Author/s:
Kumfor, F;Tracy, LM;Wei, G;Chen, Y;Domínguez D., JF;Whittle, S;Wearne, T;Kelly, M

Title:
Social and affective neuroscience: An Australian perspective

Date:
2020-09-01

Citation:
Kumfor, F., Tracy, L. M., Wei, G., Chen, Y., Domínguez D., J. F., Whittle, S., Wearne, T. & Kelly, M. (2020). Social and affective neuroscience: An Australian perspective. Social Cognitive and Affective Neuroscience, 15 (9), pp.965-980. https://doi.org/10.1093/scan/nsaa133.

Persistent Link:
https://hdl.handle.net/11343/252936

Social Cognitive and Affective Neuroscience, 2020, 965–980

doi:10.1093/scan/nsaa133
Advance Access Publication Date: 7 October 2020
Original Manuscript

Social and affective neuroscience: an Australian perspective

Fiona Kumfor[1], Lincoln M. Tracy[2], Grace Wei[1], Yu Chen[3], Juan F. Domínguez D.[4], Sarah Whittle[5], Travis Wearne[6] and Michelle Kelly[7]

[1]The University of Sydney, Brain & Mind Centre & School of Psychology, Sydney, Australia, [2]Monash University, School of Public Health and Preventive Medicine, Melbourne, Australia, [3]Capital Medical University, Department of Neurology, Beijing Tiantan Hospital, China National Clinical Research Center for Neurological Diseases, Beijing, China, [4]Deakin University, School of Psychology, Melbourne, Australia, [5]The University of Melbourne and Melbourne Health, Melbourne Neuropsychiatry Centre, Department of Psychiatry, Melbourne, Australia, [6]University of New South Wales, School of Psychology, Sydney, Australia and [7]University of Newcastle, School of Psychology, Newcastle, Australia

Correspondence should be addressed to Fiona Kumfor Senior Lecturer & Senior Research Fellow The University of Sydney, Brain and Mind Centre, 94 Mallett St, Camperdown, Sydney, NSW, Australia. E-mail: fiona.kumfor@sydney.edu.au

Abstract

While research in social and affective neuroscience has a long history, it is only in the last few decades that it has been truly established as an independent field of investigation. In the Australian region, despite having an even shorter history, this field of research is experiencing a dramatic rise. In this review, we present recent findings from a survey conducted on behalf of the Australasian Society for Social and Affective Neuroscience (AS4SAN) and from an analysis of the field to highlight contributions and strengths from our region (with a focus on Australia). Our results demonstrate that researchers in this field draw on a broad range of techniques, with the most common being behavioural experiments and neuropsychological assessment, as well as structural and functional magnetic resonance imaging. The Australian region has a particular strength in clinically driven research, evidenced by the types of populations under investigation, top cited papers from the region, and funding sources. We propose that the Australian region has potential to contribute to cross-cultural research and facilitating data sharing, and that improved links with international leaders will continue to strengthen this burgeoning field.

Key words: social neuroscience; affective neuroscience; social cognition; social cognitive neuroscience

Introduction

The beginning of the fields of social neuroscience, affective neuroscience, and social cognitive neuroscience can be traced as far back as the case of Phineas Gage (1848) and work by Paul Broca (1878), James Papez (1937), and Paul MacLean (1949) on the limbic system. However, it is only in the last few decades that 'social and affective neuroscience', which encompasses the three aforementioned fields, has truly established itself as an area of enquiry in its own right. Publications from American and European perspectives have pointed to periods of growth in the 1990s in affective neuroscience (Singer, 2012) and the mid-1990s to early 2000s in social neuroscience (Lieberman, 2012). But as of yet, Australia's contribution to this field has not been for-

Received: 22 December 2019; **Revised:** 14 August 2020; **Accepted:** 28 September 2020

Box 1. Abbreviations and terminology

Term	Definition
Social neuroscience	The interdisciplinary field devoted to the study of neural, hormonal, cellular, and genetic mechanisms, and to the study of the associations and influences between social and biological levels of organisation[1]
Affective neuroscience	Associated with a broad family of approaches to understanding the neural basis of emotion within animal models and linking these to studies of human emotion[2]
Social cognitive neuroscience	Examines social phenomena and processes using cognitive neuroscience tools such as neuroimaging and neuropsychology[3]
Australasia	A region of Oceania comprising Australia, New Zealand, New Guinea, and neighbouring islands in the Pacific Ocean
Asia-Pacific	A region consisting of Asia as well as the Pacific rim countries Australia and New Zealand

Note. Based on definitions from [1](Cacioppo and Decety, 2011); [2](Panksepp *et al.*, 2017); [3](Lieberman, 2007).

mally considered. In this paper, we review the history of social and affective neuroscience in Australia, report findings on the scope of current research and consider future challenges and opportunities in the region (Box 1 for a key to abbreviations and terminology used in this review).

In light of this growing field of study, and no local society dedicated to this field of research, the Australasian Society for Social and Affective Neuroscience (AS4SAN) was officially established on 23 September 2015 following a successful Australasian Social Neuroscience meeting held in Melbourne in March 2014. The AS4SAN is a non-profit organisation that aims to promote basic and applied research investigating social and affective behaviour across a wide range of different species using a variety of neuroscience and neuropsychological techniques. The AS4SAN views social and affective neuroscience as an interdisciplinary field devoted to the study of central and peripheral nervous system mechanisms (e.g. neural, hormonal, cellular, physiological, and genetic) underlying social and affective behaviour, in the context of both normal development and functioning and in clinical disorders. In addition to promoting research, the goals of AS4SAN are to: (i) encourage and support student and early career researcher endeavours in the area, at all levels of training; (ii) create contexts in which researchers at all levels of training can interact in both formal and informal ways, and in which interdisciplinary collaborations can be fostered; (iii) demonstrate the considerable applied value of this research area in clinical and community settings; (iv) engage in collaborative endeavours with community partners; and (v) ensure that the translational value of research in this broad area is communicated effectively to the public. While AS4SAN intends to represent the Australasian region (i.e. Australia, New Zealand, and Pacific Islands) with increasing ties with Asia, current membership and committee representatives are largely based in Australia. Therefore, here, we provide an Australian perspective on the history and current trends in social and affective neuroscience.

Recent publications have reviewed the contributions of Europe and the United States to social and affective neuroscience (Lieberman, 2012; Singer, 2012). International societies have also been established to support these growing fields (e.g. Social and Affective Neuroscience Society https://socialaffectiveneuro.org/; The Society for Social Neuroscience https://www.s4sn.org/; and the European Society for Cognitive and Affective Neuroscience https://escaneurosci.eu/). However, the contributions of Australia have been largely overlooked in the literature. Moreover, recognition of regionally specific challenges and strengths of this region to the field is lacking. In 2018, the AS4SAN initiated a survey on social and affective neuroscience research, aimed to collect information about research currently being undertaken. We also examined the output of the region (publications from Australia vis-à-vis the international field) and the funding available for social and affective neuroscience, to better understand the current regional context. Our aim was two-fold: firstly, to highlight how Australia is contributing to social and affective neuroscience research from an international perspective and to identify potential strengths and weaknesses with respect to the other major regions worldwide. Secondly, to gain a better understanding of the types of research being conducted, the leaders in the field, the funding available and the level of productivity from a regional perspective. Provision of up to date and reliable data will be useful to help support researchers, as well as potentially lobby policy makers, industry and philanthropy by highlighting the significant and sizeable contributions of research in this area.

Methods

Survey

A survey was developed by authors FK, MK, and GW in consultation and review with members of the AS4SAN Committee during 2018. The final survey (Appendix) included 19 questions. These questions covered demographic information including age, gender, location, level of study, employment status, and current institution. Membership status and opinions on specific goals and plans for the AS4SAN were also gathered. The remaining questions focused on the area of research interest (population of study) and types of techniques or data collection methods employed. Potential respondents were contacted through the AS4SAN email list, AS4SAN Facebook page, the AS4SAN webpage, Twitter accounts, word of mouth, and via advertisement at the annual AS4SAN conference. Respondents were provided with a link to an online survey hosted by Qualtrics Software. Links were not personalised for participants and as such could be forwarded on to colleagues easily. The survey remained open for approximately 10 weeks and one reminder email was sent to the mailing list during this time. Participation was voluntary and all data were de-identified with only IP address being collected, but this was not used for analytic purposes. The study was approved by the University of Sydney, Research Integrity and Ethics Administration (2018/307).

Social media trends

Website number of views and unique visits (year-on-year data), as well as geography of IP addresses were acquired from Squarespace (which hosts the AS4SAN webpage, www.

as4san.com). Quarterly newsletters are sent via MailChimp, with number of opens (instances of newsletters being opened) and geography statistics reported. Twitter data for the AS4SAN account (@AS4SANinc) were extracted via the 'Analytics' function (analytics.twitter.com). Facebook data were extracted via the 'Insights' function (www.facebook.com/AS4SAN/insights).

Publications and funding

Publications in the field of social and affective neuroscience were identified via Scopus. A search was conducted using the title, abstract, and keyword fields for the terms 'social cognition', 'social psychology', 'social behaviour [behavior]', 'emotion', 'affective', 'empathy' or 'theory of mind' in combination with 'neuroscience', 'magnetic resonance imaging', 'magnetoencephalography' 'MEG', 'electroencephalography', 'EEG', 'brain imaging', 'biology', 'psychophysiology', 'neuropsychology', 'neural', 'hormone', 'cellular' or 'genetic'. The search was limited to an 18-year publication period (2001–2018).[1] The following publication types were excluded: editorials, notes, short surveys, letters, conference papers and reviews, retractions and errata.

Scopus was used to determine the number of papers per country (based on primary affiliation), and the reported funding bodies stated in the acknowledgements of the paper. In order to gauge the regional representation of research being undertaken, we analysed the primary affiliations of the top 25 most cited papers.

