Alexander Cates

Ph.D. Candidate

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Personal Profile

My research focus is to understand the neurological function which underlies human motor control and to apply this knowledge to develop novel interventions to improve both motor performance and recovery from neurological injury. Vision is a dominant source of sensory information, guiding movement and influencing motor control strategies, particularly during walking. Individuals with different levels of locomotor abilty (such as elite athletes with more ability or clinical populations with less ability in terms of balance, efficiency, etc.) often display different gaze behaviors. How these differences develop though remains to be understood. My research therefore aims to characterize how the role of vision changes in relation to motor skill and alongside motor learning paradigms. Before starting my PhD at Northwestern, I completed undergraduate research with Dr. Ravi Thiruchselvam at Hamilton college, completing an undergraduate thesis on how individual mood impacts visual perception. I then conducted research at Halo Neuroscience on the mechanisms of motor control and how transcranial direct current stimulation may accelerate or alter motor learning and neuromuscular control in athletic and clinical populations. Since starting my PhD at Northwestern University, I have investigated how training with visual perturbations may improve balance in a clinical population and developed initial investigations to assess how gaze behavior and the value of different types of visual information changes during motor learning both during walking and in an online figer coordination paradigm. These experiences provide me with the necessary skills to achieve both my current research goals and to continue develop novel interventions to improve motor performance and recovery going forward.

Education

Northwestern University

PhD. Candidate, Neuroscience, 2018 - Current

Studying gaze behavior and locomotor learning in healthy and individuals post-concussion under Dr. Keith Gordon

Hamilton College

B.A., Neuroscience (minor Mathematics), 2011 - 2015

Thesis: Beauty is in the mood of the beholder: Positive affect alters the neural responses to facial attractiveness

Society Membership

Society for Neuroscience

Graduate Student Member, Current

American Society for Biomechanics

Student Member, Current

American College of Sports Medicine

Student Member, Current

International Society of Posture and Gait Research

Student Member, Current

Research Experience

PhD Candidate at Human Agility Lab, Northwestern University

2019 - Current

As a Ph.D. Candidate in the Human Agility Lab I am:

- Investigating how the role of vision changes with differing level of motor skill (elite, healthy and clinical populations)
- Using modern eye tracking and 3d motion capture techniques to quantify where participants are looking and modulate what visual information is available to them
- Conducting in person and online based motor learning research trials to assess the role and reliance of vision during the motor learning process.

Graduate Student Researcher at Searle Teaching as Research Program, Northwestern University

2020 - 2020

As a Graduate Student Researcher in the Teaching as Research Program I:

- Used natural language processing to analyze course evaluation comments and relate them to actionable teaching goals, the results of which are currently in preparation for submission.

Senior Research Associate at Halo Neuroscience

2015 - 2018

As a Senior Research associate at Halo Neuroscience I:

- Researched how to use Transcranial Direct Current Stimulation (tdcs) to accelerate motor learning in clinical, healthy, and elite athlete populations
- Designed and ran clinical trials with healthy (average and elite athletes) and clinical (stroke) populations
- Organized and advised independent researchers around the world on the use of neural stimulation, published 1 paper, 3 conference presentations, and 2 grant applications
- Designed a data analytics system to glean customer information from support interactions

Teaching Experience

CIRTL Programming at Northwestern University

2019 - Current

As a Cirtl Practitioner I completed teaching-focused courses through the Center for Integration of Research, Teaching and Learning at Northwestern including:

- Mentored Discussions in Teaching (Winter 2019)
- An Introduction to Evidence-based Undergraduate STEM Teaching MOOC and MCLC (Summer 2019)
- The Searle Teaching as Research program (Spring 2020)
- CIRTL Journal Club (2021)
- Basics of Online Learning and Teaching (Summer 2022)

Lecturer at Northwestern Center for Talent Development

2022 - 2022

As a Lecturer I:

- Designed and delivered guest lectures on motor adaptation and neural plasticity for high school students completing a summer course

Graduate Tutor at NUIN

2021 - 2021

As a Graduate Tutor I:

- led weekly 2 hour tutoring sessions with 2 graduate students focused on a combination of matlab and motor/cognitive neuroscience as part of NUIN 401-3 and NUIN 408

Teaching Assistant at Northwestern University

2020 - 2020

As a Teaching Assistant of 2 graduate level classes I:

- Lead lectures on Matlab programming, Signal Processing, and Data Vizualization
- Designed and conducted review sessions
- Provided course design and grading assistance to the professor

Workshop Leader at NU SPLASH

2020 - 2020

As a Workshop Leader I:

- Designed and taught a workshop on data science for local high school students

Python Workshop Leader at Northwestern University

2019 - 2019

As a Python Workshop Leader I:

- Designed and taught a 3-hour workshop on how to use the python package Pandas to process and analyze different types of data.

