Diamond in the rough? An 'empty review' of research into 'neurodiversity' and a road map for developing the inclusion agenda

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Letter to the reviewers.

Firstly, thank you again for your attention to detail and thorough consideration of our work. We appreciate your comments. We have made comments in response to your edits, italicized below.

1) There are several grammatical errors throughout the document (e.g., “there” instead of “their”, missing punctuation). Please correct these in your next submission.

We have sent the document to a copy editor as well as our own thorough review and hope that these are much improved.

2) Both reviewers noted that the practice implications section could use more explicit and tangible advice. After this revision we still feel that more can still be added here. Specifically, the practice implications section of the paper remains primarily focused on what not to do, issues with research, and the difficulties of inclusion. These points are important, but why not highlight more clearly the practical ideas noted in Table 5, sharing some concrete examples of what practitioners can do? Your contributions on neurodiversity and HR universal design will be extremely informative for practitioners (you have done great work with Table 5). I believe that this table should be summarized/specific points should mentioned in the practice implications section as well. Otherwise, your practical implications are too heavily weighted towards caveats, with too little emphasis on concrete actions that practitioners can start engaging in today.

We agree and we felt broadly that the issue was one of flow, and that our tables were presented in the wrong sections. We hope that by moving these around, and by including some additional reflexive practice questions in addition to some clarity in the text, that we have addressed this point.

Further you note in the practice implications section that "Employment inclusion practitioners could learn from more mature research bodies such as mental health, race, gender and sexual orientation inclusion in order to mitigate the impact of marginalization." Yet, you do not identify clearly what can be learnt from these literatures. If you wish to keep this point, identify how these literatures can guide practice in the context of your manuscript.

We note that this suggested occurs in a number of places in the article. We have included some examples and signposted to what could be possible from such an endeavour, however a review of learning from these fields is a much bigger job than this single article can contain. We are in fact at the moment applying for research funding to conduct a rapid evidence review of how race and gender research could inform neurodiversity practice.

3) As you noted in your response, Table 6 will help the reader understand the critical realism perspective. Please add reference to critical realism in the title of Table 6, or within Table 6, to add clarity for the reader.

We have added the reference for the CIMO structure to the table.

Many thanks again!

Authors 1 and 2 ☺

RUNNING HEAD: Diamond in the rough?

Diamond in the rough? An 'empty review' of research into 'neurodiversity' and a road map for developing the inclusion agenda.

Introduction

'Neurodiversity' broadly refers to naturally-occurring diversity in human cognition (Singer, 1999). It ~~is frequently~~has been used as an umbrella term for a range of neurocognitive developmental disorders (Doyle, 2020; Kapp, Gillespie-Lynch, Sherman, & Hutman, 2013) including Autistic Spectrum Disorder, Attention Deficit and Hyperactivity Disorder or Dyslexia. Recent public dialogue has shifted to the term 'neurominority' to sign post that relevant individuals are disadvantaged regarding a range of life outcomes, including systemic social exclusion in education and inferior employment outcomes (Carter, Austin, & Trainor, 2012; Snowling, Adams, Bowyer-Crane, & Tobin, 2000). Subsequent restriction of opportunities for a fulfilled working life and career (Holliday et al., 1999; Taylor & Walter, 2003) is in contrast to emerging popular narratives about the talent potential of neurodiversity for modern workplaces (Austin & Pisano, 2017; Sniderman, 2014): the 'diamond in the rough' (Doyle, Patton, Fung, Bruk-Lee, & Bruyere, 2020).

In this paper, we highlight the inadequate scope and focus of academic attention on neurodiversity and employment to date across the fields of applied psychology and management studies. We contextualizse the neurodiversity paradigm from a medical, social and legal perspective in the wider workplace equality, diversity and inclusion agenda. Through a series of 'Empty Reviews' defined as a targeted analysis of literature gaps through systematic literature review principles (Schlosser & Sigafoos, 2009; Yaffe et al., 2012), we illustrate the dearth of tangible evidence. Through due diligence in our conceptualization, including definition of gaps in knowledge, we outline a future research and practice agenda to facilitate informed inclusion for a marginalized minority. In other words, it is our aim to

RUNNING HEAD: Diamond in the rough?

support evidence-based practice in this emerging field guiding Human Resources (HR) and employment policy to mitigate labor force exclusion

Defining Neurodiversity

The term 'Neurodiversity' was coined by the sociological researcher Judy Singer (Singer, 1999) in the context of rights activism during the 1990s (Mcgee, 2012; Runswick-Cole, 2014). The neurodiversity movement highlights the life-long and positive aspects of naturally--occurring cognitive 'differences', such as creativity and 'special interest' skills (Meilleur et al., 2015; Von Károlyi et al., 2003; White & Shah, 2006), as opposed to the focus on developmental 'deficits' such as language or processing speed (Armstrong, 2010; Grant, 2009; Jurecic, 2017; Kapp, Gillespie-Lynch, Sherman, & Hutman, 2012). ~~The term~~ Neurodiversity has been considered a progression from previous umbrella terms such as specific learning difficulties, neurodevelopmental disorders or hidden / invisible impairments. However, Ms Singer herself, alongside other researchers and advocates, prefers ~~the term~~'neurodiversity' to refer to the cognitive diversity in all humans (Chapman, 2020; Monzee et al., 2019; Singer, 1998; Walker, 2012) rather than appropriated as a synonym for disability. Relevant terminology continues to evolve and be hotly debated;,. ~~Current practice is to refer to neurodiversity as a species -llevel phenomenon~~we briefly define alternatives that denote equivalence to the outdated deficit model language. Those who fall in a statistical norm, based on relevant cognitive tests or behavioral assessments, are referred to as '"~~"~~neurotypical~~"~~"' and those who would previously have been termed disordered are referred to as '"~~"~~'~~-~~neurodivergent,' 'neurodiverse'~~"~~" or part of a '"~~"~~'neurominority'~~"~~" (Bottema-Beutel et al., 2020; ~~N.~~ Doyle, 2020; Singer, 1998; Walker, 2012). ~~Armstrong~~ Some authors includes general learning disabilities and/or mental health needs in ~~his~~ definitions (~~T~~ Armstrong, 2010; Chapman & Veit, 2020). Typically, though, the following conditions are considered

neurominorities: Attention Deficit Hyperactivity Disorder (ADHD); Autism; Dyslexia; Dyspraxia/Developmental Coordination Disorder (DCD); Tourette Syndrome (TS); Dyscalculia and Dysgraphia (Bewley & George, 2016; Grant, 2009; Jurecic, 2007; Kapp et al., 2013; Snowling, 2005). Definitions of each condition have evolved over time and diagnostic criteria, as well as treatment approaches, continue to vary considerably (Elliot & Grigorenko, 2014; Kirby et al., 2011; Shelley-Tremblay & Rosen, 1996). For a historical review of neurodiversity/neurodivergence since the industrialisation, see Doyle (2020). Below we present a brief summary of some of the educo-medical models and conceptualizations and prevalence; see Doyle (2017) for a working summary of the occupational strengths and weaknesses of each condition.

The medical model of neurodiversity. This model defines neurominorities linguistically through pseudo-medical deficits. The Diagnostics and Statistical Manual of Psychiatric Disorders (American Psychiatric Association, 2013), known as the 'DSM-5', is used by relevant professionals to categorize and determine individual cases. These conditions are developmental as they emerge in childhood and/or adolescence but not in response to trauma or ill health, and confer specific difficulties rather than indicat~~ion of~~e global developmental delay (Snowling, 2005). Psychological diagnostic criteria define the hallmark of a neurominority as a statistically significant within-person difference, showing a disparity between cognitive strengths and weaknesses (e.g. verbal/visual reasoning, memory). This is in contrast to a 'neurotypical' presentation where an individual's ability scores are within a standard deviation or two of each other (either below average, average or above average) (Grant, 2009; Ihori & Olvera, 2015). There are two sub-types of developmental neurominorities (Doyle, 2017). Population prevalence is shown in parentheses, based on best available data, noting that these vary across nations and depend~~ing~~ on which diagnostic criteria are applied:

RUNNING HEAD: Diamond in the rough?

(1) Clinical conditions, which are assessed by behavi~~o~~o~~u~~r / communication and typically diagnosed by Psychology, Neuropsychology and Psychiatry Clinicians working in health services:

a) ADHD ~~(~~around 5% worldwide (Catalá-López et al., 2017; Shelley-Tremblay & Rosen, 1996) but higher in USA (Danielson et al., 2018).

b) Autism ~~(~~between <1 and 1.6% globally, significantly affected by diagnostic criteria and access to services (Elsabbagh et al., 2012).

c) TS ~~(~~1%~~:~~ (CDC, 2009; Robertson, 2006)

(2) Applied conditions, which are assessed by functional difficulties, either educational or occupational, and typically diagnosed by Applied Psychologists, Educators and Occupational Therapists in school or work settings:

a. Dyslexia ~~(~~up to 10%~~:~~ (~~M. J.~~ Snowling, 2010).

b. DCD ~~(~~up to 6% (~~R.~~ Blank et al., 2019).

c. Dyscalculia ~~(~~up to 6% (~~Margaret J~~ Snowling, 2005).

d. Dysgraphia ~~(~~n/k~~)~~ (Adams, 2019).

For the purpose of this paper, we focus on the main developmental neurominorities, namely ADHD, autism, dyslexia, DCD and Tourette Syndrome, to gauge the quality of research regarding practical support and inclusion of these conditions in the workplace.

