RESEARCH PROJECT PROPOSAL

Project aims, background, methods, and use of funds (1 page, project quality and innovation 50%): This project aims to understand mechanisms through which loneliness inhibits prosociality, feeding into a problematic feedback loop that exacerbates loneliness through lost social connections.

The problem of loneliness: Loneliness is an epidemic increasing in severity. Among university students, studies suggest approximately 60% to 70% of students report feeling lonely at some point during their college experience. A survey conducted by the American College Health Association in 2021 revealed that nearly 40% of students felt so lonely that it affected their academic performance. Students experience heightened feelings of loneliness due to factors such as academic pressure, social transitions, and living away from home (Buchanan et al., 2020). Loneliness is linked to increased risk of anxiety, depression, low self-esteem, and unhealthy coping such as substance abuse (Eisenberg et al. 2009; Floyd et al., 2019).

Facets of loneliness: This work will examine the multidimensional construct of loneliness by exploring three distinct facets: existential, social, and emotional loneliness. *Existential Loneliness* refers to a deep sense of isolation that arises from the human condition itself, characterized by feelings of meaninglessness and disconnection from oneself and the world. This type of loneliness often transcends social relationships (Helm et al., 2020; Yalom, 1980). *Social Loneliness* focuses on feelings of isolation that stem from a lack of meaningful connections and friendships within social networks. This type of loneliness is particularly prevalent in university students, often affecting their mental health and social development. *Emotional Loneliness* encompasses feelings of isolation that arise from a lack of close emotional attachments, such as with a romantic partner. This can lead to significant distress, particularly in young adults for whom forming close emotional and romantic bonds is developmentally salient.

Empathy and Theory of Mind: Empathy and Theory of Mind (ToM) are distinct yet interconnected sociocognitive constructs. Empathy refers to the ability to share and understand the emotions of others, whereas ToM involves the ability to recognize that others have thoughts, beliefs, and intentions that differ from one's own. Individuals who experience chronic loneliness may become less attuned to the emotions and needs of others, leading to decreased empathy (Cacioppo et al., 2010). Lonely individuals also often exhibit deficits in ToM, making it more challenging for them to interpret social cues (Meyer et al., 2013). Reduction in empathy and ToM can create a problematic feedback loop, whereby diminished social connections further exacerbate feelings of loneliness, hindering social skills and emotional understanding (Holt-Lunstad et al., 2015; Gordon et al., 2018). Empathy and theory of mind can also influence each other. A strong theory of mind can enhance empathy by enabling individuals to grasp the emotional states and needs of others. Conversely, empathy may motivate social interactions, thereby strengthening theory of mind and providing an alternative resilience pathway.

Prosociality: Loneliness often results in decreased prosocial actions because lonely individuals may become more self-focused (Cacioppo & Patrick, 2008). Self-focused withdrawal is pronounced in situations where social connection is needed, as lonely individuals may feel less confident in their ability to form relationships (Gouin et al., 2010). Conversely, some studies suggest loneliness can motivate seeking connection through prosocial actions (Bénabou & Tirole, 2006).