Leadership and Service

Student Co-Leader at NUIN Teaching Fellowship

2021 - Current

As Student Co-Leader I:

- Organize applications and matching between fellows and mentors
- Design and lead pedegogy programming to enhance fellow experience
- Build and manage the program's web site.

Graduate Student Member at PTHMS Seminar Series Committee

2018 - Current

As a Graduate Student Member I:

- Help select, invite, and organize speakers for the department's guest lecture series

Graduate Mentor at Graduates mentoring undergraduates

2020 - 2021

As a Graduate Mentor I am:

- Paired with an undergraduate student to provide insight into post graduation experiences including both academic, industry, and non profit options.

Awards

Impact of concussion on gaze behavior during locomotion
Research Training in Sensorimotor Neurorehabitation T32, 2023

Impact of concussion on gaze behavior during locomotion
John N Nicholson Fellowship, 2021

Gaze behavior and walking in individuals with a concussion
ACSM Foundation Doctoral Student Research Grant, 2021

Gaze behavior during locomotor learning
NSF GRFP Honorable Mention, 2020

Publications

Seeing does not mean processing: Where we look and the visual information we rely on change independently as we learn to walk
Experimental Brain Research (in prep, preprint), 2023

Cates A and Gordon K.

Using natural language processing to understand student course evaluations
Assessment and evaluation in higher education. (in prep), 2023

Cates A, Woods L, and Linsenmeier R

Motor learning alters vision, but vision does not alter motor learning: an online sequence learning task
Journal of Neurophysiology. (in prep), 2023

Cates A and Gordon K.

Don't watch your step: Gaze behavior adapts with practice of a targeted stepping task
Journal of Neurophysiology, 2022

Cates A and Gordon, K

TDCS and tinnitus: A meta analytic exploration into efficacy and optimization
MetaRxiv (Preprint), 2020

Cates, A and Davies, E

Positional accuracy of scalp electrodes mounted on a ready-made band targeting motor cortex
Brain Stimulation, 2017

Lin R, Cates A, Bar-Or T, and Wingeier, B

Presentations

Visual reliance changes with sequence and general motor task learning
American Society for Biomechanics, 2022

Cates A and Gordon K.

Gaze and Gait: Changes to Gaze Behavior during Locomotor Learning

Smith Kettlewell Eye Research Institute (Talk), 2022

Cates A

The role of feedback and feedforward visuomotor control during locomotor learning

International Society of Posture and Gait Research , 2022

Cates A and Gordon K.

People value feedback visual information less after sequence learning

Society for Neuroscience (Poster), 2021

Cates, A. and Gordon, K

Vision and walking: How reliance on feedback and feedforward visual information changes during locomotor learning

Society for Neuroscience (Talk), 2021

Cates A, Dembsky J, and Gordon K

Removing feedforward visual information affects performance but not learning in a sequence learning online task

Visual Sciences Society (Poster), 2021

Cates A and Gordon K.

Gaze behavior changes from step to step based on motor performance during walking

Dynamic Walking (Poster), 2020

Cates, A. and Gordon, K

Gaze behavior changes following motor learning in a gait training task

Neuromatch 3.0 (Talk), 2020

Cates, A. and Gordon, K

Repeated sessions of transcranial direct current stimulation (tDCS) with vertical jump training improves vertical jump performance in elite athletes

North American Neuromodulation Society (Poster), 2019

Cates A, Lin R, Mayberry A, Clark R, Chao D, Taylor T, Stray-Gundersen J, and Wingeier B

Effects of transcranial direct current stimulation over the motor cortex on isometric rate of force development

NANS Summer Series (Poster), 2018

Lin R, Cates A, Bar-Or T, and Wingeier B