The emerging social model of neurodiversity. Given the high prevalence of neurominorities reported in advanced economies, there is an obvious evolutionary critique: that neurodiversity has evolved within a typical spectrum of human experience (Blank, Peters, Pickvance, Wilford, & MacDonald, 2008; Boycott, Schneider, & Osborne, 2014; Doyle, 2020; Shelley-Tremblay & Rosen, 1996). As it may be natural and useful to have a small percentage of the population with specialist rather than generalist abilities (~~T~~

RUNNING HEAD: Diamond in the rough?

Armstrong, 2010), stakeholders argue that we need to develop neutral inclusion practices that do not insinuate ill health. It is worth noting that during the past 100 years both left-handedness and homosexuality were considered psychiatric disorders, ~~which~~ demonstrate~~sing~~ that any conception of 'normal' is culturally bound and subject to historical changes in line with Ecological Systems Theory (Bronfenbrenner, 1979). We cannot be sure at this stage that a disorder based on quantifying the degree of adherence to a social norm, such as literacy, activity levels or social interactions, is truly a biological deficit. The social model of neurodiversity contends that the world is polarized and lacks in flexibility to accommodate all natural variations in human cognition and functioning (Shakespeare & Watson, 1997). Individuals who fall outside the norm represent a minority group, whose rights must be protected, and whose ways of functioning should be recognizsed, valued and harnessed (Runswick-Cole, 2014; Singer, 1998).

The social model has influenced public awareness of neurodiversity in recent years; the narrative of the 'diamond in the rough' is voiced in popular press and media world-wide (Adams, 2019; Philipson, 2014; Sniderman, 2014; Wollaston, 2016). Neurodiversity is also attracting the attention of the business press who describe a 'talent advantage' for employers through targeted recruitment of neurodiverse applicants (Austin & Pisano, 2017; Comaford, 2017). This approach chimes with broader initiatives to promote diversity and inclusion of gender, ethnic minorities and sexual orientation (Cucina et al., 2013) and disability more generally (Murfitt et al., 2018) to broaden the talent pool, known as the 'business case' for inclusion (Saleh & Bruyère, 2018).

Socio-legal barriers and protections. There is a conflict between aspiration and reality in occupational practice. Despite sparse yet consistent evidence in support of specific talents (~~Thomas~~ Armstrong, 2015; Logan, 2009; Meilleur et al., 2015; Von Károlyi et al.,

RUNNING HEAD: Diamond in the rough?

2003; White & Shah, 2006), neurominorities are currently not well accommodated by contemporary social structures based on neurotypical profiles. To illustrate, in the UK, modern apprenticeships require (high) literacy levels of grade 10 or above to access basic vocational training in fields that rely on specialist visual reasoning, such as hairdressing and plumbing (SFA, 2016). Interviews remain popular as a hiring technique globally, despite evidence that these unfairly disadvantage neurominorities, particularly autistic people (Cooper et al., 2018; Hayes et al., 2015). Such barriers matter. Only 10-16% of autistic people have a job (NAS, 2016) and ADHD has been shown to significantly increase the likelihood of incarceration in the UK and USA (Halmøy et al., 2009; Young et al., 2018). 20% of UK and 35% of US entrepreneurs are dyslexic compared to only 1% of corporate managers (Logan, 2009) and a third of long-term unemployed people are ~~disproportionately more likely to be~~ dyslexic (Jensen et al., 2000). Such systemic exclusion has moral, social and economic consequences.

To counter ~~any~~extant structural barriers in education and work, neurominorities are considered recogni~~z~~sed disabilities in most developed nations, which theoretically affords protection from discrimination by law. In the UK Equality Act (Equality Act, 2010), for example, reference is made to long-term (chronic) difficulties in memory, learning and communication which may be affected by all the above-named conditions. In the USA, Canada, Australia and throughout Europe, similar legislation provides disability protections (Australian Government, 1992; Canada, 1995; U.S. Department of Education's Office of Special Education and Rehabilitative Services (OSERS), 2006; U.S. Equal Employment Opportunities Commission, 2008) all broadly aligned to the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) (United Nations, 2006). Such legislative innovations are yet to translate into occupational success. The 'disability-employment gap' remains of concern worldwide (WHO, 2011). There is a pressing need to understand 'what

RUNNING HEAD: Diamond in the rough?

works' and move to an evidence-based practice model for applied practitioners to implement, yet this 'push' for interventions based on diagnosis somewhat undermines the 'pull' of the untapped talent model. Although applied research is sorely needed, ~~the~~ ontological positions to date ~~has~~ have been dominated by the medical model. Yet individuals with lived experience advocate a more critical and realist approach to inclusion which takes account of their priorities through inclusive research design (Bottema-Beutel et al., 2020; Rios et al., 2016; Walker, 2012). We return to this point in our discussion.

A science-practitioner gap. Activities that constitute disability 'support' vary geographically, with advanced economies applying a range of active labor market interventions supporting both the individual (pre- and during employment, 'supply side') as well as the employer through incentivization and best practice guidance ('demand side') (Murfitt et al., 2018; Saleh & Bruyère, 2018). However, the extent to which such programs are effective for neurominorities is less documented (Gerber et al., 2012). In the UK for example, there is a statutory government -body facilitating the provision of 'reasonable adjustments' or accommodations to thousands of employees with invisible disabilities per year; the third most common disability group after muscular-skeletal and sensory impairment (Gifford, 2011). The program, known as 'Access to Work', offers one-to-one coaching and assistive technology to individuals (at approx. $1000 per person) and is broadly well-regarded, as evidenced by user survey data (Adams, Tindle, Downing, & Morrice, 2018; Melvill, Stevens, & Vaid, 2015). Similar programs such as 'Jobs in Jeopardy', part of the Australian Disability Employment Service, are also seen ~~value added~~ to add good value for the tax-payer, yet do not specifically focus on the experience of neurominorities, with the exception of autistic people (DEEWR, 2013). The provision of such interventions has received minimal attention in research evidenced by high level summaries yet insufficient high-quality studies. We are unaware of any process evaluations of relevant interventions

most frequently recommended for neurominorities by these programs, such as coaching, mentoring and assistive technology (~~N.~~ Doyle, 2019; Kulow & Thomas, 2019; Lindstedt & Umb-Carlsson, 2013; Sundar, 2017; Work and Pensions Committee, 2018) that could elucidate psychological mechanisms of change or evidence career advancement outcomes. We are witnessing increasing practitioner advice from business advisor groups (ACAS, 2016; ODEP, 2020; Spargo-Mabbs et al., 2020; TUC, 2011) including coaching, assistive technology, provision of extra time, flexible hours policies and use of acoustic barriers to mitigate background noise distractions. There is a lack of reliable experimental work evaluating the effectiveness of relevant support structures for neurodivergent individuals (Patton, 2019; Sundar, 2017; Whitby, 2017) meaning that it is difficult to demarcate evidence-based practice (Briner & Rousseau, 2011).

Globally, disability programmes tend to be led by healthcare provision, vocational rehabilitation and occupational therapy tending towards those with more medicalized needs (~~N.~~ Doyle, 2021). It is unclear the extent to which ~~applied~~ neurominorities such as ADHD, TS, dyslexic and dyspraxic employees might be covered by such programs, though autism has received increased attention (Lawer et al., 2009). For example, ~~individualized supported employment plans~~Individual Placement Support (IPS) ~~are~~ is sometimes provided for autistic people, which ~~are~~ is well-regarded and reasonably well-evaluated (Lounds-Taylor et al., 2012; Wehman et al., 2016). The principles and practices of such relevant interventions could provide a rich resource for expansion to accommodate other neurominorities. Yet they are based on a medical model, which implies that the workplace environment is fixed and the individual is impaired and therefore needs to adapt. This is at odds with the social model ambitions of the neurodiversity movement and the UNCRPD (United Nations ~~Convention on the Rights of Persons with Disabilities~~, 2006). ~~At~~ Further, at an average cost of tens of thousands of dollars per person, which is an investment that an employer or employee alone

RUNNING HEAD: Diamond in the rough?

cannot justify, ~~these~~ IPS interventions only break even when reductions in public spending are included (Jacob et al., 2015; Knapp et al., 2013). Employee Assistance Programs are also relevant in this context as a potential source of specific support. However, such programs tend to accommodate mental health specifically, they are potentially oblivious to cognitive strengths and impairment, ~~and~~ as well as being somewhat vague about any benefit for individual work performance (Joseph et al., 2018). While it may be essential to address acute mental distress at source, it is possible that support for stress and anxiety when the cause is cognitive (not emotional or social) could create more long-term harm than good if support activities are not informed by a more holistic perspective on neurominorities. More specifically, any~~the~~ presupposition that the cause is individual failure to adapt rather than structural exclusion could be detrimental for self-worth, employment and other outcomes, leading to a spiral of negativity. Therefore, any academic enquiry must take a holistic perspective on interventions to address socially-constructed marginalization and individual need to inform evidence-based professional practice.

In summary, evidence regarding any activities to support improving job performance and subsequent occupational inclusion through disability accommodation for neurominorities is lacking (Adamou et al., 2013; Kirby et al., 2011; Palmer & Stern, 2015; Rice & Brooks, 2004). We consider the development of a research agenda an essential and urgent task for the neurodiversity inclusion movement.

Review questions

Against a context of overlapping and potentially conflicting societal, legal and conceptual developments, we aimed to map any existing evidence and scrutini~~s~~ze robustness as well as disciplinary origin. Although we endeavoured to keep an open mind, it was our assumption from the outset that our research would draw from the principles of 'Empty

Reviews'. Empty reviews are becoming common in health and medical fields to establish lack of evidence for any interventions (Yaffe, Montgomery, Hopewell, & Shepard, 2012). Guided by a systematic review methodology, we (1) formulated specific a priori questions, (2) devised a search protocol, (3) applied a predefined relevance inclusion criteria and process for achieving consensus and (4) applied a predefined quality inclusion criteria. Our protocol was based on best practice guidance from the management/ business field, given the work context for any relevant evidence (Denyer & Tranfield, 2009; Rousseau et al., 2008). Our research questions were:

1. How many papers are published in mainstream empirical organizational and management psychology publications related to the inclusion of neurodiversity (or related conditions) in work contexts?
2. How many papers exist in general psychological domains regarding neurodiversity?
3. How much research exists in any academic domain concerning the occupational presentation of neurodiversity?

