Applied and Computational Mathematics Seminar

Title: One Plus One Sometimes Equals Two: Mathematical Models of Multisensory Integration

Speaker: John Butler (Technological University of Dublin)

Date: Mon 4th April 2022 at 3:00PM

Location: Seminar Room SCN 1.25

Abstract: In order to navigate the world in an efficient manner, the brain seamlessly integrate signals received across multiple sensory modalities. Breakdowns in the combination of sensory (multisensory) processing has been as an indicator of predicted falls in older adults. A number of mathematical models have been used to investigate unisensory decision and reaction tasks, but to date very few have been extended to include multisensory processing. I will present systems of differential equations to model the neuronal and behavioural processes in multisensory tasks. To align with the experimental findings the model includes noise to account for withing participant trial to trial variability and sampling from a parameter space simulates different 'participants'. Our model replicates previous experimental studies showing multisensory improvement of accuracy and reaction time. The simulated 'participant' reaction time and accuracy data were analysed using the Fokker-Planck equation to investigate if the improvement in the multisensory condition was optimal. The minor but significant discrepancies in our predicted and observed data demonstrate that despite reproducing a measured improvement in the multisensory condition, the winner-take all model fails to account for optimal cue combination. Future adaptations of this model will seek to compute the weights associated with true and optimal multisensory integration which has previously only been observed experimentally and

to investigate the breakdown in this integration process that occurs in the aging brain.

More details of John's research can be found at: https://johnsbutler.netlify.app/

https://maths.ucd.ie/ACMSeminars/2122/