

24 July 2026

To the Scientific Committee of the Institute of Psychology of the Polish Academy of Sciences,

I read and evaluated Sena Bilgin's doctoral dissertation, which comprises three highly interrelated manuscripts (two published and one preprint) and a combined introduction and discussion section that consolidate the motivation for this work and present the results within a common framework to the best extent possible. This composition meets the requirements set by the Polish Academy of Sciences. The candidate is the first author on all the work presented in the doctoral dissertation.

The first paper presents an innovative and direct comparison of temporal error monitoring performance across humans and rats using virtually the same task, which has been recently developed by Dr. Kononowicz. The candidate finds that both species exhibit temporal error monitoring performance; however, rats are more sensitive to current trial-based performance, whereas humans rely more on performance history, reminiscent of a Bayesian agent. Based on this particular observation and the better temporal error monitoring performance of rats compared to humans, the candidate poses a critical question for the field of comparative cognition; namely, whether the task representation is comparable between the two species and addresses this question with appropriate analyses. When the task rule was better matched between species, the candidate found that the observed empirical differences between rats and humans were primarily due to strategy rather than timing processes and temporal metacognitive mechanisms. This paper represents a very elegant approach to comparative cognition in a much-debated domain, that is, performance monitoring. The analyses that have been planned to address the core questions are innovative and appropriate, clearly demonstrating the candidate's

analytical maturity along with their ability to address core ideas with direct evidence. Aligning the threshold between species is a commendable idea.

In the second work, the candidate addresses another core question regarding the information-processing bases of temporal error monitoring, namely, whether subjects track the timing uncertainty or the uncertainty introduced by the sensorimotor system. The candidate poses very clear hypotheses regarding what is expected under these two competing ideas when more motor uncertainty is induced (i.e., disruption of performance if the uncertainty “representation” that drives temporal error monitoring is the timing). Although these are not mutually exclusive possibilities, the paper is duly designed to provide at least qualitative evidence to resolve this question. The data gathered from the experiments have been analyzed in a confirmatory fashion and appropriately. The results, albeit not showing exactly the relative contribution of different sources of uncertainty, support the notion that the timing errors are monitored rather than motor errors. This very finding has a very vital theoretical implication in that the performance observed in many paradigms is truly temporal error monitoring rather than motor error monitoring. These results nicely ground this concept in timing mechanisms rather than other potential processes.

The candidate's last study shifts the approach from a purely behavioural one to an electrophysiological one. The candidate studies the electrophysiological correlates of temporal error monitoring in humans using scalp EEG and shows that temporal error monitoring does not depend on a single oscillatory process but the integration of multiple oscillatory processes. This result resonates well with recent theoretical developments in temporal error monitoring that argue that the related performance does not depend on a single but multiple (at least two clock processes). Although it cannot be directly addressed by the current study, the candidate also addresses the question of whether temporal error monitoring depends on pre-response or post-response processes. The candidate appropriately acknowledges that the multi-band dynamics might be an artifact of insufficient trials to decode the temporal dynamics from a single oscillatory process. This paper represents the pinnacle of the candidate’s Ph.D. research both in terms of theoretical and technical handling.

The doctoral dissertation meets the conditions specified in art. 187 of the Act of 20 July 2018 - Law on Higher Education and Science (Journal of Laws of 2021, item 478, 619, 1630).

Overall, I find that this doctoral thesis well exceeds the expectations from a Ph.D. candidate both in terms of quality and quantity of the work conducted. The candidate has clearly demonstrated their ability and ambition to translate their study outputs into impactful peer-reviewed papers. The journals where the papers have been published or can be published are well-respected in the field. The candidate also demonstrates a great ability to capture a conceptual flow while presenting complex ideas and clearly outlines where their research questions fall with respect to the state of the art. Based on this positive assessment of the doctoral dissertation, I think the current doctoral dissertation can be considered distinguished.

Fuat Balci, Ph.D.



Full Professor

Department of Biological Sciences

University of Manitoba

50 Sifton Road, Office 222

Winnipeg, R3T 2M5, Canada

Phone: +1 204 474-6379

+90 532 474-1190

Email: fuat.balci@umanitoba.ca

Alumni of Global Young Academy

Former Member of Sigma Xi

Editor-in-Chief, Timing & Time Perception