [Tehrani-Safa et al., 2024](#). Learning Risk Preferences Through Social Interaction: An Active Inference Approach
- [Fox, 2021](#). Active inference: Applicability to different types of social organization explained through reference to industrial engineering and quality management.
- [Bezzazi, 2021](#). Social Active Inference.
- [Ohata and Tani, 2020](#). Investigation of the Sense of Agency in Social Cognition, Based on Frameworks of Predictive Coding and Active Inference: A Simulation Study on Multimodal Imitative Interaction.
- [Matsumura et al, 2023](#). Social Emotional Valence for Regulating Empathy in Active Inference.
- [Solymosi and Schulkin, 2024](#). Creative Resilience. Flourishing and Valuation through Social Allostasis and Active Inference.
- [Tani, 2019](#). Accounting Social Cognitive Mechanisms by the Framework of Predictive Coding and Active Inference: A Synthetic Experimental Study using Robotics Interaction Platforms.

Logistics

“Enhancing Population-based Search with Active Inference” ([Dehouche and Friedman, 2024](#))

Scientific Method

See [≈ Active Entity Ontology for Science \(AEOS\)](#)

Distributed Science - The Scientific Process as Multi-Scale Active Inference ([Balzan et al. 2023](#))

Generative Research Teams: Active Inference Compositions For Research and Meta-Science ([Friedman & Smekal 2023](#))

DeSci

Decentralized Science ([DeSci](#)) was explored in the [Active Entity Ontology for Science \(AEOS\)](#) work.

Discussion and Future Directions

The Active Inference Institute attracts and amplifies the self-organizing abilities of people, thereby potentiating a unique opportunity and a powerful and scalable platform from which to accomplish research and development goals. As members of the Ecosystem, we continue to evolve an understanding and “voice” clarifying who we are, and who we might become, as a collective. In the process of building both an organizational reputation and individual expectations, we are constantly reminded of and inspired by the fact that the object of our research and development work, Active Inference, itself anticipates analysis and integration well beyond systems that are “closed” in time or space (i.e. those constrained to evolve linearly with a beginning, middle, and end as structure). We are interested in modeling, designing, and working with “open” systems, and have sought to cultivate an Ecosystem and larger community that reflects the intrinsic openness and systemic “curiosity” of Active Inference. With additional resources to support the work described in this application, the benefits of these open systems and guidance on future interaction practices consistent with Active Inference can be readily made available across myriad domains.

The Institute's work and community building efforts have always exemplified the benefits of “open” systems, consistent with the insights gleaned from Active Inference research itself. For example, when tracking open system behavior associated with the development and evolution of Active Inference, The Institute might have chosen to place an emphasis on “closing” (i.e. erecting constraints, applying limits, setting conditions, etc.) to simplify the challenge of modeling the space. However, rather than take a closed system (laboratory-centric) approach alone, which might have relegated Active Inference to an isolated academic disciplinary silo, we recognized the benefits that accrue from an “open” approach that invites self-organizers in the broader Active Inference Ecosystem to migrate (the “active” in Active Inference) into programs and participation that best suits their needs and prior experiences. Members of the Ecosystem will continue to encourage and support the opportunities to embrace variation-retained field studies for Active Inference...everywhere.

In the Ecosystem, we recognize that people and entities are explorers, capable of self-organization, motivated and eager to discover, and change agents of Active Inference approaches in the truest sense. By applying and leveraging the collective expertise of our community in preparation, scouting, and wayfinding practices, The Institute aims to continue helping Ecosystem participants to move ideas off-the-bench and into complex real world situations where the interaction environment acts as the ultimate scrutinizer. The resilience, sustainability and responsiveness of biological systems described through Active Inference research suggests that the human and social systems benefits of applied Active Inference framings will enhance the positive impact on the organization and operation of humans, including but not limited to The Institute itself.

To the people already involved in the Active Inference community, the “Ecosystem” isn't just a hypothetical and aspirational future state. Instead, it is the actual current world of interactions among members of the Active Inference community that we inhabit at all times. Active Inference, The Institute and members of the Ecosystem are all focused on dynamically adapting the efficiencies of change management practices as we prepare, scout, and “way find” our way into the future with measurable degrees of understanding around confidences, probabilities and the underlying mechanics involved, rather than depending on static plans that are quickly rendered obsolete in times of rapid change. As The Institute and Ecosystem help build competence and confidence in more agents in forms of organization and operation that reflect and apply Active Inference concepts, we will grow the pool of potential first finds (discoveries and inventions) and high-reliability knowledge systems in our world. Cultivating those skills as part of who we are as individuals and in organizations, and sharing those skills with others who are eager to see the future, and to be the future, is more than just an attractor state to guide our actions. It is the core mission of The Institute, Ecosystem, and its participants.

Act. Infer. Serve.

