Summer School 2026

Monday, 20 July 2026 - Friday, 24 July 2026

Tagungszentrum Historische Sternwarte

Scientific Programme

The summer school will consist of a number of theory talks, hands-on workshops, poster sessions, and lots of space for discussion with our participants and speakers.
Georg Loewenstein:
Talk: Three Decades of Intermittent Information-gap Research

In a 1994 review of the literature on curiosity, I proposed an account of curiosity based on the concept of an "information gap." In this talk, I will discuss different lines of research I've pursued since then that have emanated from the initial paper, including a formal model of information gaps that Russell Golman and I developed and have applied to different domains of judgment and decision making.
Alejandro Sánchez-Amaro:
Talk: Curiosity in Primates

Curiosity—the intrinsic motivation to seek new information—plays a central role in human learning. But to what extent is this drive shared with other primates? In this talk, I present a comparative overview of recent advances in the study of curiosity across non-human primate species, with a special focus on great apes. The goal of this talk is to examine how different paradigms used to study curiosity—such as novel food and object exploration, preferential tasks (e.g., social information versus reward), and risk-taking tasks (uncertain versus certain outcomes)—relate to ecological pressures, social structure, and individual and species differences. I will further argue that curiosity plays a foundational role across other key domains in primate cognition, including culture, cooperation, and theory of mind, by shaping individuals' motivation to seek, attend to, and use information in both social and non-social contexts. Importantly, I will place these findings in a broader comparative framework by drawing parallels with developmental studies in human children, where curiosity has been extensively investigated as a driver of learning and exploration. By integrating insights from both human and non-human research, this talk aims to highlight shared mechanisms as well as key divergences in how curiosity emerges and is expressed across species and developmental stages.

Finally, I will expand beyond primates to consider evidence of curiosity-like behaviours in other taxa, exploring whether common traits—such as information-seeking, exploration of novelty, and sensitivity to uncertainty—can be identified across species.
Workshop:

This interactive workshop explores curiosity in animals through the lens of comparative psychology, with a particular focus on primates such as the bonobo and the chimpanzee. We will move from conceptual discussions to hands-on research activities, learning how curiosity can be systematically observed, defined, and measured. The workshop will begin by introducing curiosity as a motivational and cognitive process linked to exploration, learning, and innovation in line with the previous talk. Participants will then engage with core methodological tools used in behavioural research, including the development of ethograms and the application of different observational sampling techniques. A central component of the workshop involves practical observation sessions using video data, where participants will record and analyse behaviours associated with curiosity, assess inter-observer reliability, and reflect on sources of bias. They will also design simple experimental paradigms to investigate curiosity, considering key variables and predictions. By the end of the session, participants will have a deeper understanding of the challenges involved in measuring internal states in non-verbal species, as well as the broader implications of curiosity for animal cognition.
Mehdi Khamassi:
Talk: From reinforcement learning to world models: computational accounts of learning and curiosity

Reinforcement learning (RL) provides a powerful computational framework to explain how animals adapt their behavior through trial and error. In particular, RL models formalize how learning can be driven by reward prediction errors and have been highly successful in accounting for a wide range of phenomena from the conditioning literature, including Pavlovian and instrumental learning, extinction, and generalization. These models also offer a principled interpretation of dopaminergic activity as a teaching signal for updating stimulus–action associations.

However, purely associative, model-free accounts are often insufficient to explain more flexible, goal-directed behaviors. Extending RL with world models—internal representations of action–outcome contingencies and environmental structure—enables agents to go beyond reactive behavior and support planning.

Such model-based mechanisms relate to cognitive maps and enable curiosity-driven exploration by allowing agents to evaluate uncertainty and information gain. Within this perspective, phenomena such as hippocampal replay can be interpreted as internal simulations supporting planning and exploration.

Overall, this framework provides a unified account linking conditioning, decision-making, and curiosity, while offering bridges between neuroscience, psychology, and artificial intelligence.
Workshop: Curiosity and information gain in model-based reinforcement learning: a hands-on grid-world lab

This hands-on workshop introduces participants to computational mechanisms of curiosity through the lens of information-gain driven exploration in model-based reinforcement learning (RL). In contrast to purely reward-driven behavior, curiosity can be formalized as the drive to reduce uncertainty and acquire informative experiences.

Participants will work with a simplified grid-maze simulation inspired by rodent navigation tasks, in which an artificial agent learns both a cognitive map of the environment and strategies for exploration. Through guided exercises, we will explore how agents can use internal world models to evaluate not only expected rewards, but also the expected information gain of actions.

The workshop will illustrate how model-based RL enables planning under uncertainty, supports efficient exploration, and accounts for behavioral and neural phenomena such as cognitive maps and hippocampal replay. We will also discuss how these mechanisms relate to intrinsic motivation and curiosity in both biological and artificial systems.

