Three PhDs/Research Associates (all genders) - Computational Cognitive Science

Prof. Charley Wu invites applications for **three fully funded PhD positions** to join his ERC-funded project, "*C4: Compositional Compression and Cultural Cognition,*" which investigates how principles of **information compression and compositionality** shape human learning and knowledge transmission at three interconnected scales: individual cognition, group collaboration, and cultural evolution. **The deadline is July 8th, 2025 or until filled.**

Each of the three PhD positions will focus on one distinct scale of human learning:

- **Individual Learning**: Investigate how compositional compression influences individual learning processes, including how people structure knowledge across diverse domains such as spatial navigation, music, dance, and cooking. Explore how curriculum effects arise from domain-general principles.
- **Group Collaboration**: Develop formal theories of complementarity in collaborative problem-solving. This position focuses on how individuals with different cognitive representations coordinate and exchange information efficiently, using tools from compositional information theory.
- **Cultural Evolution**: Examine how compositional cognitive structures drive cultural innovation over multi-generational timescales, with a focus on the evolution and transmission of causal theories and structured knowledge.

Please specify in your cover letter which of the three research areas (individual learning, group collaboration, or cultural evolution) best matches your interests and background. Further details about the specific focus of each position will be discussed during the interview process.

Prof. Wu (incoming W3 Professor for Computational Cognitive Science) leads the "Human and Machine Cognition" lab, situated at the intersection of cognitive science and machine learning. Employing rigorous theoretical frameworks and diverse computational methods—including Bayesian modeling, reinforcement learning, program induction, and information theory—the lab investigates foundational aspects of human cognition, learning, decision-making, social interaction, and cultural evolution. Prof. Wu's research is funded by Hessian AI, an ERC Starting Grant, and a LOEWE Start Professorship.

Positions will be based at TU Darmstadt, Germany, with flexible starting dates. Salaries are competitive by U.S. and European standards and commensurate with experience and expertise (German pay scale 75% TV-E13, upgradable to 100% after 3 months). The working language of the lab and broader academic community is English; fluency in German is not required, though the university provides free German language courses for interested scientific staff. For more information on Dr. Wu's research group, see: hmc-lab.com

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About us:
TU Darmstadt stands for excellent and relevant science. We shape far-reaching processes of global change—from energy transition to artificial intelligence—through outstanding scientific knowledge and innovative academic programs. Our cutting-edge research focuses on three fields: Energy and Environment, Information and Intelligence, Matter and Materials. With strong ties to the Frankfurt Rhine-Main metropolitan region (~18 mins to Frankfurt HBF by train), we have an exceptionally international orientation and actively support European integration.

About our department:
TU Darmstadt is one of Europe's leading institutions in cognitive science and artificial intelligence (csrankings.org), bringing together interdisciplinary research on cognition through the Centre for Cognitive Science and intelligent systems as a member of the European Laboratory for Learning and Intelligent Systems (ELLIS). The department provides a vibrant, inclusive research environment and encourages extensive collaboration with leading cognitive science and AI researchers, both locally (via the Hessian AI Center) and internationally.

Your profile:

- Master's degree (or equivalent) in cognitive science, computational neuroscience, psychology, artificial intelligence, or a closely related field
- Strong analytical skills and experience with mathematical modeling or computational cognitive science
- Proficiency in programming (e.g., Python, R, MATLAB)
- Motivation for rigorous scientific research and creativity
- Strong written and spoken English; German proficiency is not required

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Your tasks:

Key Responsibilities (shared across all positions):

- Design and implementation of experiments tailored to the scale of learning under investigation
- Development and application of computational models using methods from Bayesian modeling, information theory, and program induction
- Analysis and interpretation of behavioral, interactional, and/or cultural data
- Preparation of scientific manuscripts and conference presentations
- Active contribution to the dissemination of research results at international conferences
- Supervision or mentoring of student assistants

Project-Specific Focus Areas

- **Individual Learning**: Conduct cognitive experiments to test how compositional compression and curriculum structure influence learning across domains such as navigation, music, dance, and cooking.
- **Group Collaboration**: Investigate collaborative problem-solving by designing interaction-based experiments and applying techniques like partial information decomposition and synergy analysis to model group complementarity.
- **Cultural Evolution**: Run cultural transmission experiments (e.g., transmission chains) and analyze large-scale text corpora using program induction and large language models to study the evolution of causal and compositional knowledge structures.

We offer:

TU Darmstadt offers varied and challenging assignments, freedom to work independently, the latest technologies, good collaboration between colleagues in partnership, needs-based training opportunities and customized personnel development.

The fulfillment of the duties likewise enables the scientific qualifications of the candidate.

- Development and organisation – comprehensive in-house training offers, including the opportunity for continuing education and development;
- Annual leave/educational leave – 30 days annual leave (full-time employment) and 5 days educational leave;
- Sustainable and mobile – eligibility to free public transport in the state of Hesse with the LandesTicket Hessen (Hesse StateTicket) in accordance with the currently valid collective agreement, in addition to opportunities to working mobile at times;
- Fit and healthy – free of charge preventive medical check-ups and a wide-ranging subsidised sports programme
- Work-life balance – flexible working time models, plus BGM (*Betriebliches Gesundheitsmanagement* – University Health Management);
- Pension scheme – supplementary public service pension scheme (VBL) in accordance with the currently applicable regulations;
- University bicycle

- Family-friendliness/compatibility of family/care/career – (university-run) childcare services, child allowance (based on the collective agreement), childcare programmes during school holidays

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General information, data privacy:

TU Darmstadt intends to increase the number of female employees and encourages female candidates to apply. In case of equal qualifications, applicants with a degree of disability of at least 50 or equal will be given preference. Remuneration is in accordance with the collective agreement for the Technical University of Darmstadt (TV - TU Darmstadt). Part-time employment is generally possible.

By submitting your application, you agree that your data may be stored and processed for the purpose of filling the vacancy. You can find our privacy policy on our webpage.

Contact:

If you have any questions about this position, please contact Charley Wu (charley[dot]wu[at]tu-darmstadt[dot]de).

Your application should be written in **English** and include a cover letter, CV, masters certificate, graduate transcripts, contact info for 2 references. Most importantly, **include a short research concept** (1-2 pages) detailing your which scale(s) of human learning you are most interested in (individual, group, or cultural), your research interests, expertise, and an explanation for why you are a particularly good fit for the position (references to prior published research and links to public code repositories are appreciated).

Submit your application here: https://www.career.tu-darmstadt.de/HPv3.ApplicationForm/ShortApply/Index/48023

In case of any technical issues please contact Charley Wu with all application materials attached in a single PDF. The **subject of the email** should be "*PhD application for Computational Cognitive Science*"