From the third search, we were able to formulate a fourth question:

4. In which academic disciplines is relevant academic research currently located?

From these structured searches, our synthesis will consider:

1. What, if anything, can we infer from the current literature about 'what works' in practice to improve the inclusion of neurodivergent individuals at work?
2. How should the prospective research agenda be epistemologically framed?

Systematic Empty Review Protocol

Search terms

RUNNING HEAD: Diamond in the rough?

Our review focused on developmental neurominorities using search terms which reflected differences in labels over time. We excluded mental health needs, chronic health conditions, acquired brain injury and general learning disabilities since they are already addressed in ~~a~~ more advanced research fields (Corbière et al., 2014; McGonagle et al., 2014; Tyerman, 2012). Some mental health research was extracted as a point of reference to compare volume of returns. Dyscalculia and dysgraphia *are* included in the taxonomy of developmental conditions but not considered in the extraction given the previously noted absence of research (Doyle, 2017). Table 1 summarizes all search terms.

****Note to Editor, insert Table 1 about here*****

Extraction protocol. There were three iterative searches, conducted in January 2017 and repeated in August 2018; these are ~~and~~ summarized in Figure 1.

Search one: How many papers are published in mainstream empirical organizational psychology publications related to neurodiversity (or related conditions) in work contexts?

The first search represented a systematic check that this field was indeed under-researched, by focusing on what ought to be ideal publications for considering the intersection of neurodiversity (a psychological phenomenon) and workplace inclusion: *The Journal of Applied Psychology*, *Personnel Psychology*, *Industrial and Organizational Psychology* and the *Journal of Occupational and Organizational Psychology*. We commenced by hand-searching the four journal websites specifically for the five conditions and the term 'neurodiversity' to understand the extent to which they featured in key applied psychology research.

RUNNING HEAD: Diamond in the rough?

~~**Search one:** How many papers are published in mainstream empirical organizational psychology publications related to neurodiversity (or related conditions) in work contexts?~~

No time limits were applied. The primary aim of this search was to extract the number of references to neurominorities and the term 'neurodiversity' itself, and we did not initially subject papers to a second stage rigorous relevance and quality criteria check. However, the small number of returns enabled a qualitative review of the extent to which conditions were merely 'mentioned' as opposed to explored conceptually or evaluated. Table 2 shows the number of returns compared to the number mentioning mild-to-moderate mental health needs in two of the journals.

Search two: how many papers refer to ~~neurodiverse~~ neurominority conditions in general psychology domains?

A second search of the broader psychological domains was conducted across the *Journal of Occupational and Organizational Psychology* (repeated); *British Journal of Psychology*; *British Journal of Clinical Psychology*; *British Journal of Developmental Psychology*; *British Journal of Educational Psychology*; *British Journal of Health Psychology* and *British Journal of Social Psychology* in order to sample check whether or not consideration of neurodiversity was better represented in relevant psychological sub-disciplines. The second search was not intended to be definitive, but indicative of the spread of individual condition representation in research relevant to the neurodiversity. We did not apply time limits but categorized the returns into papers published before 1995, 1995-2005 and 2005+ to consider if the developing social movement was in any way linked to number or foci of publications. As with search one, the extracted papers were not subjected to relevance and quality review and may only 'mention' the condition rather than explore

thoroughly. We compared the relative percentages of each condition's prevalence rates with the relative volume of research, to observe any over- or underrepresentation.

Search three: Hhow many papers address the occupational presentation of neurodiversity to a high academic standard of evidence in any discipline?

Question four: In which academic disciplines is relevant academic research currently located?

We undertook a wider, more international review of the literature on occupational presentation of neurodiversity in EBSCO-hosted journals to ascertain if there was a tranche of yielding principles (Cucina et al., 2013) that could be appropriated for inclusion practice from related disciplines, for example such as vocational rehabilitation. We limited the search to the English language and included grey literature using all terms in Table 1. We took a systematic approach, with an initial 1439 returns creating a bespoke extraction form in Excel. We then filtered results by abstract screening, removing any papers without reference to occupational issues. The second author undertook spot checks and a discursive review of ambiguous cases until we achieved full consensus for inclusion, leaving us with 111 papers. We did not explicitly seek to apply a rigorous quality check at this stage, mainly because the aim of the review was not meta-analysis of an intervention success, simply exploration of the extent of research. Instead, we considered the hierarchy of evidence principles (Rousseau et al., 2008) and used quality guidance from related systematic reviews (Doyle & McDowall, 2019; Rojon, McDowall, & Saunders, 2011) to rate papers as strong evidence (systematic review and meta-analysis), medium evidence (well-constructed primary papers) or weak evidence (poorly-constructed papers, case studies, practitioner opinion and anecdotal evidence). The primary author performed these ratings, the second author cross-checked and discussion was held to resolve conflicts until full consensus was reached. Papers scoring

medium or above were retained: 48 papers in total. Finally, the papers were categorizsed by academic discipline using journal titles (or full paper review if not clear) to consider where, if not in organizational psychology or management, knowledge regarding the occupational presentation of neurodiversity is currently located. Figure 1 depicts the number of included papers at each stage.

****Note to Editor, insert Figure 1 about here*****

Results and Synthesis

Below we present the number of returns in each extraction, categorized as described above, and a brief narrative summary of the findings for each search according to the first three review questions:

Search 1: Organizational psychology journals. Table 2 shows the number of papers mentioning neurominority conditions and an absence of the phrase neurodiversity to date in the contemporary organizational psychology that we selected. Only 32 papers mentioned ~~neurodiverse~~ neurominority conditions at all; 22 of these were in SIOP's *Industrial and Organizational Psychology* journal, three in the *Journal of Applied Psychology* and two in *Personnel Psychology*. The *Journal of Occupational and Organizational Psychology* (JOOP) mentions neurodiverse conditions on only five occasions compared with 413 mentions of mental health conditions.

****Note to Editor, insert Table 2 about here*****

Full paper review of the returns did not provide evidence of the intervention evaluations required to support disability inclusion practice, protect employers/employees or justify current policy. For example, the two dyslexia returns within *JOOP* pertain to (1) the use of handwriting as a recruitment technique (Klimoski & Rafaeli, 1983) and (2) a broader

article about employer responses to disability inclusion (Jackson et al., 2000). Similarly, the other neurominorities listed above are mentioned in references related to a broader theme, rather than examined as to how they relate to occupational psychology per se (for example, both ADHD and autism are within the reference list for the coaching review conducted by Jones et al. 2016). While SIOP's *Industrial and Organizational Psychology* journal marks a significant improvement in volume compared with others in the discipline, there are two points of note: (1) mental health papers were still disproportionally better represented and (2) papers were cross-sectional and/or conceptual reviews offering descriptions of problems rather than experimental work regarding potential solutions (Ashworth, 2014; Bono et al., 2009; Gabbard et al., 2014; Hyland & Rutigliano, 2013; Saal et al., 2014; Santuzzi et al., 2014).

Search 2: broader psychological research. The results presented in table 3 show the number of papers mentioning neurominorities and mental health conditions in a sample of UK-based psychology journals.

****Note to Editor, insert Table 3 about here***

The UK-based psychology journal search revealed an increasingly disproportionate body of research focusing on mental health needs and autism, relative to their prevalence. Closer inspection of two journals revealed consistent cross-disciplinary research between mental health and occupational psychology: 1686 studies referenced 'work' in the *British Journal of Clinical Psychology* and 413 studies on mental health were published in the *JOOP*, which suggests a more mature research field concerning the impact of mental health in the workplace, though we concede that this has not been quality checked. Conversely, dyslexia studies appear to be decreasing in number and mainly focused on the diagnosis of

children to the exclusion of occupational contexts. ADHD, Dyslexia, DCD and TS are all under-researched compared to their population prevalence.

Search 3 and Question 4: Multi-disciplinary studies on neurodiversity and work. Of the 48 extracted papers, the following conditions were represented: ADHD, 13 papers; Autism, 19 papers (including four with strong evidence supporting inclusion activities); DCD, five papers; Dyslexia, six papers and TS, five papers. Table 4 shows the professional discipline sources (indicated by journal title) of the 48 papers. We note that, while neuroscientific research has proliferated in recent years and accounts for much of the extant condition-specific literature, only one neuroscience paper met the criterion of referring to occupational issues. A full list of the journal titles for extracted studies is presented in appendix 1.

****Note to Editor, insert Table 4 about here*****

Synthesis Question 1: What, if anything, can we infer from the current literature about 'what works' to improve the inclusion of neurodivergent individuals at work?

Given the absence of relevant intervention evaluation (either randomized control trial, cross-sectional research, process analysis or qualitative) in mainstream organizational and management psychology, we consider our first search an 'empty review' (Yaffe et al., 2012). ~~The limited number of primary papers across broader applied psychological domains describe issues and call for further research, yet do not culminate in a clear research agenda congruent with evidence-based practice (Schlosser & Sigafoos, 2009).~~ Further, search two indicated that the investigation of individual ~~neurodiverse~~ neurominority conditions per se is unrepresentative of population prevalence and seems instead to be led by media fashion~~;~~, ~~(e.g.~~ for example, ~~-~~ the dominance of autism within current popular narratives (Bernick,

2019)~~)~~. -The limited number of primary papers across broader applied psychological domains describe issues and call for further research, yet do not culminate in a clear research agenda congruent with evidence-based practice (Schlosser & Sigafoos, 2009).

