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OCULAR-BASED BIOFEEDBACK TO IMPEDE FATIGUE DURING COMPUTER WORK



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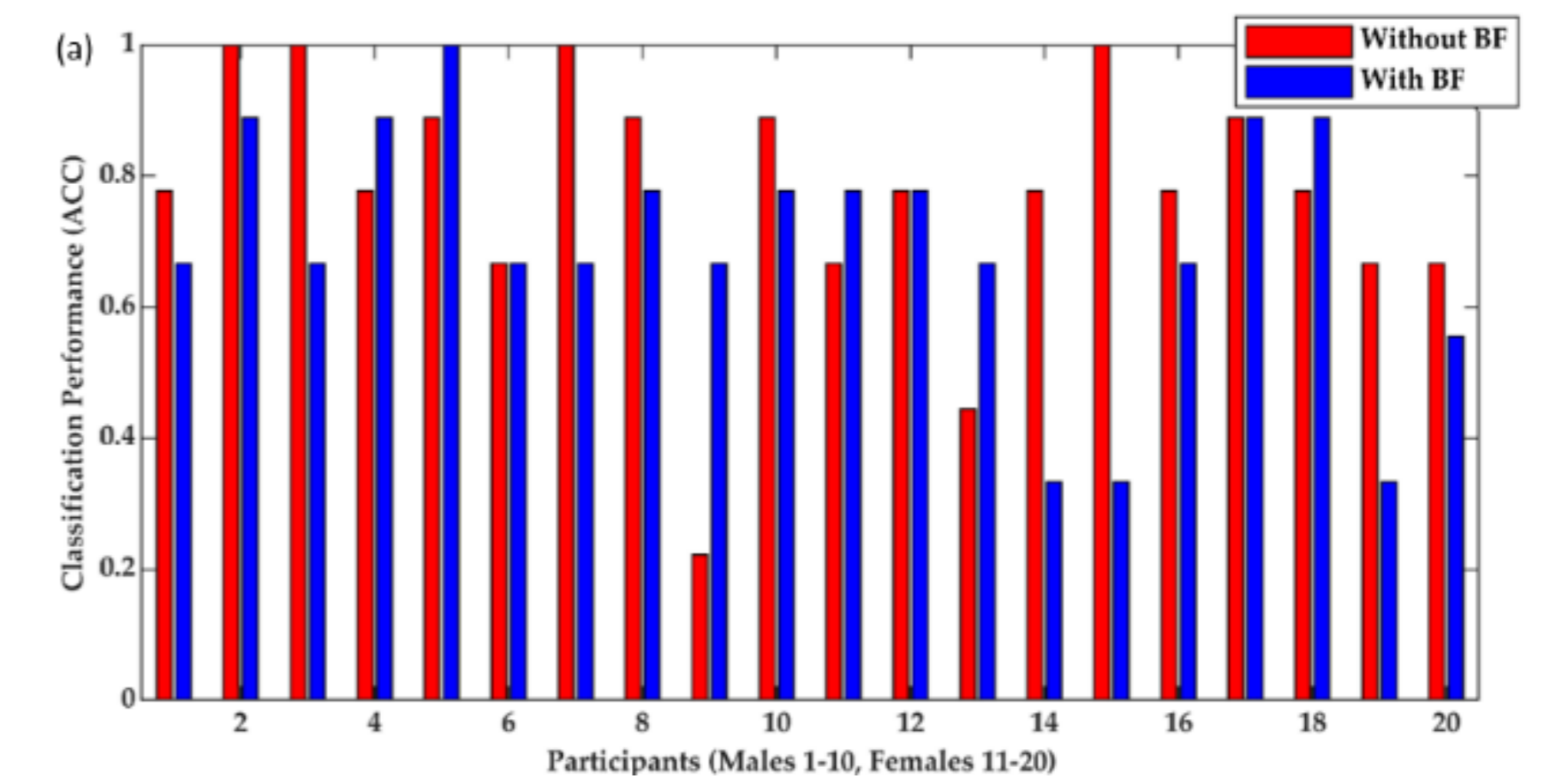
Introduction

- Fatigue may develop due to prolonged mental demands (Ishii et al., 2017).
- A non-pharmaceutical strategy to impede fatigue is to take micro-breaks. Optimized design of micro-breaks including their timing plan is an open research question for productivity. Integration of fatigue-related physiological data may be useful.
- Eye tracking is a relevant modality to detect fatigue which has a potential to be implemented unobtrusively. Eye tracking can be used in a biofeedback system to inform a computer user to adjust their behavior in relation to fatigue to counteract it, for example by taking micro-breaks.