Methods: The study will examine loneliness, empathy, ToM, and prosociality using self-report questionnaires and behavioural measures in a large sample of University students (N=500). The Existential Loneliness Scale, Social and Emotional Loneliness Scale, and UCLA Loneliness Scale, will capture the nuances of existential, social, and emotional loneliness, and general loneliness respectively. The Interpersonal Reactivity Index will assess self-report reflections on empathetic feelings and behaviours. The Theory of Mind Inventory (ToMI) will be used to capture self-report evaluations of understanding others' mental states in various situations. The EmpaToM task (Fig. 1) will be used to measure behavioural indices of empathy, theory of mind, compassion, and prosociality. Participants will also play the Prosocial Reinforcement Learning Task (Fig. 1) to examine computational parameters of learning to obtain rewards for oneself, others, and no one. All measures and tasks will be completed online using jsPsych (a JavaScript library designed for creating and running behavioural experiments in a web browser) and Pavlovia (an online platform designed for running experiments created with jsPsych).
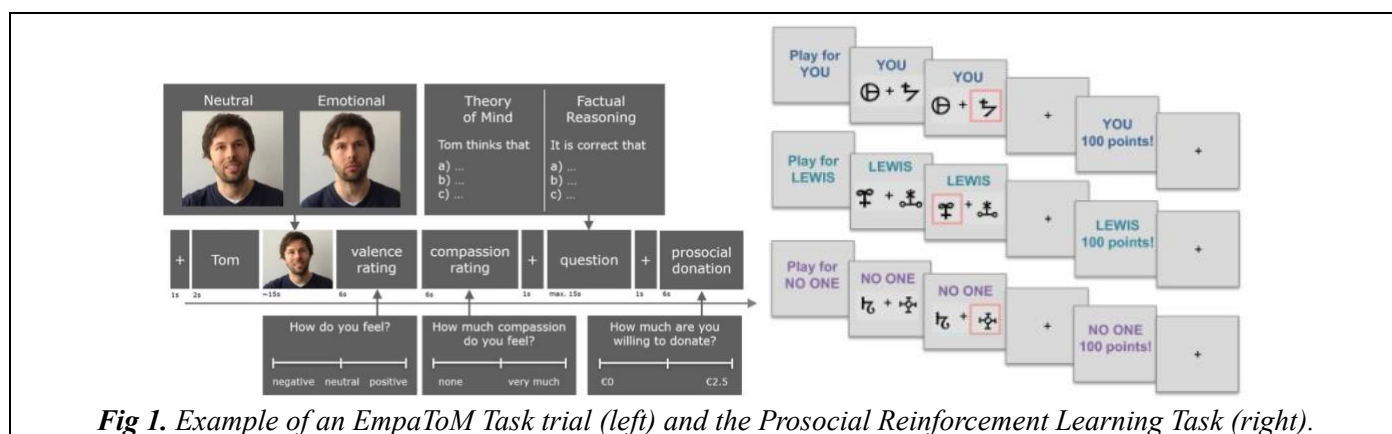
Fig 1. *Example of an EmpaToM Task trial (left) and the Prosocial Reinforcement Learning Task (right).*

Use of funds: Funds will be used for RA support for task coding, data collection, data cleaning and quality assurance, and project management. An RA (cost $49 / hour at level RA.2) is expected to support the project for 10 hours per week over 10 weeks at a cost of 100 hours.

Project benefit/significance (15%): This study has the potential to pave the way in which we characterise prosocial interactions in those with disordered social cognition and will provide potential pathways to halt the detrimental feedback loop through which loneliness is exacerbated. These data will be used as pilot data for larger future grant applications to investigate neural systems underpinning these constructs, providing understanding of cognitive mechanisms facilitating human social interaction.

It remains unclear whether and how loneliness influences prosocial behaviour. This project will contribute considerably to characterizing loneliness among University students, and will examine how different facets of loneliness manifest in social cognition. We will identify mechanisms linking empathy and theory of mind to one another, to loneliness, as well as pathways through which loneliness influences prosocial giving and learning. Prosociality is fundamental for promoting social bonds and buffering against poor mental health, which is often exacerbated during the University years.

By deepening our understanding of the connections between loneliness, empathy, and prosociality, this research will inform targeted interventions to enhance social support systems on campuses. Findings may lead to programs aimed at fostering empathy and theory of mind among students, ultimately contributing to a more connected college environment. Furthermore, insights from this project could influence broader societal approaches to addressing loneliness, highlighting the importance of sociocognitive development to nurturing social relationships thereby enhancing community well-being and mental health resilience.

Feasibility (15%): This project is highly feasible. The tasks are currently being developed in my lab using the publicly available JSPsych platform for online dissemination. I am an expert in JavaScript coding and my lab has extensive experience in successful implementation of these methods. I have access to University students for research participation through the University of Melbourne Research Experience Program at no additional cost. I have submitted an ethics application for this project which is anticipated to receive approval prior to January 2025. I currently supervise 1 postdoctoral scholar, 1 PhD student, 1 Masters student, 2 Honours students, 1 co-advised PhD student, and 10 RAs. I have successfully contributed to large neuroimaging and behavioural research projects and have the resources available to successfully complete these aims.