Regarding our third review question concerning quality of evidence for determining 'what works', we note limited research that could contribute to an evidence-based agenda which is dispersed across disciplines lacking relevance to the socio-legal, economic and occupational context; for example, neuroscience, child development and social work, which leaves crucial epistemological and applied knowledge gaps in our understanding. While we commend the neuroscience paradigm for advancing our etiological understanding of symptomatology, it does not reference functional, workplace-contextualized outcomes and is thus lacking ecological validity (Chaytor et al., 2006; D'Souza & Karmiloff-Smith, 2017). Vocational rehabilitation and Occupational Health are the closest represented disciplines in terms of purpose, specifically exploring conditions, their impact on the workplace and intervention evaluation. However, these fields are more closely aligned to the medical paradigm which implicates a disability inclusion model for practice, rather than an organizational-level talent management approach such as the mentoring and peer support programs favoured by gender and race inclusion initiatives (Roberson, 2018).

We conclude that there is insufficient academic enquiry into neurodiversity at work and highlight a need for broadening the epistemological frameworks of neurodiversity research to offer theoretical support to the developing agenda.

Synthesis Question 2: How should the prospective research agenda be epistemologically framed?

To address the disparity between research to date and the emerging social movement arguing for marginalized lived experience at the heart of research (Bottema-Beutel et al.,

RUNNING HEAD: Diamond in the rough?

2020; Rios et al., 2016), a constructivist investigation of experience and power dynamics appears crucial. Alongside, we recognize the need for positivist evaluation of interventions; the limited extant studies indicate an immature evidence base to underpin practice and policy. Controlled trials must be broadened from the individual to the organizational level of analysis. Minded that qualitiative and quantitative research are complementary, not conflicted, we propose Critical Realism (Houston, 2014) as an appropriate epistemology for a developing research agenda. Critical Realism facilitates inductive, hypothetic-deductive and abductive reasoning, required to iteratively blend theory and method (Van Maanen et al., 2007) for the development of a nascent research field in a Pragmatic Paradigm (Simpson, 2018). Our proposed ecological framework is outlined in Figure 2, ~~with~~deploying multiple levels of analysis (Bronfenbrenner, 1979) ~~focusing~~ in which we focus on two intersecting points for intervention and analysis: the micro/meso and the meso/macro.~~;~~ T~~t~~his is congruent with Critical Realist research and incorporates the ecological approach that has been more thoroughly explored in general disability employment (Szymanski~~, E.~~ et al., 2012).

****Note to Editor, insert Figure 2 about here*****

We now briefly explore the issues within each level of analysis before outlining a research and practice agenda in more detail in the next section. The micro level refers to the neurodivergent employee, their individual work performance, and the current perceived need to attain levels of literacy, sedentary concentration and/or social communication norms akin to their neurotypical co-workers~~,~~ in order to retain their employment. ~~Critical Realism facilitates evaluative studies regarding individual level accommodations as described above, as well as exploring specific influences on career inclusion such as the cognitive ability, self-efficacy and career awareness (Leather et al., 2011; Nalavany et al., 2017; Test et al., 2009).~~ Individual level effects will be additionally influenced by ~~marginalization~~

RUNNING HEAD: Diamond in the rough?

~~and~~intersectionality, such as marginalization resulting from ~~internalized stereo-type threat to career ambition, such as~~ gender, gender identity, ethnicity and race, sexual orientation, age and socio-economic status (Crenshaw, 1991; Cucina et al., 2013; Greenhaus et al., 1990; Ozbilgin et al., 2011; Szymanski~~, E.~~ et al., 2012; Young et al., 2020). Critical Realism facilitates evaluative studies regarding individual level accommodations as described above, as well as exploring ~~specific~~the influences on career inclusion caused by the power dynamics;~~ such as the cognitive ability~~for example, self-efficacy and career awareness (Leather et al., 2011; Nalavany et al., 2017; Test et al., 2009).

The meso level refers to the immediate context of the neurodivergent employee, including design of their job, workstation and environment, but also the communication norms of their team and organization. The meso level is influenced heavily by the socio-historical context of said norms including the prioritization of literacy and fine motor control as the major form of communication, and sedentary, hyper-social education and work (~~N.~~ Doyle, 2020). We also note current occupational constructions drawn from the macro-historical level of analysis which create meso-level norms. For example ~~such as~~ office work, which made sense when staff needed access to paper files and ledgers in the 19th and 20th centuries, but makes less sense now that our work is stored electronically and remotely. Such norms have ~~creating~~ created exclusion and segregation~~,~~ for example, ~~for~~ the illiterate dyslexic who should be avoided or the autistic technologist who might be desirable but only in a limited role. Thus, ~~as well as~~alongside a 'Realist' evaluation of direct support effectiveness for employers such as toolkits and inclusion best practice guidance, a 'Critical' challenge of common / absent narratives and role models in business is encouraged.

The macro level of analysis influences neurodiversity inclusion through the use of active labor market policies such as those described in the introduction (e.g. Access to Work,

RUNNING HEAD: Diamond in the rough?

Jobs in Jeopardy) and the extent to which employers are incentivized to address disability inclusion in hiring and talent management (Murfitt et al., 2018; Saleh & Bruyère, 2018). As mentioned in the introduction, such policies are lacking in longitudinal evaluation, which is an urgent concern considering the persistent disability employment gap more broadly. Yet such policies also exist in a macro-historical context of wider technological advancement that facilitates new possibilities for inclusion. Contemporary expectations of normalization and homogeneity at work, inherited from the industrial revolution as above, are in flux as we adapt to ubiquitous technology, cloud access to records and indeed even the type of work available (ONCE, 2019; WEF, 2020), impacting the policies and institutions just as they affect businesses. For neurominorities who have struggled with tasks typically framed as necessary for 'good' performance, including literacy and handwriting, hyper-socialization and sedentary work, such changes require critical appraisal as they offer potential for increased inclusion across the lifespan. For instance, writing tasks are already becoming more fully supported through adaptive software, which allow more accurate dictation and transcription; these changes will increasingly be incorporated into education and national training design. We see opportunity here for ~~T~~the next generation of neurominority workers, who could be significantly less disabled if policies can catch up with technological trends. For example, incentivising acceleration of digitization and automation of literacy production in education and public sector workplaces could have a ripple effect to meso-level workplace norms more generally.~~.~~

The next section focuses on specific research activities required to mature the neurodiversity field of practice, building on the Critical Realist epistemology framework to evaluate and challenge both supply and demand approaches.

Discussion: Mapping a new field of research and practice~~research agenda~~

RUNNING HEAD: Diamond in the rough?

The research agenda. Given the current dearth of evidence as evidenced through our empty review, our attention must turn to the focus for a new research agenda~~, a good place to start are primary evaluative studies~~. One particularly urgent concern is the need for longitudinal evaluation and process analysis of adjustments that are currently routinely deployed at the micro level, such as coaching and assistive technology (~~Nancy~~ Doyle, 2019)~~. , and blanket use of heuristical practices originating in education, selection and assessment, such as 25% 'extra time' (Carpenter & Paetzold, 2013).~~ We need to understand ~~which~~ how accommodations 'work' as interventions for a number of target outcomes, such as ~~, in that they might lead to~~ secure employment ~~and~~, improved career advancement~~, for , be valued by individuals ultimately evidenced by a reduced disability employment gap and~~ ~~recipients and~~ added value ~~to an~~for employers through enhanced work performance, but ultimately evidenced by a reduced disability employment gap~~. Cost-benefit analysis can be applied and efforts directed to the most productive solutions. We need to understand how pivotal adjustment activities are in improving job performance, and whether improvements lead to increased employment opportunities to reduce the disability employment gap.~~Generalist disability research ~~includes~~has ~~demonstrated~~produced some cost benefit analysis of supply side adjustments ~~but also~~as well as how to implement productive demand side interventions, such as networking, best practice sharing, reporting on disability inclusion data and influencing the will of businesses in acting inclusively (Saleh & Bruyère, 2018). The neurodiversity movement needs replicate, in order~~evaluating against~~ to evidence the business case argument that inclusion equals talent and may improve morale and productivity (ILO, 2010)~~. In this section, encompassing Tables 5 and 6, we~~~~We argue that a perspective is most suited to such aims given the complex interplay of individual needs and business requirements~~

RUNNING HEAD: Diamond in the rough?

~~Critical Analysis. The i~~Alone, intervention evaluation of which activities deployed in practice 'work' will only ~~described above all locate~~focus on change at the micro level, with meso and macro 'success' markers ~~being~~ as an aggregate of individual improvement and achievement. Yet, globally, current legislation requires the employer to make accommodations / adjustments to infrastructure; it does not require the individual employee to change (social model). Without multi-level, critical analysis we risk appropriating medical research agendas that ignore the social model identity of that minority (Huijg, 2020; Riddick, 2001; Shakespeare & Watson, 1997). Such limited perspective may not only fail to recognizse individual strength and capabilities, but also resonate ~~, which will play~~ poorly with an increasingly vocal stakeholder movement who ascribe to the 'nothing about us without us' (Charlton, 1998) principle (Bottema-Beutel et al., 2020). ~~In Figure 3 we briefly explore the nuances of this conflict as it stands in socio-legal practice.~~

~~**Note to Editor, insert Figure 3 about here***~~

~~The case study presented in Figure 3 illustrates the limitation of the 'case-by-case' approach. In~~ We argue that we can learn from ~~To apply~~ principles adapted from analogous fields such as~~on~~ race and gender inclusion~~, fields~~ which focus es on ~~, research here tends towards~~ identifying unconscious biases in hiring, managing and promoting marginalized workers (Roberson, 2018). Outcomes such as pay disparity and representation at senior levels are considered markers of success, not the effectiveness of programs to improve the performance of individuals who happen to be black, ~~brown~~ trans or female. Race and gender interventions are thus less medicalized, without the 'diagnosis' and 'treatment' lens favored in supply side interventions for neurominorities, though we acknowledge that ~~even if~~ the ~~Pressure to behave to the~~ social 'norms' of the white male are still implicitly applied ~~and~~ through widespread mentoring arrangements ~~are widespread~~ (Dashper, 2019; Kandola, 2018).

