

What is the Impact of AI-Adaptive Sensory Environments on Child Behaviour and Cognition?

Supervisors: Dr Virginia Carter Leno & Professor Denis Mareschal

Background and Proposed Work

AI-assisted technologies are being developed to allow real-time adjustments of sensory environments for children and young people with sensory sensitivities (e.g., <https://shorturl.at/2YvLI>). However, the mechanisms by which these could support educational engagement and cognitive development are not well understood.

This project will combine cutting-edge virtual reality (VR) technology, psychophysiological measurement and AI-informed algorithms to test whether sensory adaptive cognitive paradigms promote learning and engagement. The core question is whether cognitive tasks that use AI to adapt to children's arousal level and consequently alter the immediate sensory environment are advantageous for cognitive outcomes. Alongside clear clinical and educational implications, this project will interrogate long-standing theoretical accounts on the role of sensory input, arousal and regulation in how children interact with their local environment.

The PhD candidate will lead on developing the VR-arousal adaptive system, and testing how real-time task adaptation to sensory arousal impacts engagement and performance in pre-school children (~4-6 years) with varying levels of sensory sensitivities. Training will be provided in VR technology, physiological measurement, cognitive assessment and development theory.

You will join the project at its earliest stages, with ample opportunity to contribute to the design and direction of planned studies. The candidate will work independently and in collaboration with other members of Dr Carter Leno's group (<https://www.indielablondon.co.uk>). You will also join and be expected to contribute to a thriving research community at the Centre for Brain and Cognitive Development at Birkbeck, and will be encouraged to take part in research networks within the department and at other institutions nearby. Being based at the Toddlerlab offers extensive opportunities for training in theory and innovative methods at an internationally recognised centre of developmental science.

Key References

- Ben-Sasson, A., Carter, A. S., & Briggs-Gowan, M. J. (2009). Sensory over-responsivity in elementary school: Prevalence and social-emotional correlates. *Journal of abnormal child psychology*, 37(5), 705-716.
- Jung, Zbozinek, Cummings, Wilhelm, Dapretto, Craske, Bookheimer, Green (2021). Associations between physiological and neural measures of sensory reactivity in youth with autism. *J Child Psychol Psychiatry*. 1183-1194. doi: 10.1111/jcpp.13387.
- Khazaei, Amin and Faghieh. (2021) "Decoding a Neurofeedback-Modulated Cognitive Arousal State to Investigate Performance Regulation by the Yerkes-Dodson Law," 2021 43rd Annual International Conference of the IEEE

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10.1109/EMBC46164.2021.9629764

- Yerkes, & Dodson. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology & Psychology*, 18, 459–482.
- Zentall, & Zentall. (1983). Optimal stimulation: a model of disordered activity and performance in normal and deviant children. *Psychological Bulletin*, 94(3), 446.

Candidate Requirements

We are looking for a highly motivated candidate who is interested in child development and the role of sensory sensitives on learning and well-being. Candidates are required to have a high 2:1 (≥ 65 pass mark) or 1st class undergraduate degree in a psychology, neuroscience or computer science, along with a MSc which included a substantial research component using quantitative data analysis and statistics. The candidate should also have an understanding of theories of the mechanisms and consequences of sensory sensitives and over/under arousal. Candidates should have excellent written and verbal communication skills in English, and be able to work both independently but also be part of and contribute to a broader research team. Publications and/or evidence of scientific dissemination are desirable but not essential.

Given the nature of the project, the candidate should have good programming skills (e.g., in Matlab, Unity) *and* experience collecting data in child populations. We are willing to consider candidates who have either, rather than both, of these two crucial criteria if well justified in the cover letter. As this project is using cutting-edge and novel technology, candidates should be highly organised with strong problem-solving skills.

Applicants should provide a CV and a cover letter via the general Birkbeck PhD application portal ([insert link here](#)). The cover letter should detail why they think this topic is important, give one or more brief examples of how they picture key hypotheses could be tested, and why they are a suitable candidate to complete the project. **The deadline for applications is the 25th May and interviews will be held at the beginning of June.**

This studentship covers PhD tuition fees at *Home level* and provides a tax-free living stipend (comparable to UKRI levels for 2026). International students can apply but if successful, will only be awarded the tuition fees at the UK home fee rate. The PhD will commence in October 2026.

Any informal interest or questions about the post can be sent to Dr Carter Leno at v.carterleno@bbk.ac.uk. Please include a CV in the first instance.