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Faculty of Human Sciences

Strukturbereich Kognitionswissenschaften
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**Funding application to SBKW for a
Collaborative Study on “Numbers and Space”**

(Professors Ehlert, Fischer, Kortenkamp, Lonnemann)

We are a multi-disciplinary group of researchers in Golm who are interested in the relationship between spatial and mathematical cognition from the cognitive science, education science, developmental and didactical perspectives. Our group has previously applied for internal funding to support a PhD studentship.

Although our application was unsuccessful, we meet regularly to establish a track record of collaboration that will lead to a joint publication and allow us to successfully apply for external funds (e.g., DFG or BMBF) in the future. Now we plan to conduct a joint study on bi-directional links between mental arithmetic and manual movements.

Based on recent literature we have developed a dual-task involving simultaneous calculation and movement (both recorded on-line). We plan to test at least 60 adults in various versions of this dual-task (different arithmetic tasks and manual movements) to document on-line changes in spatial-numerical associations, as predicted from the recent international literature (citations below).

We require the help of two short-term research assistants for recruitment, testing, and initial data collation. The group members will provide supervision, lab space, lab equipment (e.g., tablets) and assistance during the design and analysis phases of the project. The study will run **from October 2020 through December 2020** and we plan to submit results to peer-reviewed journals.

Bankverbindung:
Landesbank Hessen-Thüringen
Konto-Nr. 711 040 2844
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Karl-Liebnecht-Str. 24/25
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Estimated Budget

Activity	Cost in Euro
2 RAs with experience in conducting experiments (recruitment, testing, analysis (2x3 months, each 8 h/week))	3,262
Participant payment (60 x 8 €/h)	480
Total	3,742

We request a total of **3,742€** as seed funding to support this interdisciplinary activity and look forward to the decision of SBKW.

Martin Fischer

on behalf of all applicants

Example Background Literature for our project

- Cheng, Y.-L. & Mix, K. S. (2014). Spatial training improves children's mathematics ability. *Journal of Cognition and Development, 15*, 2–11.
- Dehaene, S. (1992). Varieties of numerical abilities. *Cognition, 44*, 1–42.
- Felisatti, A., Laubrock, J., Shaki, S., & Fischer, M. H. (2020). A biological foundation for spatial–numerical associations: The brain's asymmetric frequency tuning. *Annals of the New York Academy of Sciences*, in press. doi: 10.1111/nyas.14418
- Fischer, M. H., & Shaki, S. (2018). Number concepts – abstract and embodied. *Philosophical Transactions of the Royal Society B, 373* (1752), 20170125. DOI: 10.1098/rstb.2017.0125
- Fritz, A., Ehlert, A., & Balzer, L. (2013). Development of mathematical concepts as basis for an elaborated mathematical understanding. *South African Journal of Childhood Education, 3*, 38–67.
- Gilligan, K. A., Thomas, M. S., & Farran, E. K. (2019). First demonstration of effective spatial training for near-transfer to spatial performance and far-transfer to a range of mathematics skills at 8 years. *Developmental Science*, e12909.
- Lonnemann, J., Müller, C., Büttner, G., & Hasselhorn, M. (2019). The influence of visual–spatial skills on the association between processing of nonsymbolic numerical magnitude and number word sequence skills. *Journal of Experimental Child Psychology, 178*, 184–197.
- Lourenco, S. F., Cheung, C.-N., & Aulet, L. S. (2018). Chapter 10 – Is visuospatial reasoning related to early mathematical development? A critical review. In A. Henik & W. Fias (Eds.), *Heterogeneity of function in numerical cognition* (pp. 177–210). Academic Press, London, UK.
- Mix, K. S., & Cheng, Y. -L. (2012). The relation between space and math: Developmental and educational implications. In J. B. Benson (Ed.), *Advances in child development and behavior* (Vol. 42, pp. 197–243). New York, NY: Elsevier.
- Werner, K., Raab, M., & Fischer, M.H. (2019): Moving arms: The effects of sensorimotor information on the problem-solving process. *Thinking & Reasoning, 25*, 171-191.
- Wohlschläger, A., & Wohlschläger, A. (1998). Mental and manual rotation. *Journal of Experimental Psychology: Human Perception and Performance, 24*, 397–412.

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