RUNNING HEAD: Diamond in the rough?

y et race and gender interventions are less medicalized, without 'diagnosis' and 'treatment' protocols. OTo summarize, operating from the social model inferssignposts that, like wider equality diversity and inclusion initiatives, it is businesses that who need to change, not individuals. a position There is a clear need for neurodiversity research which incorporates a macro-economic, socio-legal perspective and identifies areas within the employee life cycle where policy change would lead to greater inclusion.

We look to generalist disability inclusion research again for further insight on macro-economic research directions. thatHerein, it remains unclear whether demand side intervention policies such as tax breaks, quota targets and penalties stimulate systemic change (Salah and Bruyere 2018)stimulate systemic change long term systemic inclusion change., although it is, however, paradoxically possible that by aligning with disability,, neurominorities may benefit from these types of inclusionalthough there is a moral (and legal) imperative for starting at the system level. Yet, CeCurrent organizational practice in neurodiversity inclusion, however, tends more towards the 'carrot' than the 'stick' however. Key stakeholders in business may not respond positively to mandated quotas and this could set the movement back, rather than drive acceptance. Building on piloted affirmative action programs such as Autism at Work initiatives, employers may instead prefer to be guided by clear policy suggestions on how to graduateprogress from token inclusion to systemic inclusion. Research activities will again need to replicate this sort of analysis to support the development of policy through evaluation of neurodiversity specific endeavours currently in vogue such as affirmative action.

Here we proposeThe Neurodiversity movement may yet aspire to macro, structural inclusion goals, adapting 'Universal Design', a set of principles currently aimed at increasing accessibility of buildings and technology (The Center for Universal Design, 1997) to HR

~~processes Universal Design for HR and targeting the subtle implicit normalization executed through recruitment, performance management, appraisal and promotion. Arguably this is more in line with wider diversity and inclusion initiatives seeking to reduce the effect of stereotypes and norms that are baked in to human resource. This might include avoiding unnecessary interview requirements for jobs that hinge on data analytics (where work sample testing would be more appropriate, and tap into the typically autistic talent of accuracy, for example) or over use of cognitive testing, including without assistive technology compatibility, where specialist thinkers are required to demonstrate generalist abilities for specialist roles. Such an approach could be contextualized as unleashing talent rather than adding to manager's to do lists, and would be congruent with the aspirations of the Neurodiversity movement. In short, there are a number of ways in which HR could adapt to maximize the talent potential of this untapped minority, without compromising the integrity of recruitment and organizational performance. Table 5 indicates how Universal Design principles could be manifested across six core areas of HR: job design, hiring, onboarding, training and development, performance management and well-being support. We recommend review, critique and further development of these ideas within industrial/organizational psychology and human resource management research.~~

~~**Note to editor, insert Table 5 about here**~~

To summarize, mainstream psychology and management research have failed to heed the call for research to support the needs of a significant minority (Beauregard et al., 2018; Ozbilgin et al., 2011) and interventions remain focused at the individual level. We argue that this is short-sighted and ~~incomplete given the Social Model of legislation, the future of work design and the talent principles of the Neurodiversity paradigm. We~~ propose ~~the following~~a series of research questions, presented ~~below~~ in Table ~~6~~5, using the 'Context, Intervention.

RUNNING HEAD: Diamond in the rough?

Mechanism, Outcome' (CIMO) framework as a guiding structure in ~~pragmatic~~ Realist research (Denyer et al., 2008). Our ~~but with a~~Ccritical lens acknowledginges the ontological duality of medical and social models in neurodiversity and enables both inductive and deductive research, in iterations and cycles rather than a beginning and an end. ~~Such an approach is essential due to the socio-historical constructed nature of the disablement.~~ The Critical Realist paradigm epistemologically frames the need for research to simultaneously consider 'what works' with appropriate challenge to the dominant paradigm of what is 'not working.' ~~.~~

****Note to Editor, insert Table ~~5~~5 about here*****

Practice Implications: The neurodiversity paradigm is yet to make an evidence-informed impact on organizational practice. ~~W~~To advance practice whilst awaiting the development of specific research, we propose applying 'Universal Design'~~,~~; a set of principles about justice, flexibility and simplicity, currently aimed at increasing accessibility of buildings and technology (The Center for Universal Design, 1997) to Human Resource (HR) processes. ~~The~~Our overarching premisse is to ensure inclusive practice throughout the employment lifecycle to pre-empt~~,~~ (rather than remediate)~~,~~ exclusion and bias embedding activities ~~which benefit the entire organisation~~. Examples might include replacing unnecessary interview requirements for jobs that hinge on data analytics (where work sample testing would be more appropriate, and tap into the typically autistic talent of accuracy, for example) or considering the overuse of cognitive testing, including without assistive technology compatibility, where specialist thinkers are required to demonstrate generalist abilities for specialist roles. Both these activities could improve the predictive validity of recruitment and benefit a wider population. In short, HR could adapt to maximize the talent potential of this untapped minority, without compromising the integrity of recruitment and

organizational performance. Table 6 indicates how Universal Design principles could be applied across six core areas of HR: job design, hiring, onboarding, training and development, performance management and well-being support. We recommend the review, critique and further development of these ideas in industrial/organizational psychology and human resource management research.

** Insert Table 6 about here

Additionally to Universal Design, other bodies of work may offer guidance to practitioners. ~~The neurodiversity paradigm is in its infancy, struggling for recognition within diversity and inclusion programs and fighting the legacy of medical pathologization (Doyle, 2020)is yet to make an evidence-informed impact on organizational practice. We therefore frame the implications as set out in Table as a n appropriately caveated set of reflective questions6.~~ Those with a minority diagnosis are unlikely to disclose to employers (Madaus et al., 2002; Santuzzi et al., 2014), for (warranted) fear of prejudice and stigma (Colella et al., 1998). Employment inclusion practitioners ~~must~~ could learn ~~on examples~~ from more mature research bodies investigating minority prejudice such as mental health, race, gender ~~and~~or , sexual orientation ~~inclusion in order to~~to ~~mitigate the impact of marginalization.~~develop protocols for increasing equity (Kessler et al., 2009; Roberson, 2018). ~~They~~Practitioners should, however, ~~, whilst also~~simultaneously balance ~~appreciating~~ the legal obligations for disability support and potential medical treatment that might be in operation at the micro level. In practice, relevant interventions need to include but go beyond ~~this involves not only~~ seeking qualified, professional support for individual employees to ensure that relevant activities do not remain merely compliance--focused. More fundamentally, there is a need ~~to , but also reviewing~~ for practitioners to intervene when delivering standard HR protocols around job design, hiring, contracting, training, management performance and wellbeing, to

consider the impact of the neurotypical norm (as per Table ~~5~~6). For example, does a role really ~~require high standards of spelling if all communication is electronic, and assistive technology can be applied~~ require influencing skills and teamwork if the focus is on highly accurate output produced alone? Should ~~the~~a role require full time attendance to a busy, crowded office space which has an additional cognitive burden for those with attention deficits, given the ubiquity of remote access technology? ~~Must we~~Is it necessary to ~~interview for all roles when a work sample test might be more practical at assessing the required performance, given that autistic people are more likely to underperform at interview?~~ HR, applied psychologists, occupational health and vocational rehabilitation practitioners can deliver systemic change by updating their practice to incorporate neurodiversity themes, consulting with lived experience voices ~~-~~to ensure participation and challenging 'neuronormativity' (Huijg, 2020).

~~Caution is advised with the commissioning of 'experts' to provide human resources advice and guidance. Whilst l~~Lived experience voices are essential for empowering participation; ~~, we should not expect colleagues to do the work of advising as an unpaid part of their role. wher~~we recommend that organizsations should ~~empower In house ne~~facilitate neurodiversity champions ~~must be able~~ to speak to the full variety of neurominority experiences and appreciate the different, and ~~somewhat~~ often conflicting, narratives of the people for whom they speak (Baron-Cohen, 2019; ~~N.~~ Doyle, 2021). However, we note that in-house champions should not be expected to provide professional service voluntarily alongside their paid roles. Accommodation and inclusion policy initiatives should still be advi~~s~~sed by occupational professionals with expertise in disability (Spargo-Mabbs et al., 2020). There are harsh legal penalties for failing in practice, both for individuals who may

lose their job and employers who could be sued. ~~The credentials of those issuing inclusion advice would be viewed negatively by courts or insurers if they relied solely on personal, anecdotal experience and thus equally the employers following such guidance could also be viewed negatively. In summary,~~As neurodiversity inclusion currently sits at the intersection between disability accommodation and diversity inclusion, practitioners must walk a tight rope between the medical and social models to improve occupational access and success. Current advice is therefore to target all levels of analysis in weighing up appropriate interventions, combining participation from those affected with professional recommendations and services. Practitioners are encouraged to seek evaluation opportunities and to work with academic partners on longitudinal studies to build the evidence base in this area, as per the activities in Tables 5 and 6. In Table 7, we pose a series of reflective questions for practitioners to consider when beginning to adopt neurodiversity inclusive protocols and projects.

