

BASIS



August 15, 2025

About Basis

Basis is a 501(c)(3) nonprofit applied AI research organization driven by two mutually reinforcing goals. The first is to **build and understand intelligence**. This means establishing the underlying mathematical principles of intelligence independent of any specific problem—what it means to infer, learn, make decisions, understand, and explain—and constructing a new generation of AI software that realizes these principles.

The second is to **advance society’s ability to solve intractable problems**. This means expanding the scale, complexity, and breadth of problems we can solve today, and accelerating our ability to solve problems in the future.

Core Technology

Basis’ core research program is to **build a universal reasoning engine**. To achieve this, we are creating systems for probabilistic and causal reasoning at scale, synthesizing techniques from deep learning, probabilistic modeling, causal inference, and programming languages. Within each research line (see below), we identify foundational problems, develop algorithms to address them, and generalize both the problems and their solutions as broadly as possible along relevant conceptual dimensions.

Active Research Lines

MARA – Modeling, Abstraction & Reasoning Agents

Science advances by discovering useful abstractions. MARA operationalizes this insight into software agents. Instead of passively absorbing data, MARA agents propose hypotheses, run physical or simulated experiments, and revise models of the world until a compact, coherent theory emerges. Early results show MARA systems solving previously withheld (ARC) Abstraction and Reasoning Corpus tasks; widely considered among the hardest AI benchmarks today. The next internal release will include a benchmark suite to evaluate ‘open-world’ scientific progress, alongside theory and algorithms enabling agents to perform all key MARA tasks.

Purpose

A domain-general agent that *does* everyday science: it designs experiments, builds abstract causal models, and uses them to act.

Leads

Kevin Ellis, Zenna Tavares

Phase

Year 1 of 3

Collaborators

Cornell University, MIT

Collaborative Intelligent Systems

This research line brings the mathematical clarity of probabilistic and causal reasoning to the messiness of social behavior. Current work focuses on groups of animals foraging in groups, including NYC rats, and multi-species groups of birds in Arctic Alaska. We are building a computational toolkit for understanding social behavior. Given high-resolution tracking of animal behavior, what can we infer about their values? Can we decipher what they are saying? Communicate with them? Learn how their strategies adapt in dynamic urban environments?

R-ADA – a Rational Automated Design Agent

R-ADA aims to automate robotics, codesigning robot morphology (hardware) with controllers (software). We are treating the robot design as a sequential decision process, akin to human designers. A multimodal reasoning system designs robots as CAD programs, deploying both tools (e.g. FEM analysis) and internal world models, to understand what changes it should make and why. Candidate robots are evaluated in simulation using cross-morphology meta-policies, efficiently estimating their optimal performance across various tasks. A probabilistic back-end updates its understanding of the physics gap with every real-world test. The payoff is a pipeline to quickly design optimal robots tailored to specific tasks, on the fly.

Our Cities

While cities grow organically, the policies and decisions that shape their growth are often made using brittle or inflexible frameworks. We fuse diverse data sources—including transit feeds, zoning regulations, and eviction records—into a unified probabilistic framework, enabling counterfactual evaluation of policy interventions. The initial alpha predicts changes (demographic, economic, etc.) at the block level both into the future and retroactively into the past. We are building partnerships with municipalities to deploy these tools in real-world urban policy decision-making.

Purpose

Toolkits and theory for groups of animals, humans & AIs to reason, learn and decide *together*—scaling cognition through cooperation.

Leads

Emily Mackevicius
Dmitry Batenkov, Rafal Urbaniak

Phase

Prototype libraries

Collaborators

NYU, UCSD, Max Planck Institute of Animal Behavior

Purpose

End-to-end co-design of robot morphology *and* controller, guided by Bayesian reasoning and simulation-to-reality inference.

Leads

Tim Cooijmans, Zenna Tavares

Phase

Year 1 of 3

Collaborators

ARIA (UK), Shadow Robot, VSim

Purpose

City-scale causal twins that let planners ask “what if?”—and get quantitative, uncertainty-aware answers.

Leads

Jack Feser, Rafal Urbaniak

Phase

Alpha prototype

Collaborators

Andy Cantu (NYC Dept. of City Planning), Census Bureau

In Development

Spectre

Imagine lining warehouse walls with modular tiles, capable of conjuring reconfigurable robots seemingly from thin air. *Spectre* scales recent acoustic-levitation breakthroughs 100×, coupling AI-assisted wave-field design with modular transducer hardware. If successful, a single installation could alternate between delicate biotech handling at dawn and heavy-duty pick-and-place by noon, with only a software reload in between.

Aim

A room-scale robotics platform whose "body" is formed entirely of phased-array ultrasound—software-defined, contact-free actuation.

Status

Pre-proposal

Laboratory of the Hypothetical

The **Laboratory of the Hypothetical** will expand society's imagination about what's possible with current and emerging technologies. The Lab will assemble researchers with filmmakers, game designers, and storytellers to collaboratively prototype artifacts of the future. Outputs—including short films, physical prototypes, and speculative devices—will stimulate novel technical questions and gauge societal resonance long before practical deployment.

Aim

A creative engine where scientists, artists and engineers prototype "artifacts of the future"—stories, interfaces, physical prototypes—that recycle imagination back into research.

Status

Concept stage; partner discussions under way