In addition, we systematically examined funding outcomes from the two largest funding bodies in Australia; the 'Australian Research Council' (ARC) and the 'National Health and Medical Research Council' (NHMRC). Both agencies provide fellowships and project funds on a competitive. For the NHMRC, we reviewed their full list of successful grant applications from 2001 to 2018 which is available on their website (https://www.nhmrc.gov.au/funding/data-research/outcomes-funding-rounds). For ARC, a search feature is provided to enable successful grants to be searched for using specific key-terms or names of researchers (https://dataportal.arc.gov.au/NCGP/Web/Grant/Grants). The ARC search was carried out using the following keywords: 'social neuroscience', 'affective neuroscience' or 'social cognition', 'social psychology', 'biological psychology', 'social behaviour', 'emotion', 'affective', 'empathy', or 'theory of mind', with 'neuroscience', 'magnetic resonance imaging', 'magnetoencephalography' 'MEG', 'electroencephalography', 'EEG', 'brain imaging', 'biology', 'psychophysiology', 'neuropsychology', 'neural', 'hormone', 'cellular' or 'genetic'. Inclusion was based on whether the project satisfied the definitions outlined in Box 1. Infrastructure and equipment grants were excluded from the list. The screening of titles and project synopses was conducted by TW and cross-checked by JD. The final list of funding titles was determined by FK, TW, and JD by consensus. For the purposes of this paper, we examined the number of successful project applications, the total funding allocated towards social and affective neuroscience projects, and the percentage of these allocations as a function of the total projects and funding provided by ARC and NHMRC from 2001 to 2018.

Analyses

Survey responses from Qualtrics were downloaded analysed using the R statistical environment (R Development Core Team, 2014). Descriptive statistics (independent samples *t*-tests for continuous data; chi-square tests for categorical data) are presented for all data using the 'tableone' package (Yoshida and Bohn, 2018). Additional statistical tests (i.e. Wilcoxon rank-sum tests, Fisher's exact tests) were performed using the 'stats' and 'gmodels' packages as appropriate (R Development Core Team, 2014). Figures were produced using Graphpad Prism software.

Results

Survey

The descriptive characteristics of the 100 survey respondents are in Table 1. The median time to survey completion for respondents was 3.9 min (interquartile range (IQR) 2.8–6.1 min). Respondents were predominantly female ($n = 75$) with a mean age of 34.4 years. Most respondents were based in Australia ($n = 80$) with the largest proportion of respondents outside Australia from China ($n = 15$). Although AS4SAN members were targeted, responses were also received from Croatia, France, Germany, and Ireland. Respondents identified mainly as students ($n = 38$) or academics (i.e. employed by a university; $n = 37$). All except two students were studying full time (Figure 1a), while 49 (83.1%) of the non-student respondents were employed full time (Figure 1b). More than half of the respondents ($n = 66$) had completed postgraduate studies. Respondents with a PhD were a median of 7.5 (IQR 2.8–12.1) years post-PhD, but approximately 40% of those with a PhD had graduated less than 5 years ago. Approximately half ($n = 51$, 52.6%) of the respondents were a current member of AS4SAN. Although less than a third of respondents attended the 2017 AS4SAN conference, 85% ($n = 81$) intended to attend a future AS4SAN conference.

Table 1. Profile of survey respondents

	Overall ($n = 100$)
Age (years), mean ± SD	34.4 ± 10.2
Male: Female	25:75
Country of Residence, n (%)[a]	
Australia	80 (81.6)
China	14 (14.1)
Outside of Asia-Pacific	4 (4.1)
Current Role, n (%)[b]	
Student	38 (38)
Academic	37 (37)
Research assistant	4 (4)
Research fellow	15 (15)
Working in industry	4 (4)
Other	2 (2)
Highest Degree Obtained, n (%)	
None yet completed	4 (4)
Undergraduate	9 (9)
Honours	21 (21)
Master's degree	12 (12)
PhD	54 (54)
Years Post-PhD, median (IQR)[#b]	7.5 (2.8-12.1)
Years Post-PhD, n (%)[#b]	
0-5 years	20 (39.2)
5-10 years	13 (25.5)
≥ 10 years	18 (35.3)
AS4SAN Membership, n (%)[b]	
Yes	51 (52.6)
No	46 (47.4)

[a] $n = 2$ missing;
[b] $n = 3$ missing
[#] For respondents who have completed a PhD.
AS4SAN = Australasian Society for Social and Affective Neuroscience; IQR = interquartile range; n = number; PhD = Doctor of Philosophy; SD = standard deviation.

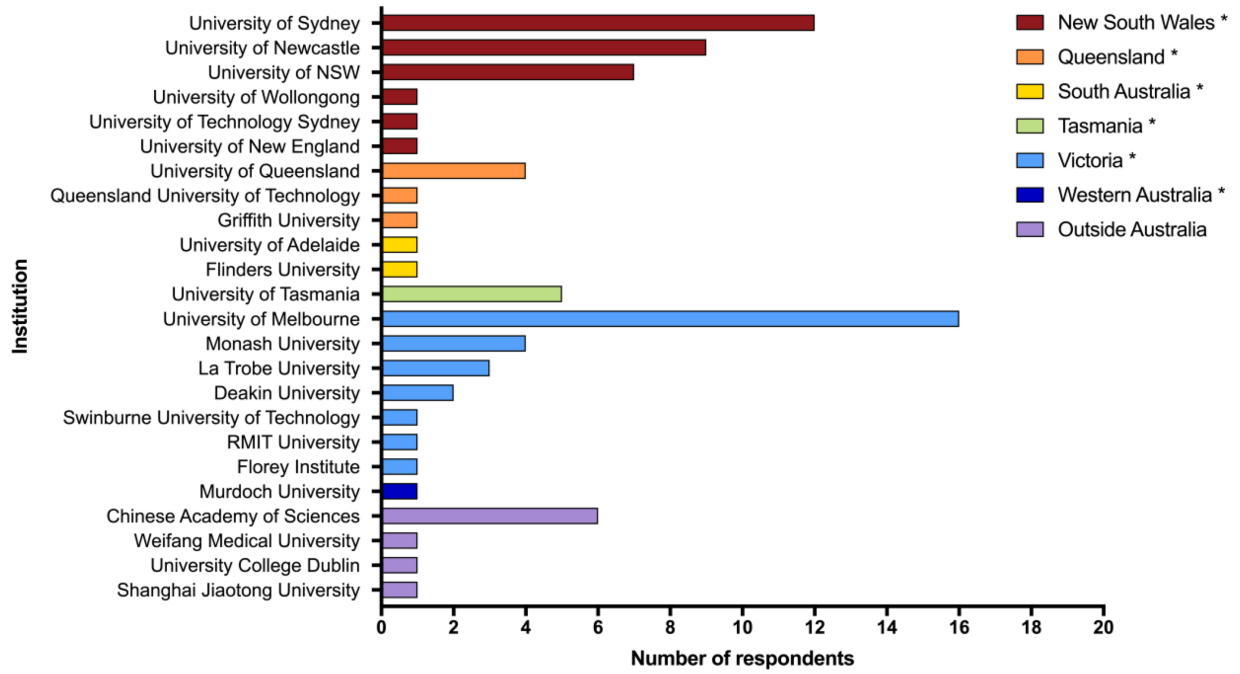

Fig. 1. Work/study institutions of survey respondents grouped by region. *Note.* * indicates Australian states. *Note.* Excludes respondents where institution was not stated ($n = 7$) or was unable to be categorised ($n = 1$; i.e. the institution had several campuses across different states but no discernible way to tell which state the respondent belonged to).

Institutional representation. The highest number of respondents were from the University of Melbourne ($n = 16$; Figure 1). Fourteen institutions had one respondent only. All Australian states were represented; however, no respondents were from the Australian Capital Territory or the Northern Territory. New South Wales ($n = 31$) was the region with the most survey respondents, followed by Victoria ($n = 28$). The most common non-Australian institution was the Chinese Academy of Sciences ($n = 6$).

Research techniques and populations. The research techniques employed by the survey respondents are depicted in Figure 2. Behavioural experiments ($n = 50$) and neuropsychological assessment ($n = 48$) were the most common research techniques employed (Figure 2a), followed by structural ($n = 46$) and functional ($n = 43$) magnetic resonance imaging (MRI). Other popular research techniques included recording psychophysiological data (heart rate, respiration, and skin conductance), electroencephalography (EEG), and hormonal assays.

Respondents most commonly worked with clinical populations ($n = 61$; Figure 2a), followed by healthy adults aged 18–65 ($n = 39$), healthy children and adolescents (under the age of 18, $n = 16$), and healthy adults over the age of 65 ($n = 12$; Figure 2b).

Priorities for society to pursue. Survey respondents prioritised student/early career training and opportunities for national collaboration over networking with emerging and senior leaders in the field (Figure 3a). Facilitating collaboration with community partners was the least common priority selected from the choices provided (Figure 3a). Respondents prioritised increasing the clinical utility of social and affective neuroscience, and increasing the academic profile as key focuses for the AS4SAN, with less priority for increasing the community profile of social and affective neuroscience in Australia (Figure 3b).

Publications and funding

Publications. Despite a somewhat slow beginning, the social and affective neuroscience field has grown rapidly, with more than 55 000 papers published globally since 2001 (2001–2018). Australia accounted for 4.4% of output in the field (Figure 4). Notably, with respect to the number of publications in the field internationally, Australia is ranked eighth, following the United States (USA), United Kingdom (UK), Germany, Canada, Italy, China, and the Netherlands. The top 10 regions, ranked by number of publications (2001–2018) are illustrated in Figure 5.

Analysis of Scopus data identified the following top 25 highly cited papers in the field with an Australian affiliation. We then examined primary affiliations of these top 25 most cited papers in the field (2001–2018; Table 2). Fifty-six per cent of these publications had primary affiliation in Australia. The majority of publications with a primary affiliation outside Australia were led by researchers based in the USA (24%).