** Insert Table 7 about here

Conclusion

In this paper we have systematically described the dearth of consistent and ecologically-valid research regarding neurodiversity at work. This, ~~, which~~ we argue, is a risk for individuals, employers, policy makers and applied disability inclusion practice. ~~. In particular, the mainstream organizational and~~ applied ~~psychological disciplines are yet to pick up the theme.~~ The neurodiversity phenomenon is no longer new, and we thus present it as an exciting opportunity for multi-disciplinary researchers to explore the implications ~~of neurodiversity~~ for both individual career interventions and organizational design. We have outlined an epistemological starting point for the field of research to ~~, wherein we can~~ begin answering the pressing question of 'what works'~~, to mitigate the risk of practitioners or~~

RUNNING HEAD: Diamond in the rough?

~~vested amateurs applying unsubstantiated advice~~. ~~We also caution that failure to do so will further the science-practice gap (Briner & Walshe, 2013).~~ The~~se~~ practical concerns we have outlined contribute to a wider need to reflect on the broader influence of disability inclusion legislation which, despite decades of operation in developed countries, has yet to make a substantive impact on disability employment (Scope, 2018; WHO, 2011). ~~This~~ We indicate~~s~~ a ~~clear~~ need to ~~offer not only~~build further than the ~~a~~ consideration of 'what works', ~~but to~~~~also~~ 'what can we make work', by incorporating appropriate structural flexibility to facilitate positive work, life and societal outcomes for the many neurodiverse 'diamonds in the rough'. We conclude with a clear message for five shifts in ~~thinking ,~~thinking, as depicted in Figure 3.

** Insert Figure 3 about here

~~s~~We advocate for starting with a mov~~in~~ge from ~~a~~the medical to ~~a~~ social perspective, ~~to~~then embracing context-sensitive and inclusive research ~~to~~and interrogating~~e~~ policy and practice based on ~~habitually~~legal compliance~~t based policy and practice~~. Learning from other, more mature fields is a ~~starting point~~necessary step to enable organizsations to move towards inclusive design without repeating mistakes or reinventing the wheel. We hope we have inspired researchers and practitioners alike to critically reflect on the gaps in our understanding and begin building neurodiversity into studies and projects. We will know this is working when we see neurominorities represented in all forms of employment, adding critical diversity of thought and experience to the design, delivery and support of human endeavo~~u~~rs. Inclusive work practices benefit everyone~~, not just neurominorities~~.

RUNNING HEAD: Diamond in the rough?

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RUNNING HEAD: Diamond in the rough?

Diamond in the rough? An 'empty review' of research into 'neurodiversity' and a road map for developing the inclusion agenda.

Introduction

'Neurodiversity' broadly refers to naturally-occurring diversity in human cognition (Singer, 1999). It has been used as an umbrella term for a range of neurocognitive developmental disorders (Doyle, 2020; Kapp, Gillespie-Lynch, Sherman, & Hutman, 2013) including Autistic Spectrum Disorder, Attention Deficit and Hyperactivity Disorder or Dyslexia. Recent public dialogue has shifted to the term 'neurominority' to signpost that relevant individuals are disadvantaged regarding a range of life outcomes, including systemic social exclusion in education and inferior employment outcomes (Carter, Austin, & Trainor, 2012; Snowling, Adams, Bowyer-Crane, & Tobin, 2000). Subsequent restriction of opportunities for a fulfilled working life and career (Holliday et al., 1999; Taylor & Walter, 2003) is in contrast to emerging popular narratives about the talent potential of neurodiversity for modern workplaces (Austin & Pisano, 2017; Sniderman, 2014): the 'diamond in the rough' (Doyle, Patton, Fung, Bruk-Lee, & Bruyere, 2020).

In this paper, we highlight the inadequate scope and focus of academic attention on neurodiversity and employment to date across the fields of applied psychology and management studies. We contextualize the neurodiversity paradigm from a medical, social and legal perspective in the wider workplace equality, diversity and inclusion agenda. Through a series of 'Empty Reviews' defined as a targeted analysis of literature gaps through systematic literature review principles (Schlosser & Sigafoos, 2009; Yaffe et al., 2012), we illustrate the dearth of tangible evidence. Through due diligence in our conceptualization, including definition of gaps in knowledge, we outline a future research and practice agenda to facilitate informed inclusion for a marginalized minority. In other words, it is our aim to

support evidence-based practice in this emerging field guiding Human Resources (HR) and employment policy to mitigate labor force exclusion

Defining Neurodiversity

The term 'Neurodiversity' was coined by the sociological researcher Judy Singer (Singer, 1999) in the context of rights activism during the 1990s (Mcgee, 2012; Runswick-Cole, 2014). The neurodiversity movement highlights the life-long and positive aspects of naturally-occurring cognitive 'differences', such as creativity and 'special interest' skills (Meilleur et al., 2015; Von Károlyi et al., 2003; White & Shah, 2006), as opposed to the focus on developmental 'deficits' such as language or processing speed (Armstrong, 2010; Grant, 2009; Jurecic, 2017; Kapp, Gillespie-Lynch, Sherman, & Hutman, 2012). Neurodiversity has been considered a progression from previous umbrella terms such as specific learning difficulties, neurodevelopmental disorders or hidden / invisible impairments. However, Ms Singer herself, alongside other researchers and advocates, prefers 'neurodiversity' to refer to the cognitive diversity in all humans (Chapman, 2020; Monzee et al., 2019; Singer, 1998; Walker, 2012) rather than appropriated as a synonym for disability. Relevant terminology continues to evolve and be hotly debated; we briefly define alternatives that denote equivalence to the outdated deficit model language. Those who fall in a statistical norm, based on relevant cognitive tests or behavioral assessments, are referred to as 'neurotypical' and those who would previously have been termed disordered are referred to as 'neurodivergent,' 'neurodiverse' or part of a 'neurominority' (Bottema-Beutel et al., 2020; Doyle, 2020; Singer, 1998; Walker, 2012). Some authors include general learning disabilities and/or mental health needs in definitions (Armstrong, 2010; Chapman & Veit, 2020). Typically, though, the following conditions are considered neurominorities: Attention Deficit Hyperactivity Disorder (ADHD); Autism; Dyslexia; Dyspraxia/Developmental Coordination

Disorder (DCD); Tourette Syndrome (TS); Dyscalculia and Dysgraphia (Bewley & George, 2016; Grant, 2009; Jurecic, 2007; Kapp et al., 2013; Snowling, 2005). Definitions of each condition have evolved over time and diagnostic criteria, as well as treatment approaches, continue to vary considerably (Elliot & Grigorenko, 2014; Kirby et al., 2011; Shelley-Tremblay & Rosen, 1996). For a historical review of neurodiversity/neurodivergence since the industrialisation, see Doyle (2020). Below we present a brief summary of some of the educo-medical models and conceptualizations and prevalence; see Doyle (2017) for a working summary of the occupational strengths and weaknesses of each condition.

The medical model of neurodiversity. This model defines neurominorities linguistically through pseudo-medical deficits. The Diagnostics and Statistical Manual of Psychiatric Disorders (American Psychiatric Association, 2013), known as the 'DSM-5', is used by relevant professionals to categorize and determine individual cases. These conditions are developmental as they emerge in childhood and/or adolescence but not in response to trauma or ill health, and confer specific difficulties rather than indicate global developmental delay (Snowling, 2005). Psychological diagnostic criteria define the hallmark of a neurominority as a statistically significant within-person difference, showing a disparity between cognitive strengths and weaknesses (e.g. verbal/visual reasoning, memory). This is in contrast to a 'neurotypical' presentation where an individual's ability scores are within a standard deviation or two of each other (either below average, average or above average) (Grant, 2009; Ihori & Olvera, 2015). There are two sub-types of developmental neurominorities (Doyle, 2017). Population prevalence is shown in parentheses, based on best available data, noting that these vary across nations and depend on which diagnostic criteria are applied:

RUNNING HEAD: Diamond in the rough?

(1) Clinical conditions, which are assessed by behavior / communication and typically diagnosed by Psychology, Neuropsychology and Psychiatry Clinicians working in health services:

a) ADHD around 5% worldwide (Catalá-López et al., 2017; Shelley-Tremblay & Rosen, 1996) but higher in USA (Danielson et al., 2018).

b) Autism between <1 and 1.6% globally, significantly affected by diagnostic criteria and access to services (Elsabbagh et al., 2012).

c) TS 1% (CDC, 2009; Robertson, 2006)

(2) Applied conditions, which are assessed by functional difficulties, either educational or occupational, and typically diagnosed by Applied Psychologists, Educators and Occupational Therapists in school or work settings:

a. Dyslexia up to 10% (Snowling, 2010).

b. DCD up to 6% (Blank et al., 2019).

c. Dyscalculia up to 6% (Snowling, 2005).

d. Dysgraphia n/k (Adams, 2019).

For the purpose of this paper, we focus on the main developmental neurominorities, namely ADHD, autism, dyslexia, DCD and Tourette Syndrome, to gauge the quality of research regarding practical support and inclusion of these conditions in the workplace.

