Ece Kaya, Ph.D.

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RESEARCH PROFILE

I am a cognitive scientist and researcher specialized in rhythm, timing and auditory perception, with interdisciplinary roots in psychology, neuroscience, linguistics, signal processing and music. My work combines behavioral methods, computational modeling, EEG, ECG and physiological signals to study how the body and brain synchronize to the rhythmic structure in the environment, from controlled psychophysics to naturalistic, multimodal settings.

EDUCATION

Ph.D. — Psychology 2020 – 2024

Maastricht University, The Netherlands

Thesis: *Individual differences in oscillator properties and rhythmic entrainment*

Supervisors: *Molly Henry · Sonja Kotz*

M.A. — Cognitive Science (Psychology & Linguistics) 2015 – 2019

Bogazici University, Istanbul, Turkey

Thesis: *In search of language-based factors influencing rhythmic grouping*

Supervisors: *Esra Mungan · Pavel Logacev*

B.A. — Psychology 2009 – 2014

Ege University, Izmir, Turkey

WORK EXPERIENCE

Postdoctoral Researcher — Havenith & Schölvinck Lab May 2024 – Aug 2026

Ernst Strüngmann Institute (ESI) of the Max Planck Society Frankfurt am Main

"A Comprehensive Neuropsychological Test of Breathwork as a Tool for Trauma Processing and Mental Well-being" — Funded by Tiny Blue Dot Foundation

Neuroscience

- Designed and built a multimodal data acquisition laboratory from scratch, integrating 64-channel passive EEG, ECG, respiration, audio and video with a custom triggering and synchronization system
- Ran most of the data collection for a 48-session study (5-hour sessions) combining physiological recordings with questionnaires, motor tasks and interviews with timestamped video annotations
- Coordinated the Frankfurt site of a collaboration with HU Berlin, harmonized protocols, platforms and ethics
- Contributed to ethics applications, grant reporting, GDPR-compliant data handling
- Developed a custom ECG R-peak detection pipeline for high-noise recordings under heavy breathing
- Developed EEG preprocessing for high-motion data (ICA artifact removal, evaluation of ICLabel)
- Analysed EEG with frequency-domain, aperiodic, complexity and connectivity measures
- Built pipelines that aggregate and synchronize data streams across modalities, including video
- Mentored junior researchers through data collection and analysis

Doctoral Researcher — Neural and Environmental Rhythms Group Sep 2019 – Mar 2024

Max Planck Institute for Empirical Aesthetics Frankfurt am Main

"BRAINSYNC: Brain-environment Synchrony and the Auditory Perception Problem" — Funded by ERC Starting Grant (BRAINSYNC-804029), awarded to M.J. Henry

Cognitive Psychology

- Developed a fast-paced tapping paradigm and a model-based method to estimate individual preferred rate and flexibility of attentional oscillators (Scientific Reports 2022; eLife 2023)

- Built computational oscillator models of rhythm perception and temporal adaptation, with optimization and parameter recovery for individual datasets
- Showed an age-related decline in rhythmic flexibility in studies with younger and older adults
- Built in-lab experimental protocols with precise audio synchronization for tapping paradigms
- Designed and deployed online experiments using jsPsych

Project Assistant Dec 2018 – Sep 2019

Bogazici University Istanbul

"In Search of Influences of Music and Language on Rhythm Perception"

Psychology, Linguistics

- Conducted psychophysics experiments on culture-specific priors in rhythmic grouping
- Completed M.A. thesis on language-based factors in rhythmic grouping
- Collected data for a 15-country cross-cultural study on rhythm priors (Nature Human Behaviour 2024)

Project Assistant Apr 2017 – Jan 2018

Bogazici University Istanbul

"Concepts and Beliefs: From Perception to Action"

Philosophy

- Participated in theoretical discussions on predictive processing and embodied cognition in perception and action
- Assisted in organizing events and journal clubs for the research group

TECHNICAL SKILLS

EEG & Physiological Signals

- EEG analysis — FieldTrip, EEGLAB: spectral, aperiodic, complexity and connectivity analysis
- EEG preprocessing — ICA-based artifact removal, custom pipelines for high-motion data
- ECG — custom R-peak detection pipeline robust to respiratory artifacts, HRV analysis
- Respiration — respiratory signal acquisition and analysis, ECG-derived respiration

Multimodal Acquisition & Synchronization

- Lab building — multimodal acquisition lab (EEG, ECG, respiration, audio, video) built from scratch
- Synchronization — hardware triggering (LabJack), LED-based video synchronization, audio synchronization
- Hardware — Arduino, Raspberry Pi: sensor integration
- Video — FFmpeg, MediaPipe: landmark extraction, frame-drop handling, smoothing
- Real-time systems — MaxMSP, Unity (beginner): biofeedback and audiovisual programming