Funding sources. The data from Scopus revealed that most publications globally, are funded by US bodies, including the National Institutes of Health ($n = 3723$), National Institute of Mental Health ($n = 2096$), National Science Foundation ($n = 1172$), National Alliance for Research on Schizophrenia and Depression ($n = 504$), and the National Institute on Drug Abuse ($n = 482$). After the USA, key funding bodies were based in Germany (Deutsche Forschungsgemeinschaft (German Research Foundation; $n = 1181$)), China (National Natural Science Foundation of China ($n = 1171$)), the UK (Medical Research Council ($n = 559$), and the Wellcome Trust ($n = 514$)), and Canada (Canadian Institutes of Health Research ($n = 474$) Figure 6).

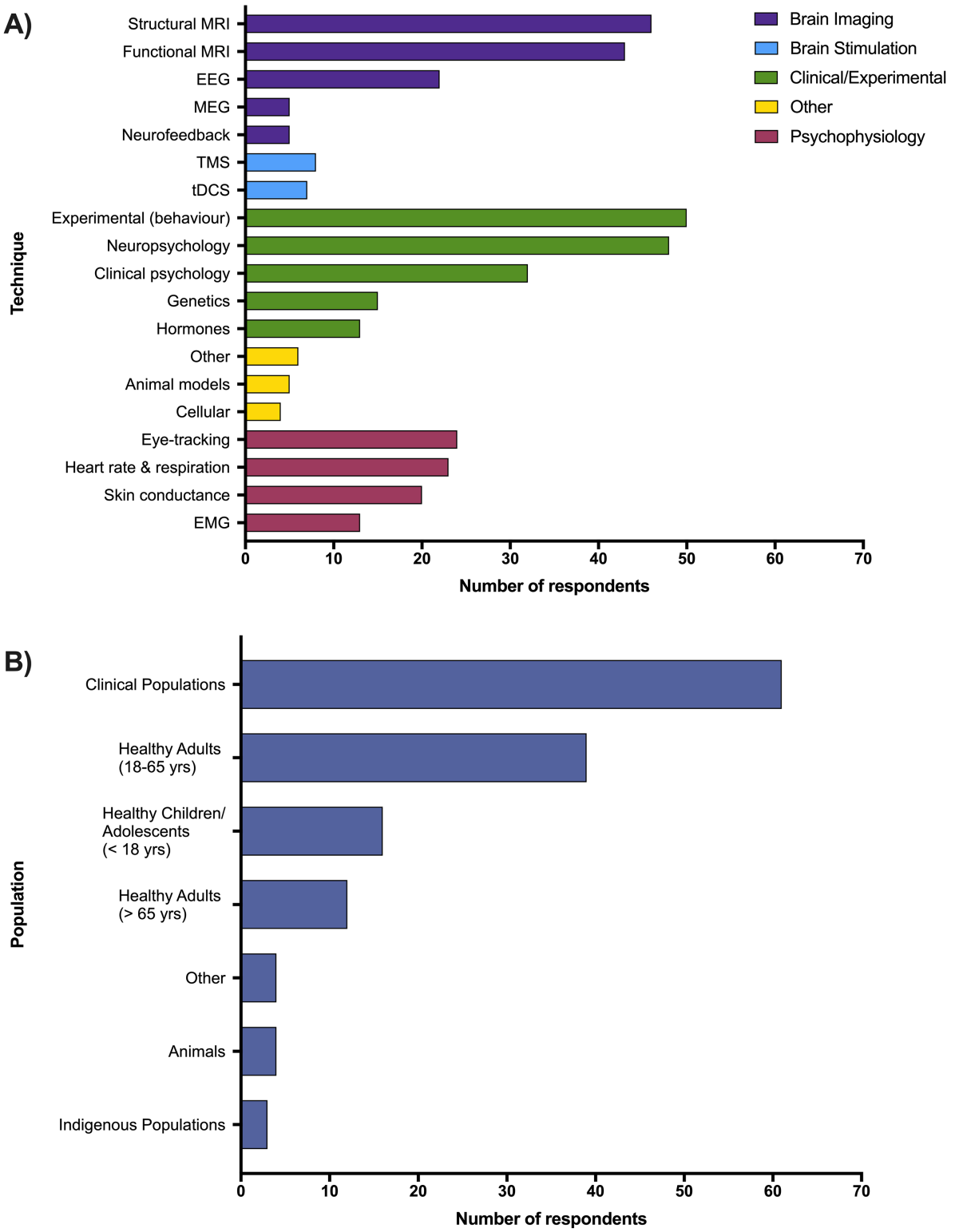

Fig. 2. A) Research techniques utilised by survey respondents. B) Populations of interest in survey respondent's work or study. *Note.* Respondents could select multiple research techniques and more than one population for their work. EEG = electroencephalography; EMG = electromyography; MEG = magnetoencephalography; MRI = magnetic resonance imaging; tDCS = transcranial direct current stimulation; TMS = transcranial magnetic stimulation.

Figure 7 shows the combined funding from the ARC and NHMRC for years 2001–2018. The ARC search yielded a total of 1952 records, of which 991 were identified as duplicates. The remaining 961 ARC grants, together with the full list of successful NHMRC grants from 2001 to 2018 ($n = 19\,111$), were then manually inspected to determine whether they fulfilled

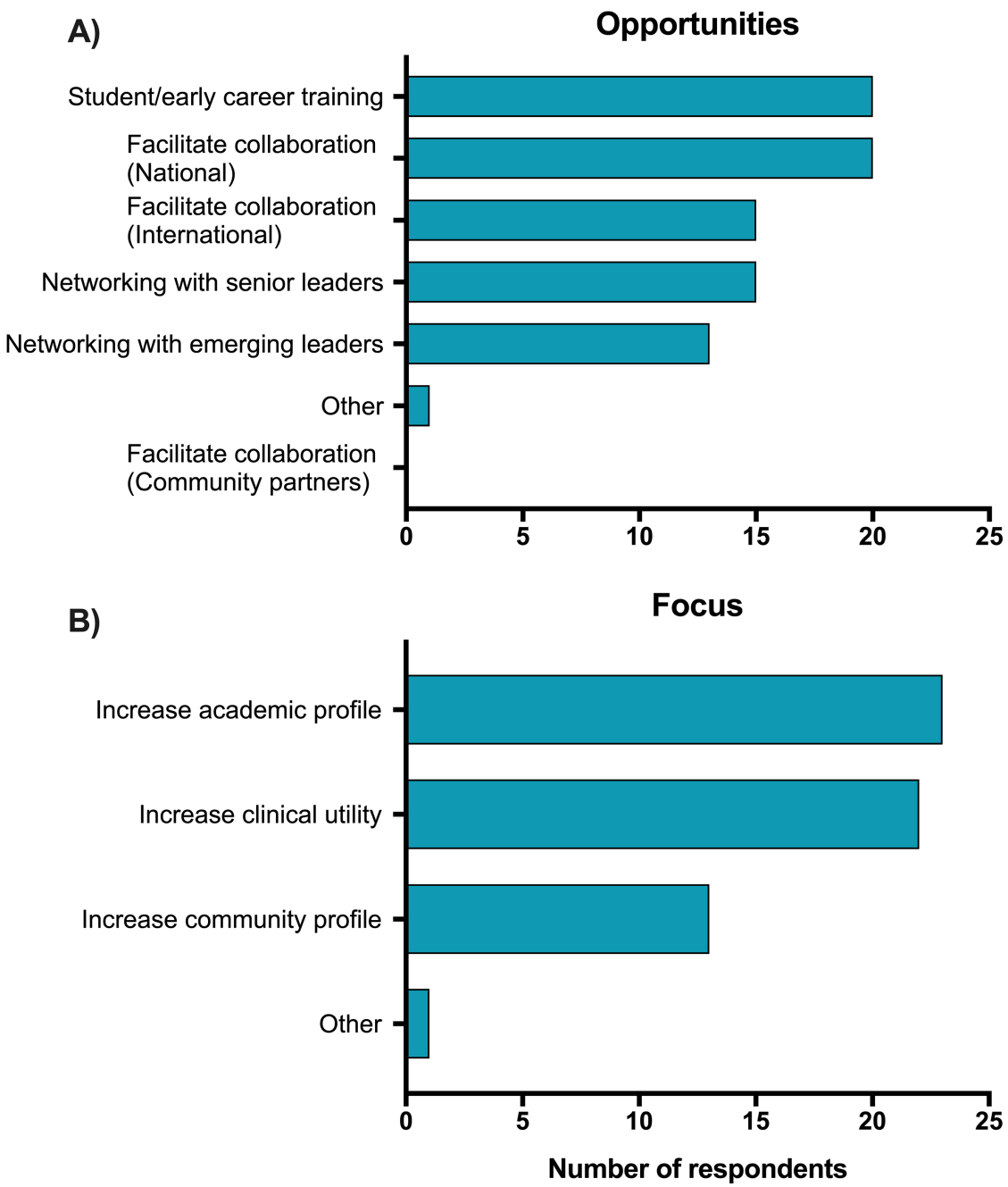

Fig. 3. A) Number of times ranked as the top priority for opportunities for the AS4SAN to facilitate. B) Number of times ranked as top priority for preferred focus of the AS4SAN. *Note.* For A) Data missing for 16 respondents. The "*other*" response was "*new information*". For B) Data missing for 41 respondents. The "*other*" response was "*Open access, reporting of effect size (e.g. parameter estimates in fMRI) and confidence intervals, data sharing, facilitating large collaborations (e.g. fMRI projects)*".

inclusion criteria. Analysis of the funding data revealed that from 2001 to 2018, a total of 373 grants on social and affective neuroscience were awarded from ARC or NHMRC. An average of 20.72 grants were awarded each year (range 6–37). The total funding allocated to social and affective neuroscience projects in this period was $210 million Australian dollars, with an average of $534 000 allocated for each successful application (range $7000–$21M). This represented, on average, 0.83% of the total number of successful grants and 0.84% of the total funding allocated for projects in this time period. Examination of the funding allocated to social and affective neuroscience projects in three year blocks from 2001 to 2018, indicated no significant change over time, $F(5373) = 1.256$, $p = 0.282$, or any significant difference in the funding allocated by funding bodies, $F(1373) = 0.00$, $p = 0.961$, or significant interaction between funding source and time, $F(5373) = 1.038$, $p = 0.395$. The same results were found when examining the funds as a function of total expenditure (i.e. the percentage of funding allocated to social and affective neuroscience grants as a function of total funding).