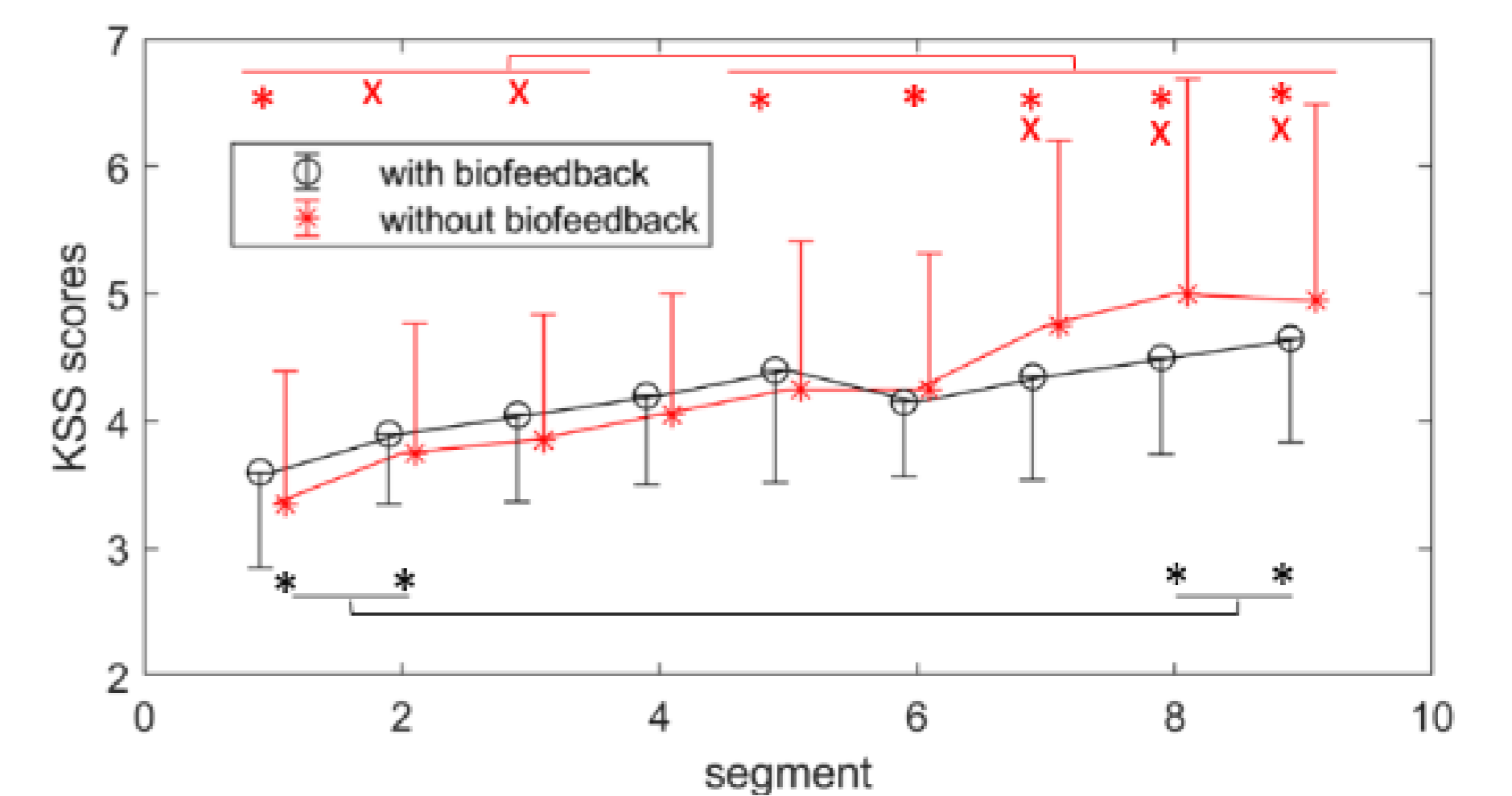
Methods

- Twenty healthy young (10 females and 10 males) aged 18-30 years participated.
- A task consisting of a sequence of cyclic computer operations including memorization, washout and replication was designed (Fig 1.B.). The task was performed for 31-33 min divided in 12x20 cycles separated by 5-s pauses followed by a possible micro-break triggered by a biofeedback system in automatic sessions or manually in manual sessions (Fig 1.A.).
- The perceived level of mental fatigue before and after the task completion as well as the overall performance during the task were acquired.
- Eye movements and pupillary responses were recorded using a head-mounted eye tracker while performing the task.

Results



Fatigue was predicted with approx. 70% accuracy.



Fatigue developed slower in the automatic sessions

Objectives

- To develop a biofeedback system to objectively detect fatigue and provide an individualized timing plan for micro-breaks to impede fatigue during computer work.