Analysis, Statistics & Modelling

- MATLAB (primary) — neural and physiological analysis, signal processing, statistics incl. permutation testing, machine learning (MathWorks course)
- Python — video and multimodal time-series analysis
- R — mixed models, Bayesian statistics
- Computational modelling — oscillator models of rhythm perception and attention, optimization and parameter recovery

Experiment Design & Teaching

- Experiment design — PsychoPy, Psychtoolbox: psychophysics and behavioral paradigms, GUI programming
- Online experiments — JavaScript, jsPsych, P5
- Data visualization — Inkscape, Illustrator: scientific figures, interactive plots, illustration, workshop instruction

Audio

- Audio signal processing — Music Information Retrieval (MIR), Praat
- Sound design — Ableton Live, Logic Pro: production, mixing, arrangement, MIDI mapping
- Musicianship — 20 years: vocals, string instruments, percussion, synthesizer

PUBLICATIONS

Kaya, E. (2024). Individual differences in oscillator properties and rhythmic entrainment. [Doctoral Thesis, Maastricht University]. https://doi.org/10.26481/dis.20241113ek

Jacoby, N., Polak, R., Grahn, J., …, **Kaya, E.**, …, McDermott, J. H. (2024). Commonality and variation in mental representations of music revealed by a cross-cultural comparison of rhythm priors in 15 countries. *Nature Human Behaviour.* https://doi.org/10.1038/s41562-023-01800-9

Kaya, E., Kotz, S. A., & Henry, M. J. (2023). A novel method for estimating properties of attentional oscillators reveals an age-related decline in flexibility. *eLife* 12:RP90735. https://doi.org/10.7554/eLife.90735.4

Kaya, E., & Henry, M. J. (2024, preprint). Modeling rhythm perception and temporal adaptation: top-down influences on a gradually decaying oscillator. https://doi.org/10.31234/osf.io/q9uvr

Kaya, E., & Henry, M. J. (2022). Reliable estimation of internal oscillator properties from a novel, fast-paced tapping paradigm. *Scientific Reports*, 12, 20466. https://doi.org/10.1038/s41598-022-24453-6

Mungan, E., & **Kaya, E**. (2020). Some Time Violations Go Less Noticed: Gestalt Grouping? *Timing & Time Perception*, 8(3-4), 350–362.

SELECTED CONFERENCE PRESENTATIONS

Porter, L., **Kaya, E**., Havenith, M. (2026, March) ECG Signatures of High-Ventilation Breathwork: Novel Methods for Assessing Cardiac Dynamics in Altered States. *13th MindBrainBody Symposium 2026, Berlin*

Kaya, E.& Henry, M. J. (2023, October) Individual differences in internal oscillator properties. *3rd Conference of the Timing Research Forum, Lisbon.*

Kaya, E. & Henry, M. J. (2023, August) Modeling rhythm perception and temporal adaptation. *Entrainment Workshop, Oslo.*

Kaya, E. & Henry, M. J. (2023, June) Individual differences in internal oscillator properties. *19th Rhythm Perception and Production Workshop, Nottingham.*

Kaya, E., & Henry, M. J. (2021, July) Individual differences in rhythmic entrainment. *ICMPC16-ESCOM11*

INVITED TALKS & WORKSHOPS

Figure 3.2.1... Publish! Data Visualization from Theory to Practice Jul 2025
3-hour workshop · GRADE Center Brain, Goethe University Frankfurt

Understanding Time and Rhythm through Dynamic Attending Theory Dec 2023
Heinrich-Heine-Universität, Düsseldorf

Estimating Properties of Internal Oscillators Underlying Rhythm Processing Jul 2023
Lunch Talk Series · MPI for Empirical Aesthetics, Frankfurt

TEACHING & MENTORSHIP

- **Workshop instructor:** Data visualization, scientific communication (GRADE Center Brain, Goethe University, 2025)
- **Research training (ESI, 2024–2026):** Trained 7 Master's students and interns in EEG hardware handling, data collection, FieldTrip-based EEG analysis, signal processing and survey analysis

COMMUNITY & SERVICE

- Timing Research Forum — member of the Early Career Researcher committee
- ALS-MND Association, Izmir — member and advocate
- Freiraum Interdisciplinary Arts & Culture Collective, Frankfurt — musician, artist
- EDGE Neuroscience & Art e.V. — member
- Türkiye Blues Association — member, musician

LANGUAGES

Turkish (Native) — English (Full professional proficiency) — German (Conversational, B1 training)