For the NHMRC, an average of 13.83 social and affective neuroscience grants were awarded each year (total $n = 249$, range from 6–23 per year), with an average of approximately $646 000

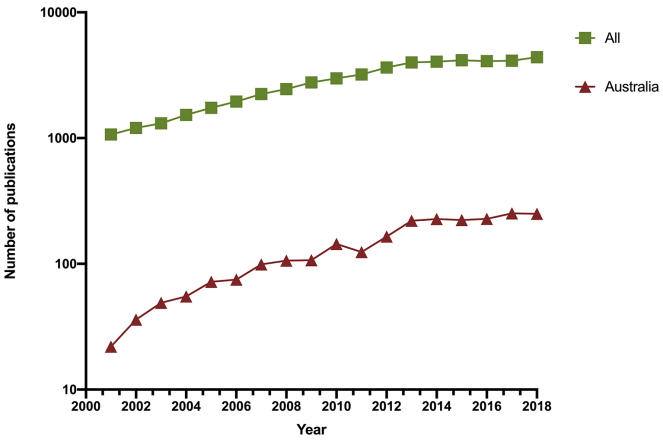

Fig. 4. Number of publications in Scopus between 2001–2018.
Note. All publications: total = 55 948; Australia = 2456. Y axis is Log 10 scale.

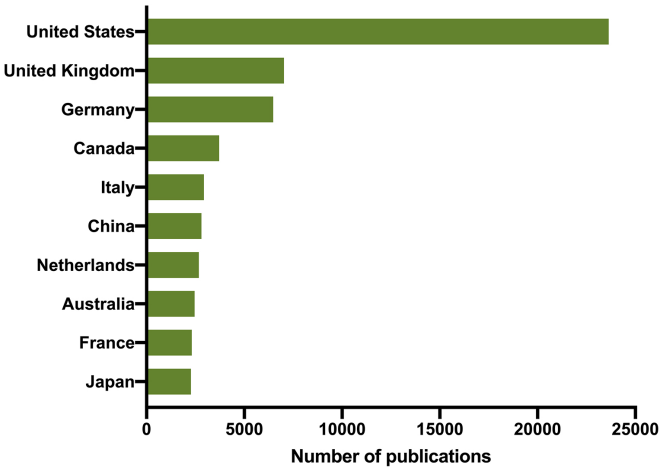

Fig. 5. Top 10 regions globally between 2001–2018 ranked by number of publications.

allocated to each project. Of the total NHMRC funding allocated, social and affective neuroscience grants represented, on average, 1.3% of the total successful projects and an average of 1.08% of the total allocated expenditure each year. For ARC, on the other hand, an average of 7.29 social and affective neuroscience grants were awarded each year (total $n = 124$, range from 2–14 each year), with an average of approximately $448 000 allocated to each project. Of the total ARC funding, social and affective neuroscience grants represented 0.48% of the total successful projects and 0.59% of the total allocated expenditure each year.

Social media trends

We also conducted an analysis of the social media channels managed by the AS4SAN. In 2018, the AS4SAN website (www.as4san.com) had 7213 page views (up 30% from 2017) by 2735 unique visitors (up 43.4% from 2017), after a period of strong investment in Facebook presence (not necessarily a natural trend). As of December 2019, the website had received 8022 page views in 2019 (+13.6%) from 2988 unique visitors (+10.4%).[2] In 2019, 63.3% of visits were from Australia, followed by visits from the USA (9.36%), China (6.42%), Canada (4.69%), Germany (2.04%), India (1.7%), and the UK (1.3%), demonstrating the reach of the website beyond Australia.

The AS4SAN joined Twitter in September 2015. As of December 2019, the Society had gained 267 followers on Twitter and tweeted 162 times. AS4SAN tweeted 3.18 times per month, on average. The most prolific month of tweeting was June 2019 (39 tweets), coinciding with AS4SAN's annual meeting. The average tweet was viewed 508.16 times and had 9.73 engagements.

The AS4SAN Facebook page was founded in August 2014. As of September 2019, the page had 627 followers and 598 likes and had posted 300 times. In general, the most engaging posts were those relating to abstract submission and those where posting coincided with AS4SAN's annual meetings. Since September 2019, the total page views, the page likes, the post reach and the page engagement increased 211%, 100%, 114% and 456%, respectively.

The AS4SAN newsletter has 490 subscribers, with newsletters sent out quarterly. Sixty-seven per cent of subscribers are from Australia and 6.0% from the USA, with the remainder from other regions.

Discussion

Australia is an active contributor to the field of social and affective neuroscience. Since 2000, over 55 000 papers on social and affective neuroscience have been published worldwide. In this time, output from Australia has doubled from 2.1% to 4.9% of total global publications, ranking in the top 10 globally in terms of publication output. Over a decade after research in social and affective neuroscience started in earnest, we reflect on the current state of affairs and consider the unique challenges and opportunities that Australia brings to this field of research. In the following sections, we discuss the findings from our survey and analysis of the field and highlight patterns of current social and affective neuroscience research topics, as well as considering the current challenges and future directions for social and affective neuroscience in the Australian region.

Research priorities in Australia

One of our key findings is the considerable work being conducted in clinical populations and with influence from neuropsychiatry, neuropsychology and neurology. Our survey data demonstrated that more than 60% of respondents were working in clinical populations, while nearly a quarter of respondents wanted the clinical utility of social and affective neuroscience to be a priority for AS4SAN. While Lieberman (2012) found that the type of research in the USA was more self-oriented and the research from Europe was predominantly other-oriented, we suggest that research from Australia may be particularly clinically oriented and, therefore, decidedly more applied. The focus of research in Australia has likely been influenced by the focus of early pioneers in the field, whose primary aim was to improve the health of clinical patients, while being guided by neurobiological theories of social and affective processes (which they were testing at same time). Ultimately, studies in both healthy and clinical (lesion/neurodegeneration/impairment) populations are necessary to solve issues of correlation versus causation. Moreover, in light of recent criticisms about replicability particularly in social psychology (Open Science Collaboration, 2015), fields which test influential theories from multiple different perspectives increase confidence in the validity of findings.

Table 2. Top 25 most cited papers identified in Scopus search with an Australian affiliation

Rank	Title	Authors	Year	Source	Cited by	Population	Primary affiliation
1	2016 European Guidelines on cardiovascular disease prevention in clinical practice	Piepoli, M.F., Hoes, A.W., Agewall, S., (...), Nesukay, E., Gale, C.	2016	European Heart Journal 37(29), pp. 2315-2381	2369	Other (Guidelines)	France
2	Does rejection hurt? An fMRI study of social exclusion	Eisenberger, N.I., Lieberman, M.D., Williams, K.D.	2003	Science 302(5643), pp. 290-292	2034	Healthy Adults (18-65yr)	USA
3	Correlates of physical activity: Why are some people physically active and others not?	Bauman, A.E., Reis, R.S., Sallis, J.F., (...), Ogilvie, D., Sarmiento, O.L.	2012	The Lancet 380(9838), pp. 258-271	1518	Review	Australia
4	Dementia prevention, intervention, and care	Livingston, G., Sommerlad, A., Orgeta, V., (...), Teri, L., Mukadam, N.	2017	The Lancet 390(10113), pp. 2673-2734	1081	Review	UK
5	A pathways model of problem and pathological gambling	Blaszczynski, A., Nower, L.	2002	Addiction 97(5), pp. 487-499	957	Review	Australia
6	Human and rodent homologies in action control: Corticostriatal determinants of goal-directed and habitual action	Balleine, B.W., O'Doherty, J.P.	2010	Neuropsychopharmacology 35(1), pp. 48-69	807	Review	Australia
7	Guidelines for the management of haemophilia	Srivastava A., Brewer A.K., Mauser-Bunschoten E.P., (...), Poon M.C., Street A.	2013	Haemophilia 19(1), pp. 1-47	874	Other (Guidelines)	India
8	Affect detection: An interdisciplinary review of models, methods, and their applications	Calvo R.A., D'Mello S.	2010	IEEE Transactions on Affective Computing 1(1), pp. 18-37	825	Review	Australia
9	Core outcome domains for chronic pain clinical trials: IMMPACT recommendations	Turk, D.C., Dworkin, R.H., Allen, R.R., (...), Tollett, J., Witter, J.	2003	Pain 106(3), pp. 337-345	739	Other (Consensus Statement)	USA
10	Gaze cueing of attention: Visual attention, social cognition, and individual differences	Frischen, A., Bayliss, A.P., Tipper, S.P.	2007	Psychological Bulletin 133(4), pp. 694-724	720	Review	Australia
11	Neural substrates for voluntary suppression of negative affect: A functional magnetic resonance imaging study	Phan, K.L., Fitzgerald, D.A., Nathan, P.J., (...), Uhde, T.W., Tancer, M.E.	2005	Biological Psychiatry 57(3), pp. 210-219	619	Healthy Adults (18-65yr)	USA
12	Amygdala-frontal connectivity during emotion regulation	Banks, S.J., Eddy, K.T., Angstadt, M., Nathan, P.J., Luan Phan, K.	2007	Social Cognitive and Affective Neuroscience 2(4), pp. 303-312	608	Healthy Adults (18-65yr)	USA
13	Meta-analysis of the heritability of human traits based on 50 years of twin studies	Polderman, T.J.C., Benyamin, B., De Leeuw, C.A., (...), Visscher, P.M., Posthuma, D.	2015	Nature Genetics 47(7), pp. 702-709	606	Review	Netherlands

(continued)

Table 2. (Continued)