Fig 1.A. Biofeedback system

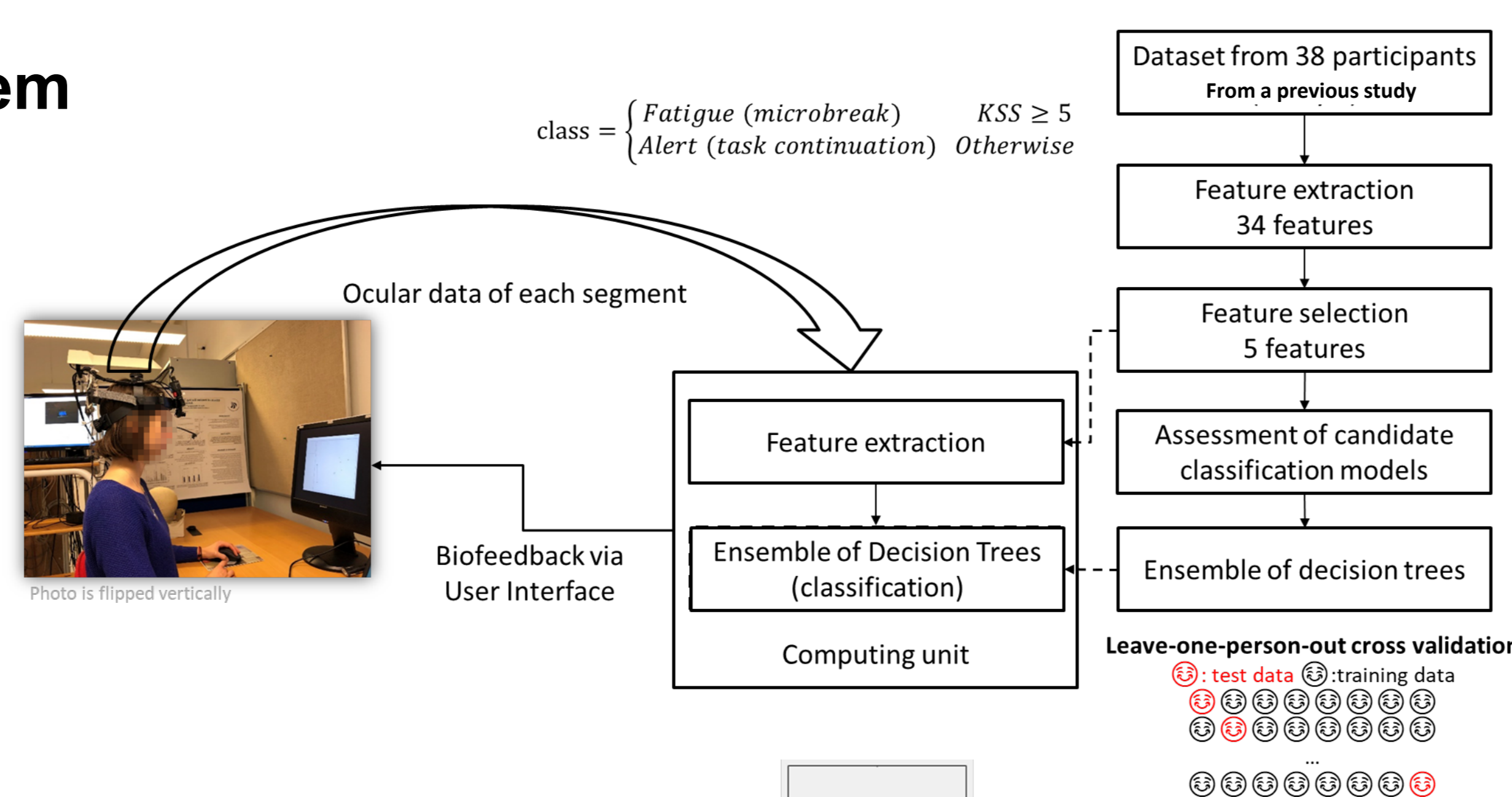
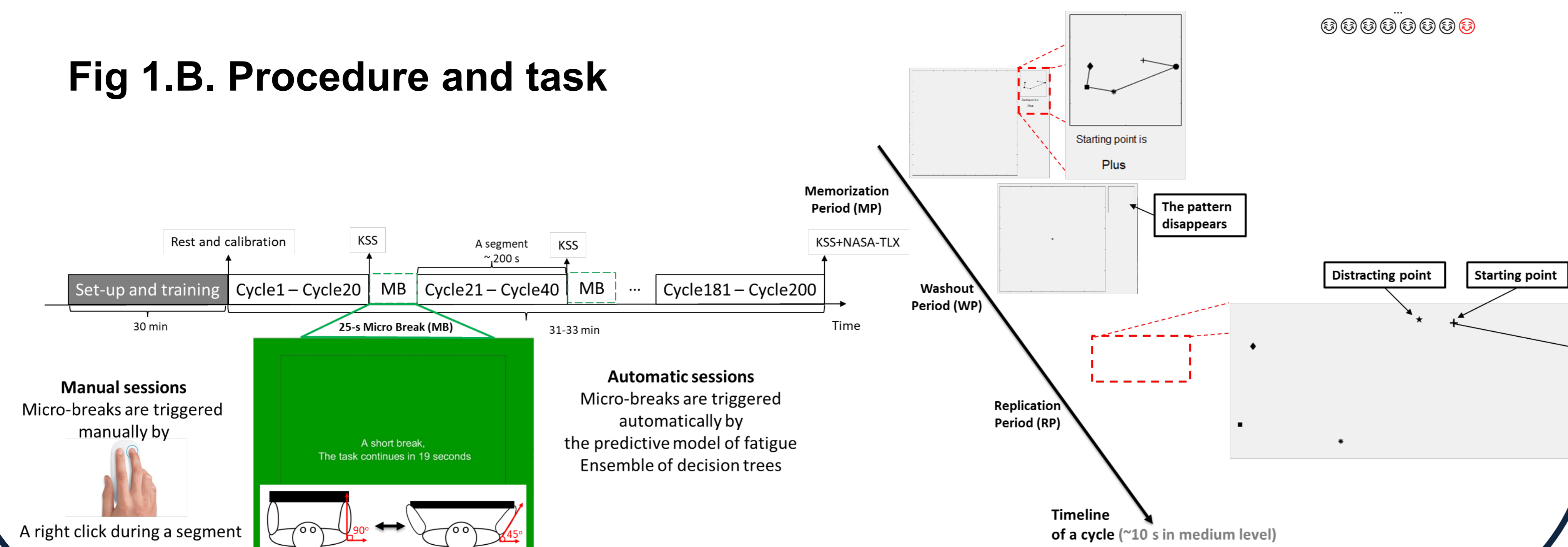


Fig 1.B. Procedure and task



Discussion

Addressed previous shortcomings

- Robust estimation of classification accuracy using leave-one-person-out cross validation
- Computational cost - Low number of features
- Ecological validity - allowed head movements
- Generalizability – no task-specific oculometrics

Future studies may consider

- Feasibility of using mobile or remote eye trackers
- Integration of other modalities and contextual data

Conclusion

- The biofeedback was useful to impede fatigue (A proof of concept) implying an improved timing plan of micro-breaks.
- Oculometrics improve the effectiveness of micro-breaks to reduce workload and impede fatigue.

References

Ishii A, et al.. Evidence for unconscious regulation of performance in fatigue. Sci Rep. 2017;7(1)..

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