Depending on the format, participants may interact with pre-implemented simulations or explore simplified computational models. The emphasis will be on developing strong intuitions about how curiosity-driven exploration can be formalized and applied across neuroscience, psychology, and artificial intelligence.
Kou Murayama:
Talk: Curiosity in Psychology

In recent years, interdisciplinary research on curiosity has surged, exploring how individuals naturally pursue knowledge without external incentives. However, this growing field has largely overlooked the extensive research on interest development in educational psychology. This talk presents a unifying conceptual perspective, the reward-learning framework of knowledge

acquisition (Murayama, 2022), which bridges these previously separate areas. The framework posits that knowledge acquisition acts as an intrinsic reward, reinforcing information-seeking behaviors through a reward-learning process. Importantly, this process can establish a positive feedback loop that sustains and amplifies information-seeking over time. This perspective offers a compelling explanation for how momentary curiosity can evolve into a long-term inclination for knowledge (interest), which we often observe in real-life settings. This perspective also underscores the need to integrate semantic sense-making processes into decision-making models.
Workshop Abstract: From Research Questions to Research Proposals—Designing Curiosity Studies

In this hands-on workshop, participants will collaboratively develop concrete research proposals on open questions in curiosity research. After an initial discussion of the big research questions in the field, small groups will design a proposal for either a systematic or scoping review, a registered report using existing behavioral data, or a registered report involving new data collection. Through iterative discussion within and across groups, proposals will be refined with the goal of producing work that could lead to publication. Led by **Kou Murayama** (University of Tübingen) and **Mats Abrahamse** (University of Tübingen).
Sebastian Haesler
Talk: Curiosity in Neuroscience

The most fundamental form of curiosity may be found among orienting behaviors. Across animal species, novel or surprising stimuli elicit arousal and evoke sensory inspection and exploration. Research in our lab focuses on understanding the neural mechanisms underlying these novelty-driven behaviors. Our experimental approach involves exposing mice to novel and familiar olfactory stimuli, while monitoring sniffing, facial movements and pupil diameter as quantitative orienting measures. Using chronic large-scale recordings we systematically characterized neural representations in olfactory cortex, oribitofrontral cortex, lateral entorhinal cortex, CA1, and subiculum. We found that the neural representations of odorant identity and novelty are differentially encoded across brain regions and undergo a progressive transformation along olfactory pathways. Importantly, we did not find evidence for stimulus-invariant encoding of novelty in any recorded areas, which questions the idea the brain computes an abstract “novelty signal”. A second research focus addresses the role of dopamine in novelty□evoked exploration and learning. Challenging current belief, we recently found that dopamine neurons do not respond to an abstract notion of novelty, but are activated by novelty-evoked movements. We further identify the mediodorsal pons as the orienting hub which drives both orienting behavior and dopamine firing. The embodiment principle we uncovered – how salient stimuli drive physiological reactions, exploration and memory formation – may not only help to refine theories of dopamine function but also inform broader reinforcement□learning frameworks in computational neuroscience, artificial intelligence and robotics.
Workshop:

The goal of the workshop is to become familiar with electrophysiological data and inform ideas about how stimulus identity, novelty, familiarity and behavioral variables are represented at the single-unit and the population level in different brain regions. To this end, we will analyse a large electrophysiology dataset collected in our lab over the past years. Using large-scale chronic electrodes, we have recorded single-unit activity from many different brain regions while mice spontaneously respond to novel and familiar olfactory stimuli. By working together in the workshop, we have the opportunity to perform similar analyses across multiple brain regions, allowing for side-by-side comparisons not performed before. Participants are invited to test their own ideas on how representations are transformed between connected brain areas and how they support behavioral responses. In the first half day of the workshop, we will become acquainted with the data structure and processing environment. In the second half, we will then explore the data. The minimal requirements for computer/notebook and software environment will be communicated shortly.

Lani Watson
Talk: Would a more curious world be a better one.

Curiosity often leads us to ask questions. Whether we are curious about the latest images from the James Webb Telescope, the latest results of political polling in the US, or the latest gossip about a colleague who has recently been fired, our curiosity typically finds us asking questions, in our own minds, online, and to each other. Curiosity manifests across a wide range of topics, from the personal to the profound, and questions follow suit. But we rarely stop to think about these questions in any depth; why are we asking these particular questions, are they good questions, should we be asking them at all.
In this talk, I explore the ways in which curiosity can go well and the ways it can be led astray by examining the intellectual virtues and vices of curiosity. I discuss how developing the skill of good questioning is key to cultivating intellectually virtuous curiosity and explore the impact this can have on our individual character and the world around us. Ultimately, we will ask (and attempt to answer) the question: would a more curious world really be a better one.