Rank	Title	Authors	Year	Source	Cited by	Population	Primary affiliation
14	A critical review of the psychophysiology of driver fatigue	Lal, S.K.L., Craig, A.	2001	Biological Psychology 55(3), pp. 173-194	580	Review	Australia
15	A meta-analytic study of changes in brain activation in depression	Fitzgerald, P.B., Laird, A.R., Maller, J., Daskalakis, Z.J.	2008	Human Brain Mapping 29(6), pp. 683-695	547	Review	Australia
16	Mindful emotion regulation: An integrative review	Chambers, R., Gullone, E., Allen, N.B.	2009	Clinical Psychology Review 29(6), pp. 560-572	510	Review	Australia
17	A meta-analytic review of emotion recognition and aging: Implications for neuropsychological models of aging	Ruffman, T., Henry, J.D., Livingstone, V., Phillips, L.H.	2008	Neuroscience and Biobehavioral Reviews 32(4), pp. 863-881	429	Review	New Zealand
18	Brain regions with mirror properties: A meta-analysis of 125 human fMRI studies	Molenberghs P., Cunnington R., Mattingley J.B.	2012	Neuroscience and Biobehavioral Reviews 36(1), pp. 341-349	416	Review	Australia
19	Are you always on my mind? A review of how face perception and attention interact	Palermo R., Rhodes G.	2007	Neuropsychologia 45(1), pp. 75-92	386	Review	Australia
20	Association between amygdala hyperactivity to harsh faces and severity of social anxiety in generalized social phobia	Phan K.L., Fitzgerald D.A., Nathan P.J., Tancer M.E.	2006	Biological Psychiatry 59(5), pp. 424-429	360	Clinical Populations	USA
21	Combined resistance and aerobic exercise program reverses muscle loss in men undergoing androgen suppression therapy for prostate cancer without bone metastases: A randomized controlled trial	Galvão D.A., Taaffe D.R., Spry N., Joseph D., Newton R.U.	2010	Journal of Clinical Oncology 28(2), pp. 340-347	355	Clinical Populations	Australia
22	Autologous olfactory ensheathing cell transplantation in human spinal cord injury	Féron F., Perry C., Cochrane J., (…), Geraghty T., Mackay-Sim A.	2005	Brain 128(12), pp. 2951-2960	350	Clinical Populations	Australia
23	Oxytocin attenuates amygdala reactivity to fear in generalized social anxiety disorder	Labuschagne, I., Phan, K.L., Wood, A., Angstadt, M., Chua, P., Heinrichs, M., Stout, J.C., Nathan, P.J.	2010	Neuropsychopharmacology 35(12), pp. 2403-2413	326	Clinical Populations	Australia
24	Brain-to-brain coupling: A mechanism for creating and sharing a social world	Hasson U., Ghazanfar A.A., Galantucci B., Garrod S., Keysers C.	2012	Trends in Cognitive Sciences 16(2), pp. 114-121	324	Review	USA
25	Consanguinity and its relevance to clinical genetics	Bittles A.H.	2001	Clinical Genetics 60(2), pp. 89-98	323	Review	Australia

Note. Papers identified include: (Bittles, 2001; Lal and Craig, 2001; Blaszczynski and Nower, 2002; Eisenberger *et al.*, 2003; Turk *et al.*, 2003; Feron *et al.*, 2005; Phan *et al.*, 2005 2006; Banks *et al.*, 2007; Frischen *et al.*, 2007; Palermo and Rhodes, 2007; Fitzgerald *et al.*, 2008; Ruffman *et al.*, 2008; Chambers *et al.*, 2009; Balleine and O'Doherty, 2010; Calvo and D'Mello, 2010; Galvao *et al.*, 2010; Labuschagne *et al.*, 2010; Bauman *et al.*, 2012; Hasson *et al.*, 2012; Molenberghs *et al.*, 2012; Srivastava *et al.*, 2013; Polderman *et al.*, 2015; Piepoli *et al.*, 2016; Livingston *et al.*, 2017).

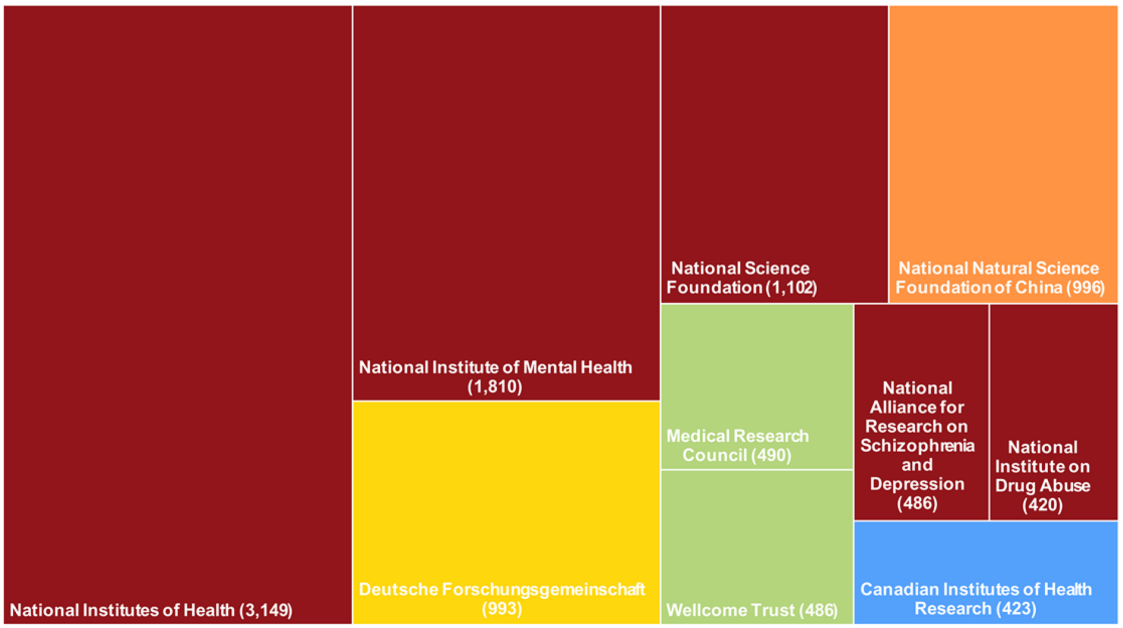

Fig. 6. Tree map of top 10 funding bodies globally between 2001–2018 ranked by number (indicated in brackets) of publications.

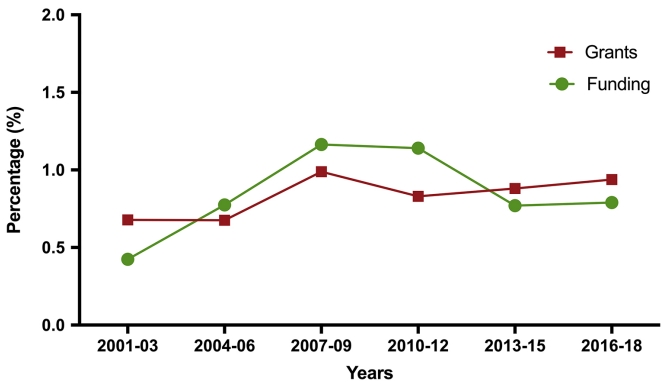

Fig. 7. Percentage of grants and funding awarded to social and affective neuroscience projects over successive three-year periods between 2001 and 2018.

Behavioural experiments and neuropsychological testing were the most commonly employed research techniques reported in our survey. Notably, despite advances in the assessment of social and affective processes in the field of neuropsychology and social neuroscience over the past couple of decades, there is still a perceived lack of valid and reliable assessment tools suitable for clinical implementation, at least within some clinical populations (Kelly *et al.*, 2017). Of those tools available for use both in the experimental and clinical fields, there is wide variation in the extent to which they could be argued to be truly social paradigms Self- and informant-reports paradigms are common, which are vulnerable to bias and lack of self-awareness and self-knowledge (particularly serious in the case of clinical populations with anosognosia), although performance-based tests designed to increase ecological validity (e.g. watching images or videos of people) have also been developed. Complementing such approaches with physiological recordings and neuroimaging will increase the objectivity of measurement as well as provide mechanistic explanations of the neurobiology. These techniques and technologies are, however, less suitable for use in real-world clinical settings and are costly to run, differentially disadvantaging countries in the region with fewer financial resources. Advances in mobile technology and e-Health (e.g. via personal trackers, iPads, desktop apps, etc.) may assist with translating such technologies from the lab into real-world clinical setting.

Current challenges

Funding. Despite Australia's increased global contribution to social and affective neuroscience, our review of Australian funding bodies (i.e. ARC and NHMRC) indicated a plateau in funding. The number of successful social and affective grant applications and the total allocation of funding did not change from 2001 to 2018, despite the increase in publication output. Indeed, Australia is currently ranked eighth globally in terms of publication output, yet Australian funding bodies did not rank highly internationally (Figure 6), with less than 1% of the entire research expenditure within Australia being allocated to social and affective neuroscience research since 2001.

This raises the sombre question of innovative research studies that are not being undertaken because investigators are unable to procure funding for their projects. This may have precluded Australia—and Australasia more broadly—from having even greater research output and international impact in the field. Lack of funding also limits the available support for early career researchers with respect to employment opportunities and advanced training. This has potential impact nationally and internationally, as it minimises the number of internationally recognised experts from Australia and has the potential to derail the region's position and output in the future. Finally, more researchers entering the field combined with the lack of change to the number of successful grants means that more applicants will be competing against colleagues for financial support in future rounds. Moving forward, we encourage researchers within social and affective neuroscience to engage with the

funding review process, with the intent of offering transparency and advocacy for social and affective neuroscience applications.