Applicant capability, relative to opportunity (20%): I am 4 years post PhD (Sept 2020) and am currently a Lecturer and Head of the Affective Neuroscience and Development Lab at University of Melbourne. I have made original contributions to the field of social and affective neuroscience, with 38 peer-reviewed publications, 17 first- 1 senior-author, 25 <4 total authors. Over my career, I have been recognized through receipt of 21 grants/fellowships and 17 competitive awards/honours. I have a strong international reputation, with a FWCI=1.69 and citations in 73 countries. I have substantial additional support through my affiliation with the Brain and Mental Health and Cognitive Neuroscience Hubs at University of Melbourne. Since founding the Affective Neuroscience and Development Lab at University of Melbourne in July 2023, I have been awarded an NHMRC Investigator EL1 Grant and was short-listed for an ARC Discovery Project 2025.

Sarah Tashjian AS4SAN Emerging Research Project Grant Application 2024

Career Disruption Statement (200 words)

I have not experienced a formal career disruption, but my progress was significantly slowed due to the COVID-19 pandemic and startup delays in moving from the United States to Australia. In Sept 2015, I enrolled in my PhD program at University of California Los Angeles (UCLA). The first 14 months consisted of Masters coursework, 50% research. The next 43 months consisted of PhD, 100% research. The last 5 of these 43 months were disrupted due to COVID shutdowns (start March 2020), 50% research. During my PhD, I published 20 papers (11 first author, 19 empirical) from 2015-2020. July 2020, I transitioned to a postdoctoral appointment in affective neuroscience at California Institute of Technology (Caltech). Despite the neuroscience focus of this position, the neuroimaging centre was closed for the first 18 months of my appointment due to COVID shutdowns. However, I still made considerable contributions, publishing 14 papers from 2021-2023 (6 first author, 10 empirical) and received a US National Science Foundation Fellowship. My overall estimated FTE actively spent in research, including during my PhD, is 7 years.

Diversity and Equity Statement (200 words)

I was a first-generation college student from an impoverished background, a mature-age post-graduate student, and am a woman in STEM. Through mentoring and teaching, I am dedicated to increasing the gender balance in science and to empower the next generation of women scientists. Beyond mentoring individuals who have had similar experiences to me, I have also mentored students from different backgrounds. At Caltech, I mentored two students through an immersive 10-week research program for underrepresented individuals pursuing STEM careers. One of these students was a Black American born in Eritrea whose project examined how judgments about racial categorization affect trust and cooperative behavior. (Ghezae, I.†, Tashjian, S. M., Gallo, M., & Camerer, C. F. (under review). Hypodescent and economic trust generalization. †*mentored student author*). At Melbourne, I have built a lab of diverse scholars who examine questions about a range of disadvantaged experiences. For example, I am currently mentoring a Taiwanese-Australian artist on a grant from Diversity Arts Australia to produce an experimental film, 'Tracing Translations', that integrates migratory narratives with fMRI insights to examine the enduring impacts of immigrant adversities on adolescent development, emotional regulation, and cognitive resilience.

Sarah M. Tashjian

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ACADEMIC POSITIONS

2023-	**Lecturer**	University of Melbourne
2023-2024	**Visiting Associate in Neuroscience**	California Institute of Technology
2020-2023	**National Science Foundation Postdoctoral Fellow**	California Institute of Technology

EDUCATION

2016-2020	**Ph.D.**	Psychology, University of California, Los Angeles, Los Angeles, CA
2015-2016	**M.A.**	Psychology, University of California, Los Angeles, Los Angeles, CA
2007-2010	**Juris Doctor**	Columbia University School of Law, New York, NY
2003-2007	**B.S.**	Psychology, cum laude, University of Florida, Gainesville, FL
2003-2007	**B.A.**	Criminology, cum laude, University of Florida, Gainesville, FL