The emerging social model of neurodiversity. Given the high prevalence of neurominorities reported in advanced economies, there is an obvious evolutionary critique: that neurodiversity has evolved within a typical spectrum of human experience (Blank, Peters, Pickvance, Wilford, & MacDonald, 2008; Boycott, Schneider, & Osborne, 2014; Doyle, 2020; Shelley-Tremblay & Rosen, 1996). As it may be natural and useful to have a small percentage of the population with specialist rather than generalist abilities (Armstrong,

2010), stakeholders argue that we need to develop neutral inclusion practices that do not insinuate ill health. It is worth noting that during the past 100 years both left-handedness and homosexuality were considered psychiatric disorders, demonstrating that any conception of 'normal' is culturally bound and subject to historical changes in line with Ecological Systems Theory (Bronfenbrenner, 1979). We cannot be sure at this stage that a disorder based on quantifying the degree of adherence to a social norm, such as literacy, activity levels or social interactions, is truly a biological deficit. The social model of neurodiversity contends that the world is polarized and lacks in flexibility to accommodate all natural variations in human cognition and functioning (Shakespeare & Watson, 1997). Individuals who fall outside the norm represent a minority group, whose rights must be protected, and whose ways of functioning should be recognized, valued and harnessed (Runswick-Cole, 2014; Singer, 1998).

The social model has influenced public awareness of neurodiversity in recent years; the narrative of the 'diamond in the rough' is voiced in popular press and media world-wide (Adams, 2019; Philipson, 2014; Sniderman, 2014; Wollaston, 2016). Neurodiversity is also attracting the attention of the business press who describe a 'talent advantage' for employers through targeted recruitment of neurodiverse applicants (Austin & Pisano, 2017; Comaford, 2017). This approach chimes with broader initiatives to promote diversity and inclusion of gender, ethnic minorities and sexual orientation (Cucina et al., 2013) and disability more generally (Murfitt et al., 2018) to broaden the talent pool, known as the 'business case' for inclusion (Saleh & Bruyère, 2018).

Socio-legal barriers and protections. There is a conflict between aspiration and reality in occupational practice. Despite sparse yet consistent evidence in support of specific talents (Armstrong, 2015; Logan, 2009; Meilleur et al., 2015; Von Károlyi et al., 2003; White

RUNNING HEAD: Diamond in the rough?

& Shah, 2006), neurominorities are currently not well accommodated by contemporary social structures based on neurotypical profiles. To illustrate, in the UK, modern apprenticeships require (high) literacy levels of grade 10 or above to access basic vocational training in fields that rely on specialist visual reasoning, such as hairdressing and plumbing (SFA, 2016). Interviews remain popular as a hiring technique globally, despite evidence that these unfairly disadvantage neurominorities, particularly autistic people (Cooper et al., 2018; Hayes et al., 2015). Such barriers matter. Only 10-16% of autistic people have a job (NAS, 2016) and ADHD has been shown to significantly increase the likelihood of incarceration in the UK and USA (Halmøy et al., 2009; Young et al., 2018). 20% of UK and 35% of US entrepreneurs are dyslexic compared to only 1% of corporate managers (Logan, 2009) and a third of long-term unemployed people are dyslexic (Jensen et al., 2000). Such systemic exclusion has moral, social and economic consequences.

To counter extant structural barriers in education and work, neurominorities are considered recognized disabilities in most developed nations, which theoretically affords protection from discrimination by law. In the UK Equality Act (Equality Act, 2010), for example, reference is made to long-term (chronic) difficulties in memory, learning and communication which may be affected by all the above-named conditions. In the USA, Canada, Australia and throughout Europe, similar legislation provides disability protections (Australian Government, 1992; Canada, 1995; U.S. Department of Education's Office of Special Education and Rehabilitative Services (OSERS), 2006; U.S. Equal Employment Opportunities Commission, 2008) all broadly aligned to the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) (United Nations, 2006). Such legislative innovations are yet to translate into occupational success. The 'disability-employment gap' remains of concern worldwide (WHO, 2011). There is a pressing need to understand 'what works' and move to an evidence-based practice model for applied practitioners to implement,

yet this 'push' for interventions based on diagnosis somewhat undermines the 'pull' of the untapped talent model. Although applied research is sorely needed, ontological positions to date have been dominated by the medical model. Yet individuals with lived experience advocate a more critical and realist approach to inclusion which takes account of their priorities through inclusive research design (Bottema-Beutel et al., 2020; Rios et al., 2016; Walker, 2012). We return to this point in our discussion.

A science-practitioner gap. Activities that constitute disability 'support' vary geographically, with advanced economies applying a range of active labor market interventions supporting both the individual (pre- and during employment, 'supply side') as well as the employer through incentivization and best practice guidance ('demand side') (Murfitt et al., 2018; Saleh & Bruyère, 2018). However, the extent to which such programs are effective for neurominorities is less documented (Gerber et al., 2012). In the UK for example, there is a statutory government body facilitating the provision of 'reasonable adjustments' or accommodations to thousands of employees with invisible disabilities per year; the third most common disability group after muscular-skeletal and sensory impairment (Gifford, 2011). The program, known as 'Access to Work', offers one-to-one coaching and assistive technology to individuals (at approx. $1000 per person) and is broadly well-regarded, as evidenced by user survey data (Adams, Tindle, Downing, & Morrice, 2018; Melvill, Stevens, & Vaid, 2015). Similar programs such as 'Jobs in Jeopardy', part of the Australian Disability Employment Service, are also seen to add good value for the tax-payer, yet do not specifically focus on the experience of neurominorities, with the exception of autistic people (DEEWR, 2013). The provision of such interventions has received minimal attention in research evidenced by high level summaries yet insufficient high-quality studies. We are unaware of any process evaluations of relevant interventions most frequently recommended for neurominorities by these programs, such as coaching, mentoring and

assistive technology (Doyle, 2019; Kulow & Thomas, 2019; Lindstedt & Umb-Carlsson, 2013; Sundar, 2017; Work and Pensions Committee, 2018) that could elucidate psychological mechanisms of change or evidence career advancement outcomes. We are witnessing increasing practitioner advice from business advisor groups (ACAS, 2016; ODEP, 2020; Spargo-Mabbs et al., 2020; TUC, 2011) including coaching, assistive technology, provision of extra time, flexible hours policies and use of acoustic barriers to mitigate background noise distractions. There is a lack of reliable experimental work evaluating the effectiveness of relevant support structures for neurodivergent individuals (Patton, 2019; Sundar, 2017; Whitby, 2017) meaning that it is difficult to demarcate evidence-based practice (Briner & Rousseau, 2011).

Globally, disability programs tend to be led by healthcare provision, vocational rehabilitation and occupational therapy tending towards those with more medicalized needs (Doyle, 2021). It is unclear the extent to which neurominorities such as ADHD, TS, dyslexic and dyspraxic employees might be covered by such programs, though autism has received increased attention (Lawer et al., 2009). For example, Individual Placement Support (IPS) is sometimes provided for autistic people, which is well-regarded and reasonably well-evaluated (Lounds-Taylor et al., 2012; Wehman et al., 2016). The principles and practices of such relevant interventions could provide a rich resource for expansion to accommodate other neurominorities. Yet they are based on a medical model, which implies that the workplace environment is fixed and the individual is impaired and therefore needs to adapt. This is at odds with the social model ambitions of the neurodiversity movement and the UNCRPD (United Nations, 2006). Further, at an average cost of tens of thousands of dollars per person, which is an investment that an employer or employee alone cannot justify, IPS interventions only break even when reductions in public spending are included (Jacob et al., 2015; Knapp et al., 2013). Employee Assistance Programs are also relevant in this context as a potential

source of specific support. However, such programs tend to accommodate mental health specifically, they are potentially oblivious to cognitive strengths and impairment, as well as being somewhat vague about any benefit for individual work performance (Joseph et al., 2018). While it may be essential to address acute mental distress at source, it is possible that support for stress and anxiety when the cause is cognitive (not emotional or social) could create more long-term harm than good if support activities are not informed by a more holistic perspective on neurominorities. More specifically, any presupposition that the cause is individual failure to adapt rather than structural exclusion could be detrimental for self-worth, employment and other outcomes, leading to a spiral of negativity. Therefore, any academic enquiry must take a holistic perspective on interventions to address socially-constructed marginalization and individual need to inform evidence-based professional practice.

In summary, evidence regarding any activities to support improving job performance and subsequent occupational inclusion through disability accommodation for neurominorities is lacking (Adamou et al., 2013; Kirby et al., 2011; Palmer & Stern, 2015; Rice & Brooks, 2004). We consider the development of a research agenda an essential and urgent task for the neurodiversity inclusion movement.

Review questions

Against a context of overlapping and potentially conflicting societal, legal and conceptual developments, we aimed to map any existing evidence and scrutinize robustness as well as disciplinary origin. Although we endeavoured to keep an open mind, it was our assumption from the outset that our research would draw from the principles of 'Empty Reviews'. Empty reviews are becoming common in health and medical fields to establish lack of evidence for any interventions (Yaffe, Montgomery, Hopewell, & Shepard, 2012).

RUNNING HEAD: Diamond in the rough?

Guided by a systematic review methodology, we (1) formulated specific a priori questions, (2) devised a search protocol, (3) applied a predefined relevance inclusion criteria and process for achieving consensus and (4) applied a predefined quality inclusion criteria. Our protocol was based on best practice guidance from the management/ business field, given the work context for any relevant evidence (Denyer & Tranfield, 2009; Rousseau et al., 2008). Our research questions were:

1. How many papers are published in mainstream empirical organizational and management psychology publications related to the inclusion of neurodiversity (or related conditions) in work contexts?
2. How many papers exist in general psychological domains regarding neurodiversity?
3. How much research exists in any academic domain concerning the occupational presentation of neurodiversity?

From the third search, we were able to formulate a fourth question:

4. In which academic disciplines is relevant academic research currently located?

From these structured searches, our synthesis will consider:

1. What, if anything, can we infer from the current literature about 'what works' in practice to improve the inclusion of neurodivergent individuals at work?
2. How should the prospective research agenda be epistemologically framed?