Our findings also indirectly suggest that social and affective neuroscience researchers remain productive despite limited financial support. Indeed, approximately 20% of the publications from Australia identified in Scopus cited ARC or NHMRC as their funding source. However, given the techniques (e.g. fMRI, brain stimulation, and genetic analyses) used by current researchers in this area (highlighted by our survey results) are expensive, it is unlikely that this research is being conducted without financial support. As such, this research may be supplemented by other funding sources, such as institutional seed funding or indirectly supported by international funding. Limitations regarding funding are especially pertinent for pre-clinical and clinical research, which can be particularly resource dependent. We found no difference between the success of grants from either NHMRC or ARC in Australia. This indicates that funding has been equally distributed between basic (i.e. ARC) and clinical/translational research (i.e. NHMRC), further illustrating the strength of the region in clinical research. We anticipate that this paper will provide grant applicants with quantifiable evidence of the impact of social and affective neuroscience researchers in Australia and hope the data provided can be helpful in lobbying funding and government bodies nationally and internationally.

International links. While the AS4SAN was founded in Australia, one of its long-term goals is to give a voice to researchers outside of the USA and Europe. The society has already taken some steps to improve regional collaboration in Australasia and with Asia. This includes inviting people from the Asia-Pacific region to be international keynote speakers at the AS4SAN conference, as well as scholars and students to become committee members of the society. One of the notable challenges with improving regional connections, particularly with China, has been its internet censorship. For example, the lack of access to social media has meant that current outreach avenues (i.e. Twitter and Facebook) have been unsuccessful. To address this, the AS4SAN established a Weibo page (Chinese equivalent to Facebook) in May 2019 to communicate social media information with members based in China (https://www.weibo.com/p/1005057060247783/home?from=page_100505&mod=TAB&is_all=1#place). As part of this process, the society name was translated into Chinese: 泛澳社会与情感神经科学学会. By December 2019, the AS4SAN Weibo account had posted 1.25 times per month and had been read 812 times. It is hoped that the society's Weibo page will be able to redress this lack of access for Chinese AS4SAN members. A second related issue is defining the scope of the society's representation. The current name—Australasian Society for Social and Affective Neuroscience—by definition includes Australia, New Zealand, New Guinea, and neighboring Pacific islands, though notably, does not include Asia. To our knowledge, similar studies focused on social and affective neuroscience do not currently exist in New Zealand or Asia. While a rebranding of the society name is unlikely in the immediate future, improved awareness of the representation of the society across the Asia-Pacific region is needed.

To advance the training and capacity (and to increase visibility) of junior social and affective neuroscience researchers, engagement with international researchers and experts in the field is imperative. International collaboration can facilitate the acquisition of new research skills and lead to advances in research methods and techniques (Freshwater *et al.*, 2006). However, the Australian region faces significant challenges in engaging with international researchers in the USA, UK, and Europe due to geographical distance. For example, the distance between Australia and the USA, UK, and Europe is on average 64% greater than the distance between them. Time zones are a challenge that compromise collaboration via tele/videoconferencing. This is particularly relevant in Australia, where global time zones are diametrically opposed to the UK and USA. Further, the cost of travel from (or to) Australia is expensive. Australia is the 12th most expensive country to fly from, in terms of cost per 100 km (https://www.kiwi.com/stories/flight-price-index-2017/). Funding available for international travel is often restricted by grant funding bodies. Nevertheless, over 70% of the top 25 most cited papers included international collaborators, suggesting that the impact of publications are potentially higher when multiple institutions are involved. One way to improve international collaboration is to enable international leaders in the field to attend local conferences in the Australian region. Moving forward, AS4SAN will continue to place international collaboration as a priority, to increase the visibility and impact of its research, and to facilitate training of junior researchers. Recent moves towards remote/online conferences may also help to improve relationships between international researchers and Australia. Meetings which are in time zones that align with Australia's near neighbours will be important in enabling greater contribution with lower income countries in the Asia-Pacific region.

Potential opportunities

Culturally appropriate assessments and a multidisciplinary approach. Australia is unique in its cultural diversity. One in four Australians were born overseas and one in two Australians have a parent who was born overseas. Nearly 20% of Australians speak a language other than English at home (Australian Human Rights Commission, 2014). Aboriginal and Torres Strait Islander Peoples also represent one of the world's oldest continuous cultures (Australian Human Rights Commission, 2014). In this context, Australia is uniquely placed to be an international leader in the development of culturally appropriate assessment tools for culturally and linguistically diverse individuals.

The need to recognise culture when designing experiments is increasingly recognised. Language is not the only disparity when making cross-cultural or multicultural comparisons. Cultural differences in idioms, personal styles and experiences also impact on test performance (Geisinger and McCormick, 2012). The perception and definition of the problem, base rates, such as depression, and numerous help-seeking behaviours should also be taken into account when conducting assessments and interpreting the results (Cuellar, 1998). Take, for instance, comparisons across White European Australians, Asian Australians and Asians, who have shown differences in cognitive styles (and associated neural correlates) variously characterised in terms of context-dependent *vs* context-independent, collectivistic *vs* individualistic and holistic *vs* analytic styles. Acculturation and assimilation into White European Australian culture makes Asian Australians perform more in accordance with White European norms. In the meantime, getting along with their Asian-born family members also implants Asian traditional values in Asian Australians. The influence of cultural differences on neuropsychological assessments can also be reflected in the context of educational attainment, which is one of many important aspects of culture (Cuellar, 1998).

Numerous well-accepted assessments and paradigms have been translated into different languages and have been widely used across countries. Although most items involved in these assessments and paradigms may simply be assumed to be equivalent across cultures, some have been adjusted to adapt to the local culture. It should be noted, however, that translated items need to be evaluated for invariance across different language tests. The gold-standard is for translated versions should be back translated into the original language by an independent person to ensure invariance across versions. Given the diversity of cultures in the region, and the multicultural nature of Australia, researchers in this region have the opportunity to become leaders in how to account for cultural variables and adopting assessments for suitability in cross-cultural or multicultural populations.

Data-sharing. There is a growing interest in data sharing, open access and building "big data" repositories. Data sharing maximises the utility of data and skills of researchers, thereby facilitating acceleration in the pace of investigations around particular questions (Choudhury *et al.*, 2014). A number of big data sets now exist that may be of utility for social and affective neuroscience research. For example, the UK Biobank is a longitudinal brain imaging population study, which, along with body and cardiac imaging, genetics, lifestyle measures, biological phenotyping, and health records, aims to provide unique insight into mechanisms underlying a number of diseases (Miller *et al.*, 2016). "Enhancing NeuroImaging Genetics through Meta-Analysis" (ENIGMA) is an international effort to bring together researchers with genetic and neuroimaging data to meta-analyse evidence for the genetic basis of brain structure, in addition to various questions regarding neurobiological abnormalities in various disease populations (Thompson *et al.*, 2014). The benefits of analyses using such national and international data collections are wide-reaching. For example, larger datasets afford increased power to detect effects of interest. They allow researchers to investigate questions about the specificity of neuroscientific findings to certain populations (e.g. cultures, diagnostic groups), or indeed whether some neuroscientific findings may be transdiagnostic. Moving forward, Australian-based social and affective neuroscience researchers have great opportunities to advance the field by developing, contributing to, and utilising data sharing/big data initiatives.

An inclusive and global approach

As this review highlights, social and affective neuroscience is thriving beyond the USA and Europe. Having a truly global perspective is important for all research fields, but arguably more so for social and affective neuroscience. Some of the major breakthroughs have been driven by cross-cultural research. For example, the seminal work initially by Charles Darwin and then by Paul Ekman was groundbreaking in demonstrating the innate and cultural universality of emotional expression (Darwin, 1872; Ekman, 1973; Ekman and Friesen, 1986). However, more recent evidence has suggested that a more nuanced account is probably more appropriate. For example, research from the University of Western Australia has indicated that mixed race faces were rated as more attractive than prototypical Japanese or Caucasian faces (Rhodes *et al.*, 2005). Studies comparing interdependent and independent cultures have also revealed that empathic responses and the associated brain activity differs between cultures, with Chinese individuals from an interdependent culture show enhanced emotion regulation mediated by greater left dorsolateral prefrontal cortex activation (de Greck *et al.*, 2012). Such insights can only be gleaned from research which harnesses the uniqueness of different cultures.

Understanding of gene and gene × environment interactions also require diversity of research participants. With the majority of genetic association studies performed in Europeans, potential understanding of genetic contributions to social behaviour has been investigated through a Eurocentric lens. These studies may lack power to detect genes which have greater presence in other countries. For example, frontotemporal dementia, a neurodegenerative disorder characterised by impaired social cognition has been associated with the *C9ORF72* gene repeat expansion in up to 30% of patients (DeJesus-Hernandez *et al.*, 2011; Renton *et al.*, 2011). However, when examined in Native American, Asian, and Pacific Island populations, this gene expansion is absent (Majounie *et al.*, 2012).

Diversity of the field is also important from an economic perspective. Research in most fields is dominated by higher income countries, reflecting the cost of conducting research. However, for social and affective neuroscience, economic factors may interact with human social behaviour. For example, socioeconomic status has been shown to correlate with capability for cognitive empathy (Jolliffe and Farrington, 2011), while neural responses when engaging in altruistic behaviour vary between individuals with high and low subjective socioeconomic status (Ma *et al.*, 2011). Thus, research from a variety of cultural and economic backgrounds is essential in gaining a comprehensive picture of mechanisms of social and affective neuroscience and ensuring that theoretical models can adequately explain human behaviour irrespective of country or economic background.

Here, we have highlighted how existing challenges, such as funding and distance, may contribute to diversity in the field, and how these barriers may be overcome. Importantly, Australian researchers' experience in conducting cross-cultural studies, and overcoming challenges of distance via remote technologies and data-sharing make Australian social and affective neuroscientists well placed to lead a truly global and diverse approach for this field in the future.

Limitations

As with all systematic reviews, the number of articles retrieved is dependent on the search terms used. Here, the search terms were selected in order to attempt to capture the wide range of research being undertaken in this field. These search terms meant that some of the top 25 most cited papers may not seem to obviously fit within the definition of social and affective neuroscience, despite including one of our key search terms In Australia and New Zealand, Field of Research (FoR) Codes are used for the measurement and analyses of research and experimental development, with a specific focus on the methodology used. Encouragingly, the field of social and affective neuroscience was recently recognised as an independent field of research (FoR code 520 207). This important step will undoubtedly result in better classification of publications and grants, and recognition of multidisciplinary work within the research and broader community. We expect this will allow clearer definition and growth of social and affective neuroscience. Finally, encouragement of consistency of keywords and recommendations for selection of keywords may be an important avenue to ensure that developments in the field are effectively captured.