SELECTED PUBLICATIONS   (FIRST AND SENIOR AUTHOR ONLY)

Google Scholar   h-index=17   i10 index=22   https://scholar.google.com/citations?user=fjfrBiIAAAAJ&hl=en

†*mentored student, ^senior author, *equal author*

Zhang, Y.†, **Tashjian, S. M.**^ (in press). Determinants of economic risk preferences across adolescence. Behavioral Decision Making. Preprint: doi.org/10.31234/osf.io/yvph8

Tashjian, S. M., Wise, T., & Mobbs, D. (2022). Increased model-based control for acquiring protection compared to acquiring reward and avoiding punishment. PLOS Computational Biology, 18, e1010805.

Tashjian, S. M., Fedrigo, V.†, Molapour, T., Mobbs, D., & Camerer, C. F. (2022). Physiological responses to a haunted house threat experience: Distinct tonic and phasic effects. Psychological Science, 33, 236-248.

Tashjian, S. M., Zbozinek, T. D., & Mobbs, D. (2021). A decision architecture for safety computations. Trends in Cognitive Sciences, 25, 342-354.

Tashjian, S. M., & Galván, A. (2021). Frontopolar cortex response to positive feedback relates to non-incentivized task persistence. Cerebral Cortex, bhab317.

Rahal, D.*, **Tashjian, S. M.***, Karan, M., Eisenberger, N., Galván, A., Fuligni, A. J. & Cole, S. W. (2021). Resting parasympathetic nervous system activity is associated with greater antiviral gene expression. Brain, Behavior, and Immunity, 98, 310-316. **equal author contribution*

Tashjian, S. M., Rahal, D., Karan, M., Eisenberger, N., Galván, A., Cole, S. W., & Fuligni, A. J. (2020). Evidence from a randomized controlled trial that altruism moderates the effect of prosocial acts on adolescent well-being. Journal of Youth and Adolescence, 50, 29-43.

Tashjian, S. M., & Galván, A. (2020). Dorsolateral prefrontal cortex response to negative tweets relates to executive functioning. Social Cognitive and Affective Neuroscience, 15, 775-787.

Tashjian, S. M., & Galván, A. (2020). Longitudinal trajectories of post-election distress track changes in psychological and neural functioning. Journal of Cognitive Neuroscience, 32, 1198-1210.

Tashjian, S. M., Guassi Moreira, J. F., & Galván, A. (2019). Multi-voxel pattern analysis reveals a neural phenotype for trust bias in adolescents. Journal of Cognitive Neuroscience, 31, 1726-1741.

Tashjian, S. M., & Galván, A. (2019). Neural recruitment related to threat perception differs as a function of adolescent sleep. Developmental Science, 21, e12933.

Tashjian, S. M., Mullins, J.†, & Galván, A. (2019). Bedtime autonomy and cellphone use influence sleep duration in adolescents. Journal of Adolescent Health, 64, 124-130.

Tashjian, S. M., & Galván, A. (2018). The role of mesolimbic circuitry in buffering election-related distress. Journal of Neuroscience, 38, 2887-2898.

Tashjian, S. M., Goldenberg, D., Monti, M. M., & Galván, A. (2018). Sleep quality and adolescent default mode network connectivity. Social Cognitive and Affective Neuroscience, 13, 290-299.

Tashjian, S. M., Weissman, D., Guyer, A. E., & Galván, A. (2018). Neural response to prosocial scenes relates to subsequent giving behavior in adolescents: A pilot study. Cognitive, Affective, & Behavioral Neuroscience, 18, 342-352.

Tashjian, S. M., Goldenberg, D., & Galván, A. (2017). Neural connectivity moderates the association between sleep and impulsivity in adolescents. Developmental Cognitive Neuroscience, 27, 35-44.

Tashjian, S. M., Goldfarb, D., Goodman, G. S., Quas, J. A., & Edelstein, R. (2016). Delay in disclosure of non-parental child sexual abuse in the context of emotional and physical maltreatment: A pilot study. Child Abuse & Neglect, 58, 149-159.

GRANTS / FELLOWSHIPS	(2020-PRESENT)
2025-2030	National Health and Medical Research Council EL1 Investigator Grant (AUD$674,400)
2024-2025	Melbourne School of Psychological Sciences Research Incentive Scheme (AUD$28,100)
2024-2025	Melbourne School of Psychological Sciences 7T MRI Research Scheme (AUD$16,000)
2024-2025	Melbourne Medicine, Dentistry & Health Sciences Catalyst Grant (AUD$40,000)
2024-2025	Melbourne Medicine, Dentistry & Health Sciences Early Career Grant (AUD$39,485)
2024-2026	Brain & Behavior Research Foundation Young Investigator Grant (NARSAD) (USD$70,000)
2023-2024	Melbourne School of Psychological Sciences Research Incentive Scheme (AUD$30,000)
2023-2024	Melbourne School of Psychological Sciences 7T MRI Research Scheme (AUD$16,000)
2023-2024	Melbourne School of Psychological Sciences Brain and Mental Health Hub (AUD$10,000)
2022-2024	National Science Foundation SBE Postdoctoral Research Fellowship (USD$138,000)
2021-2022	Character Lab (USD$5,000)

COMPETITIVE AWARDS / HONORS (USD$)	(2020-PRESENT)
2024	Friends of Psychology Early Career Award, University of Melbourne ($1000)
2023	Society of Biological Psychiatry Early Career Investigator Travel Fellowship Award ($2000)
2022	Neurobiology of Reward and Decision Making Travel Award ($1060)
2021	Flux Society Diversity Conference Registration Award ($140)
2021	Trainee Spotlight, Flux Society for Developmental Cognitive Neuroscience
2020	Top 10 Most Mentioned Articles Social Cognitive and Affective Neuroscience
2020	Millard Madsen Distinguished Dissertation Award

INVITED TALKS	(2020-PRESENT)
2024	Flux Congress Grant Writing Panel, Baltimore, Maryland
2024	Biological Psychiatry Australia Early Career Research Network Webinar, Melbourne, Australia
2024	Monash University Neurodevelopment Research Program, Melbourne, Australia
2024	Winter Conference in Developmental Psychobiology, Ohau, Hawaii
2023	Melbourne Neuropsychiatric Centre, Melbourne, Australia
2022	Summer School on Affective Neuroscience (Instructor), Leuven, Belgium
2022	Aarhus Workshop on Recreational Fear, Aarhus University, Denmark
2022	Tianqiao and Chrissy Chen Institute for Neuroscience, California Institute of Technology
2022	Motivation & Social Neuroscience Lab (PI: Lockwood), University of Birmingham, UK
2021	SCAN-Unit (PI: Lamm), University of Vienna, Austria
2021	Social Affective Neuroscience & Development Lab (PI: Silvers), UCLA
2021	IBRO-RIKEN Center for Brain Science, Summer Program, Japan
2020	KIND Lab (PI: Michalska), University of California, Riverside
2020	Brain and Cognitive Sciences Colloquium, University of Southern California
2020	Behavioral and Neuroeconomics Group (PI: Camerer), California Institute of Technology
2020	Social & Affective Neuroscience Lab (PI: FeldmanHall), Brown University

SELECTED PRESS	
2024	ABC Radio National
2024	Psychological Science
2022	Daily Mail
2018	The Los Angeles Times
2018	The Washington Post

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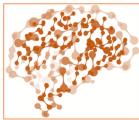**ABN:** 89691582987

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University of Melbourne

Country
Australia

Presenting at the conference?
No

Presenter Status

Dietary Requirements
Vegetarian

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Twitter Handle
@TashjianSM

Workshop 1 Attendance
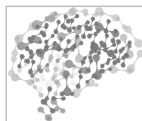
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Workshop 2 Attendance

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Student/ECR Event Attendance

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Dietary Requirements

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