A second caveat is that examination of the most cited and influential research output in the field, with Australian affiliations, may not provide an accurate reflection of the emerging themes of research in the region. Whilst valuable to

understanding of the contribution and prominence of the region on an international scale, 24% of these papers were led by the USA, likely given their unparalleled funding support. Further, as research techniques and populations do not exist as a separate field of enquiry, such analyses again rely on the inclusion of relevant keywords. Thus, a comprehensive depiction of the nature of research in the region is unlikely to be obtained based on publication data alone.

Conclusions

Social and affective neuroscience is a burgeoning interdisciplinary field spanning psychology, neuroscience, biology and the social sciences. Over the past few decades, the impact of the field has grown enormously, thanks in part to the concurrent development of neuroimaging. In Australia, formal recognition of this field has been relatively recent. Nevertheless, the results of our survey, as well as systematic analysis of funding, publications and social media trends demonstrate that this small field has significant potential, and its researchers are already having measurable impact on an international scale. At this stage, it is important for funding bodies to recognise the contribution of social and affective neuroscience at both the basic and clinical science levels. This will in part be achieved by more systematic documentation of research efforts. Australia has unique potential to contribute to cross-cultural research, as well as harnessing of technology to better enable international collaboration. We look forward to seeing how the strategies proposed here, help to mature this field over the coming decade.

Acknowledgements

We would like to thank the founders of the Australasian Society for Social and Affective Neuroscience, in particular the inaugural President Pascal Molenberghs. We also thank Debbie Booth, librarian at the University of Newcastle for assistance with publication trend data. Finally, we thank members of the Australasian Society for Social and Affective Neuroscience Committee—Femke Buisman-Pijlman, Raymond Chan, Pascal Molenberghs, and Alan Pegna—for comments on earlier versions of the manuscript.

Supllementary material

Supplementary data are available at *SCAN* online.

Funding

This work was supported by the National Health and Medical Research Council (NHRMC) Career Development Fellowship (GNT1158762 to F.K. and GNT1125504 to S.W.).

Conflict of Interest

The authors declare no conflicts of interest.

Appendices

AS4SAN Feedback Survey

Participant information statement

You are invited to take part in a study about the Australasian Society for Social and Affective Neuroscience (AS4SAN) regarding the current scope and state of social and affective neuroscience research in Australasia.

Participation in this research study is voluntary. Your decision whether or not to participate will not affect your current or future relations with the researchers or anyone else at the University of Sydney or AS4SAN.

If you decide to take part in the study, you are free to withdraw your participation at any time while completing the survey by closing the browser. Participation in this research is anonymous and your responses cannot be withdrawn once you have submitted the survey.

What does this research involve for me?
You will be asked to complete a short online survey which should take approximately 5 min to complete.

Are there any risks or costs associated with being in the study?
Aside from giving up your time, we do not expect that there will be any risks of costs associated with taking part in this study.

What will happen to information about me that is collected during this study?
By providing your consent, you are agreeing to us collecting personal information about you for the purposes of this research study. Any information that is obtained in connection with this study will be non-identifiable and therefore remain completely confidential. Your information will be stored securely and will be kept strictly confidential, except as required by law. Study findings may be published, but you will not be individually identifiable in these publications. We will keep the information we collect for this study, and we may use it in future projects. By providing your consent, you are allowing us to use your information in future projects. We will seek ethical approval before using the information in these future projects.

What if I would like further information about the study?
If you have any questions about the study, please contact Dr Fiona Kumfor on (02) 9114 4181 or fiona.kumfor@sydney.edu.au.

What if I have a complaint or any concerns about the study?
The ethical aspects of this study have been approved by the HREC at the University of Sydney (2018/307).

Who is running the study?
This study is being conducted on behalf of the AS4SAN committee and is led by Dr Fiona Kumfor (AS4SAN President) and Dr Michelle Kelly (AS4SAN Vice President). If you are concerned about the way this study is being conducted or you wish to make a complaint to someone independent from the study, please contact the university using the details outlined below.

The Manager, Ethics Administration, University of Sydney *Telephone:* +61 2 8627 8176

Fax: +61 2 8627 8177

Email: ro.humanethics@sydney.edu.au

By giving your consent to take part in this study you are telling us that you:

✓ Understand what you have read.

✓ Agree to take part in the research study as outlined above.

✓ Agree to the use of your personal information as described.

- o By **CLICKING HERE** you are providing consent to participate (**Q1**)

Q2. Please indicate your age in years:

Q3. Please indicate your gender:

a. Male
b. Female
c. Other
d. Do not wish to specify

Q4. Are you currently based in:

a. Australia
b. Other (please indicate country)

Q5. Are you predominately a:

a. Student
b. Academic (employed by university)
c. Working in industry (clinician or similar)
d. Research fellow (supported by NHMRC, ARC or other external to university fellowship)
e. Research assistant
f. Other (please specify)

Display this question: If **Q5** = *a*

Q6. Are you studying

a. Full-time
b. Part-time

Display this question: If **Q5** = *b; c; d; e; f*

Q7. Are you employed (select all that are appropriate to your main role)

o Full-time
o Part-time
o Permanent
o Casual
o Contract

Display this question if **Q5** = *b*

Q8. What is your academic workload distribution?

a. Teaching focused
b. Research focused
c. Balanced (teaching and research)
d. Other (please specify)

Display this question if **Q5** = *b*

Q9. Are you:

a. Associate Lecturer
b. Lecturer
c. Senior Lecturer
d. Associate Professor
e. Professor
f. Other (please specify)

Q10. What is your highest degree completed?

a. None yet completed
b. Undergraduate
c. Honours
d. Masters degree
e. PhD

Display this Question: If **Q10** = *e*

Q11. Years (equivalent) post PhD:

Q12. Which institution do you work/study?

a. University of Sydney
b. University of NSW
c. University of WA
d. University of Newcastle
e. University of Wollongong
f. University of Queensland
g. Monash University
h. University of Melbourne
i. La Trobe University
j. University of Technology Sydney
k. University of Western Sydney
l. Griffith University
m. University of South Australia
n. Flinders University
o. Australian National University
p. University of Tasmania
q. Swinburne University
r. Macquarie University
s. Other (please specify)

Q13. Are you a current member of AS4SAN?

a. Yes
b. No

Q14. Did you attend the AS4SAN 2017 conference in Melbourne?

a. Yes
b. No

Q15. How likely is it that you will attend a future AS4SAN conference?

a. Extremely likely
b. Slightly likely
c. Neither likely nor unlikely
d. Slightly unlikely
e. Extremely unlikely

Q16. Which of the following opportunities would you like AS4SAN to provide/offer its members? (please rank in order with 1 being most important)

_____ Networking with senior leaders
_____ Networking with emerging leaders
_____ Facilitate collaboration (national)
_____ Facilitate collaboration (international)
_____ Facilitate collaboration (community partners)
_____ Student/early career training
_____ Other (please specify)

Q17. Which of the following do you think it is important that AS4SAN focus on as a society? (please rank in order of importance with 1 being most important)

_____ Increase the academic profile of social and affective neuroscience in Australasia
_____ Increase community profile of social and affective neuroscience in Australasia
_____ Increase clinical utility of social and affective neuroscience in Australasia
_____ Other (please specify)

Q18. What is your main area of interest in your work? (select all that apply)

- o Healthy older adults (>65 yrs)
- o Healthy adults (18-65 yrs)
- o Healthy children
- o Clinical populations
- o Indigenous populations
- o Animals
- o Other (please specify)

Q19. What techniques do you employ in your work? (select all that apply)

- o Animal models
- o Hormones
- o Cellular
- o Genetic
- o EEG
- o MEG
- o TMS
- o TDCS
- o MRI (functional)
- o MRI (structural)
- o Neuropsychology
- o Clinical psychology
- o Experimental (behaviour)
- o Psychophysiology (EMG)
- o Psychophysiology (Skin conductance)
- o Psychophysiology (Heart rate, respiration)
- o Psychophysiology (Eye tracking)
- o Neurofeedback
- o Other (please specify)

References

Australian Human Rights Commission. (2014). Face the facts. Retrieved from http://www.humanrights.gov.au/publications

Balleine, B.W., O'Doherty, J.P. (2010). Human and rodent homologies in action control: corticostriatal determinants of goal-directed and habitual action. *Neuropsychopharmacology*, *35*(1), 48–69. 10.1038/npp.2009.131

Banks, S.J., Eddy, K.T., Angstadt, M., Nathan, P.J., Phan, K.L. (2007). Amygdala-frontal connectivity during emotion regulation. *Social Cognitive and Affective Neuroscience*, *2*(4), 303–12. 10.1093/scan/nsm029

Bauman, A.E., Reis, R.S., Sallis, J.F., Wells, J.C., Loos, R.J., Martin, B.W.,& Lancet Physical Activity Series Working, G. (2012). Correlates of physical activity: why are some people physically active and others not?. *Lancet*, *380*(9838), 258–71. 10.1016/S0140-6736(12)60735-1

Bittles, A. (2001). Consanguinity and its relevance to clinical genetics. *Clinical Genetics*, *60*(2), 89–98. 10.1034/j.1399-0004.2001.600201.x

Blaszczynski, A., Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction*, *97*(5), 487–99. 10.1046/j.1360-0443.2002.00015.x

Cacioppo, J.T., Decety, J. (2011). Social neuroscience: challenges and opportunities in the study of complex behavior. *Annals of the New York Academy of Sciences*, *1224*(1), 162–73.

Calvo, R.A., D'Mello, S. (2010). Affect detection: an interdisciplinary review of models, methods, and their applications. *IEEE Transactions on Affective Computing*, *1*(1), 18–37. 10.1109/T-AFFC.2010.1

Chambers, R., Gullone, E., Allen, N.B. (2009).Mindful emotion regulation: an integrative review. *Clinical Psychology Review*, *29*(6), 560–72. 10.1016/j.cpr.2009.06.005

Choudhury, S., Fishman, J.R., McGowan, M.L., Juengst, E.T. (2014). Big data, open science and the brain: lessons learned from genomics. *Frontiers in Human Neuroscience*, *8*, 239. 10.3389/fnhum.2014.00239

Cuellar, I. (1998). Cross-cultural clinical psychological assessment of hispanic americans. *Journal of Personality Assessment*, *70*(1), 71–86. 10.1207/s15327752jpa7001_5

Darwin, C. (1872). *The expression of the emotions in man and animals*. London: John Murray.

de Greck, M., Shi, Z., Wang, G. et al. (2012). Culture modulates brain activity during empathy with anger. *Neuroimage*, *59*(3), 2871–82.

DeJesus-Hernandez, M., Mackenzie, I.R., Boeve, B.F. et al. (2011). Expanded GGGGCC Hexanucleotide Repeat in Noncoding Region of *C9ORF72* Causes Chromosome 9p-Linked FTD and ALS. *Neuron*, *72*(2), 245–56.

Eisenberger, N.I., Lieberman, M.D., Williams, K.D. (2003). Does rejection hurt? An FMRI study of social exclusion. *Science*, *302*(5643), 290–92. 10.1126/science.1089134

Ekman, P. (1973). Cross-cultural studies of facial expression. *Darwin and Facial Expression: A century of research in review*, *169222*, 1

Ekman, P., Friesen, W.V. (1986). A new pancultural facial expression of emotion. *Motivation Emotion*, *10*, 159–68

Feron, F., Perry, C., Cochrane, J. et al. (2005). Autologous olfactory ensheathing cell transplantation in human spinal cord injury. *Brain*, *128*Pt 12, 2951–60. 10.1093/brain/awh657

Fitzgerald, P.B., Laird, A.R., Maller, J., Daskalakis, Z.J. (2008). A meta-analytic study of changes in brain activation in depression. *Human Brain Mapping*, *29*(6), 683–95. 10.1002/hbm.20426

Frischen, A., Bayliss, A.P., Tipper, S.P. (2007). Gaze cueing of attention: visual attention, social cognition, and individual differences. *Psychological Bulletin*, *133*(4), 694–724. 10.1037/0033-2909.133.4.694

Galvao, D.A., Taaffe, D.R., Spry, N., Joseph, D., Newton, R.U. (2010). Combined resistance and aerobic exercise program reverses muscle loss in men undergoing androgen suppression therapy for prostate cancer without bone metastases: a randomized controlled trial. *Journal of Clinical Oncology*, *28*(2), 340–47. 10.1200/JCO.2009.23.2488

Geisinger, K.F., McCormick, C. (2013). *Testing and Assessment in Cross-Cultural Psychology*. In J. R. Graham, J. A. Naglieri, I. B. Weiner (Eds.), Handbook of psychology: Assessment psychology, John Wiley & Sons, Inc., 114–39.

Hasson, U., Ghazanfar, A.A., Galantucci, B., Garrod, S., Keysers, C. (2012). Brain-to-brain coupling: a mechanism for creating and sharing a social world. *Trends in Cognitive Sciences*, *16*(2), 114–21. 10.1016/j.tics.2011.12.007

Jolliffe, D., Farrington, D.P. (2011). Is low empathy related to bullying after controlling for individual and social background variables?. *Journal of Adolescence*, *34*(1), 59–71.

Kelly, M., McDonald, S., Frith, M.H.J. (2017). A Survey of clinicians working in brain injury rehabilitation: are social cognition impairments on the radar?. *The Journal of Head Trauma Rehabilitation*, *32*(4), E55-E65. 10.1097/HTR.0000000000000269

Labuschagne, I., Phan, K.L., Wood, A. et al. (2010). Oxytocin attenuates amygdala reactivity to fear in generalized social

anxiety disorder. *Neuropsychopharmacology*, *35*(12), 2403–13. 10.1038/npp.2010.123

Lal, S.K., Craig, A. (2001). A critical review of the psychophysiology of driver fatigue. *Biological Psychology*, *55*(3), 173–94. 10.1016/s0301-0511(00)00085-5

Lieberman, M.D. (2007). Social cognitive neuroscience: a review of core Processes. *Annual Review of Psychology*, *58*(1), 259–89. 10.1146/annurev.psych.58.110405.085654

Lieberman, M.D. (2012). A geographical history of social cognitive neuroscience. *Neuroimage*, *61*(2), 432–36.

Livingston, G., Sommerlad, A., Orgeta, V. et al. (2017). Dementia prevention, intervention, and care. *Lancet*, *390*(10113), 2673–734. 10.1016/S0140-6736(17)31363-6

Ma, Y., Wang, C., Han, S. (2011). Neural responses to perceived pain in others predict real-life monetary donations in different socioeconomic contexts. *Neuroimage*, *57*(3), 1273–80. 10.1016/j.neuroimage.2011.05.003

MacLean, P.D. (1949). Psychosomatic disease and the "visceral brain": recent developments bearing on the Papez theory of emotion. *Psychosomatic Medicine*, *11*(6), 338–53.

Majounie, E., Renton, A.E., Mok, K. et al. (2012). Frequency of the C9orf72 hexanucleotide repeat expansion in patients with amyotrophic lateral sclerosis and frontotemporal dementia: a cross-sectional study. *The Lancet Neurology*, *11*(4), 323–30. 10.1016/S1474-4422(12)70043-1

Miller, K.L., Alfaro-Almagro, F., Bangerter, N.K. et al. (2016). Multimodal population brain imaging in the UK Biobank prospective epidemiological study. *Nature Neuroscience*, *19*(11), 1523–36. 10.1038/nn.4393

Molenberghs, P., Cunnington, R., Mattingley, J.B. (2012). Brain regions with mirror properties: a meta-analysis of 125 human fMRI studies.*Neuroscience and Biobehavioral Reviews*, *36*(1), 341–49. 10.1016/j.neubiorev.2011.07.004

Open Science Collaboration (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716. 10.1126/science.aac4716

Palermo, R., Rhodes, G. (2007). Are you always on my mind? a review of how face perception and attention interact. *Neuropsychologia*, *45*(1), 75–92. 10.1016/j.neuropsychologia.2006.04.025

Panksepp, J., Lane, R.D., Solms, M., Smith, R. (2017). Reconciling Cognitive And Affective Neuroscience Perspectives On The Brain Basis Of Emotional Experience. *Neuroscience and Biobehavioral Reviews*, *76*, 187–215. 10.1016/j.neubiorev.2016.09.010

Phan, K.L., Fitzgerald, D.A., Nathan, P.J., Moore, G.J., Uhde, T.W., Tancer, M.E. (2005). Neural substrates for voluntary suppression of negative affect: a functional magnetic resonance imaging study. *Biological Psychiatry*, *57*(3), 210–19. 10.1016/j.biopsych.2004.10.030

Phan, K.L., Fitzgerald, D.A., Nathan, P.J., Tancer, M.E. (2006). Association between amygdala hyperactivity to harsh faces and severity of social anxiety in generalized social phobia. *Biological Psychiatry*, *59*(5), 424–29. 10.1016/j.biopsych.2005.08.012

Piepoli, M.F., Hoes, A.W., Agewall, S. et al. (2016). European guidelines on cardiovascular disease prevention in clinical practice. *Rev Esp Cardiol (Engl Ed)*, *69*(10), 939. 10.1016/j.rec.2016.09.009

Polderman, T.J., Benyamin, B., de Leeuw, C.A. et al. (2015). Meta-analysis of the heritability of human traits based on fifty years of twin studies.*Nature Genetics*, *47*(7), 702–09. 10.1038/ng.3285

R Development Core Team. (2014). R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing.

Renton, A.E., Majounie, E., Waite, A. et al. (2011). A hexanucleotide repeat expansion in C9ORF72 is the cause of chromosome 9p21-linked ALS-FTD. *Neuron*, *72*(2), 257–68.

Rhodes, G., Lee, K., Palermo, R. et al. (2005). Attractiveness of own-race, other-race, and mixed-race faces. *Perception*, *34*(3), 319–40.

Ruffman, T., Henry, J.D., Livingstone, V., Phillips, L.H. (2008). A meta-analytic review of emotion recognition and aging: implications for neuropsychological models of aging. *Neuroscience and Biobehavioral Reviews*, *32*(4), 863–81. 10.1016/j.neubiorev.2008.01.001

Singer, T. (2012). The past, present and future of social neuroscience: A European perspective. *Neuroimage*, *61*(2), 437–49. 10.1016/j.neuroimage.2012.01.109

Srivastava, A., Brewer, A.K., Mauser-Bunschoten, E.P., Key, N.S., Kitchen, S., Llinas, A. Treatment Guidelines Working Group on Behalf of The World Federation Of, H (2013). Guidelines for the management of hemophilia. *Haemophilia*, *19*(1), e1-47. 10.1111/j.1365-2516.2012.02909.x

Thompson, P.M., Stein, J.L., Medland, S.E., Hibar, D.P., Vasquez, A.A., Renteria, M.E. Alzheimer's Disease Neuroimaging Initiative, E. C. I. C. S. Y. S. G. (2014). The ENIGMA consortium: large-scale collaborative analyses of neuroimaging and genetic data. *Brain Imaging and Behavior*, *8*(2), 153–82. 10.1007/s11682-013-9269-5

Turk, D.C., Dworkin, R.H., Allen, R.R. et al. (2003). Core outcome domains for chronic pain clinical trials: IMMPACT recommendations. *Pain*, *106*(3), 337–45. 10.1016/j.pain.2003.08.001

Yoshida, K., Bohn, J. (2018). *Tableone: create 'Table 1' to Describe Baseline Characteristics*. https://cran.r-project.org/web/packages/tableone/tableone.pdf