Systematic Empty Review Protocol

Search terms

Our review focused on developmental neurominorities using search terms which reflected differences in labels over time. We excluded mental health needs, chronic health conditions, acquired brain injury and general learning disabilities since they are already addressed in more advanced research fields (Corbière et al., 2014; McGonagle et al., 2014; Tyerman, 2012). Some mental health research was extracted as a point of reference to compare volume of returns. Dyscalculia and dysgraphia *are* included in the taxonomy of developmental conditions but not considered in the extraction given the previously noted absence of research (Doyle, 2017). Table 1 summarizes all search terms.

****Note to Editor, insert Table 1 about here*****

Extraction protocol. There were three iterative searches, conducted in January 2017 and repeated in August 2018; these are summarized in Figure 1.

Search one: How many papers are published in mainstream empirical organizational psychology publications related to neurodiversity (or related conditions) in work contexts?

The first search represented a systematic check that this field was indeed under-researched, by focusing on what ought to be ideal publications for considering the intersection of neurodiversity (a psychological phenomenon) and workplace inclusion: *The Journal of Applied Psychology*, *Personnel Psychology*, *Industrial and Organizational Psychology* and the *Journal of Occupational and Organizational Psychology*. We commenced by hand-searching the four journal websites specifically for the five conditions and the term 'neurodiversity' to understand the extent to which they featured in key applied psychology research.

RUNNING HEAD: Diamond in the rough?

No time limits were applied. The primary aim of this search was to extract the number of references to neurominorities and the term 'neurodiversity' itself, and we did not initially subject papers to a second stage rigorous relevance and quality criteria check. However, the small number of returns enabled a qualitative review of the extent to which conditions were merely 'mentioned' as opposed to explored conceptually or evaluated. Table 2 shows the number of returns compared to the number mentioning mild-to-moderate mental health needs in two of the journals.

Search two: how many papers refer to neurominority conditions in general psychology domains?

A second search of the broader psychological domains was conducted across the *Journal of Occupational and Organizational Psychology* (repeated); *British Journal of Psychology*; *British Journal of Clinical Psychology*; *British Journal of Developmental Psychology*; *British Journal of Educational Psychology*; *British Journal of Health Psychology* and *British Journal of Social Psychology* in order to sample-check whether or not consideration of neurodiversity was better represented in relevant psychological sub-disciplines. The second search was not intended to be definitive, but indicative of the spread of individual condition representation in research relevant to the neurodiversity. We did not apply time limits but categorized the returns into papers published before 1995, 1995-2005 and 2005+ to consider if the developing social movement was in any way linked to number or foci of publications. As with search one, the extracted papers were not subjected to relevance and quality review and may only 'mention' the condition rather than explore thoroughly. We compared the relative percentages of each condition's prevalence rates with the relative volume of research, to observe any over- or underrepresentation.

RUNNING HEAD: Diamond in the rough?

Search three: How many papers address the occupational presentation of neurodiversity to a high academic standard of evidence in any discipline?

Question four: In which academic disciplines is relevant academic research currently located?

We undertook a wider, more international review of the literature on occupational presentation of neurodiversity in EBSCO-hosted journals to ascertain if there was a tranche of yielding principles (Cucina et al., 2013) that could be appropriated for inclusion practice from related disciplines, for example vocational rehabilitation. We limited the search to the English language and included grey literature using all terms in Table 1. We took a systematic approach, with an initial 1439 returns creating a bespoke extraction form in Excel. We then filtered results by abstract screening, removing any papers without reference to occupational issues. The second author undertook spot checks and a discursive review of ambiguous cases until we achieved full consensus for inclusion, leaving us with 111 papers. We did not explicitly seek to apply a rigorous quality check at this stage, mainly because the aim of the review was not meta-analysis of an intervention success, simply exploration of the extent of research. Instead, we considered the hierarchy of evidence principles (Rousseau et al., 2008) and used quality guidance from related systematic reviews (Doyle & McDowall, 2019; Rojon, McDowall, & Saunders, 2011) to rate papers as strong evidence (systematic review and meta-analysis), medium evidence (well-constructed primary papers) or weak evidence (poorly-constructed papers, case studies, practitioner opinion and anecdotal evidence). The primary author performed these ratings, the second author cross-checked and discussion was held to resolve conflicts until full consensus was reached. Papers scoring medium or above were retained: 48 papers in total. Finally, the papers were categorized by academic discipline using journal titles (or full paper review if not clear) to consider where, if

not in organizational psychology or management, knowledge regarding the occupational presentation of neurodiversity is currently located. Figure 1 depicts the number of included papers at each stage.

****Note to Editor, insert Figure 1 about here*****

Results and Synthesis

Below we present the number of returns in each extraction, categorized as described above, and a brief narrative summary of the findings for each search according to the first three review questions:

Search 1: Organizational psychology journals. Table 2 shows the number of papers mentioning neurominority conditions and an absence of the phrase neurodiversity to date in the contemporary organizational psychology that we selected. Only 32 papers mentioned neurominority conditions at all; 22 of these were in SIOP's *Industrial and Organizational Psychology* journal, three in the *Journal of Applied Psychology* and two in *Personnel Psychology*. The *Journal of Occupational and Organizational Psychology* (JOOP) mentions neurodiverse conditions on only five occasions compared with 413 mentions of mental health conditions.

****Note to Editor, insert Table 2 about here*****

Full paper review of the returns did not provide evidence of the intervention evaluations required to support disability inclusion practice, protect employers/employees or justify current policy. For example, the two dyslexia returns within *JOOP* pertain to (1) the use of handwriting as a recruitment technique (Klimoski & Rafaeli, 1983) and (2) a broader article about employer responses to disability inclusion (Jackson et al., 2000). Similarly, the other neurominorities listed above are mentioned in references related to a broader theme,

rather than examined as to how they relate to occupational psychology per se (for example, both ADHD and autism are within the reference list for the coaching review conducted by Jones et al. 2016). While SIOP's *Industrial and Organizational Psychology* journal marks a significant improvement in volume compared with others in the discipline, there are two points of note: (1) mental health papers were still disproportionally better represented and (2) papers were cross-sectional and/or conceptual reviews offering descriptions of problems rather than experimental work regarding potential solutions (Ashworth, 2014; Bono et al., 2009; Gabbard et al., 2014; Hyland & Rutigliano, 2013; Saal et al., 2014; Santuzzi et al., 2014).

Search 2: broader psychological research. The results presented in table 3 show the number of papers mentioning neurominorities and mental health conditions in a sample of UK-based psychology journals.

****Note to Editor, insert Table 3 about here***

The UK-based psychology journal search revealed an increasingly disproportionate body of research focusing on mental health needs and autism, relative to their prevalence. Closer inspection of two journals revealed consistent cross-disciplinary research between mental health and occupational psychology: 1686 studies referenced 'work' in the *British Journal of Clinical Psychology* and 413 studies on mental health were published in the *JOOP*, which suggests a more mature research field concerning the impact of mental health in the workplace, though we concede that this has not been quality checked. Conversely, dyslexia studies appear to be decreasing in number and mainly focused on the diagnosis of children to the exclusion of occupational contexts. ADHD, Dyslexia, DCD and TS are all under-researched compared to their population prevalence.

RUNNING HEAD: Diamond in the rough?

Search 3 and Question 4: Multi-disciplinary studies on neurodiversity and work. Of the 48 extracted papers, the following conditions were represented: ADHD, 13 papers; Autism, 19 papers (including four with strong evidence supporting inclusion activities); DCD, five papers; Dyslexia, six papers and TS, five papers. Table 4 shows the professional discipline sources (indicated by journal title) of the 48 papers. We note that, while neuroscientific research has proliferated in recent years and accounts for much of the extant condition-specific literature, only one neuroscience paper met the criterion of referring to occupational issues. A full list of the journal titles for extracted studies is presented in appendix 1.

****Note to Editor, insert Table 4 about here*****

Synthesis Question 1: What, if anything, can we infer from the current literature about 'what works' to improve the inclusion of neurodivergent individuals at work?

Given the absence of relevant intervention evaluation (either randomized control trial, cross-sectional research, process analysis or qualitative) in mainstream organizational and management psychology, we consider our first search an 'empty review' (Yaffe et al., 2012). Further, search two indicated that the investigation of individual neurominority conditions per se is unrepresentative of population prevalence and seems instead to be led by media fashion; for example, the dominance of autism within current popular narratives (Bernick, 2019). The limited number of primary papers across broader applied psychological domains describe issues and call for further research, yet do not culminate in a clear research agenda congruent with evidence-based practice (Schlosser & Sigafoos, 2009).

Regarding our third review question concerning quality of evidence for determining 'what works', we note limited research that could contribute to an evidence-based agenda

which is dispersed across disciplines lacking relevance to the socio-legal, economic and occupational context; for example, neuroscience, child development and social work, which leaves crucial epistemological and applied knowledge gaps in our understanding. While we commend the neuroscience paradigm for advancing our etiological understanding of symptomatology, it does not reference functional, workplace-contextualized outcomes and is thus lacking ecological validity (Chaytor et al., 2006; D'Souza & Karmiloff-Smith, 2017). Vocational rehabilitation and Occupational Health are the closest represented disciplines in terms of purpose, specifically exploring conditions, their impact on the workplace and intervention evaluation. However, these fields are more closely aligned to the medical paradigm which implicates a disability inclusion model for practice, rather than an organizational-level talent management approach such as the mentoring and peer support programs favoured by gender and race inclusion initiatives (Roberson, 2018).

We conclude that there is insufficient academic enquiry into neurodiversity at work and highlight a need for broadening the epistemological frameworks of neurodiversity research to offer theoretical support to the developing agenda.

Synthesis Question 2: How should the prospective research agenda be epistemologically framed?

To address the disparity between research to date and the emerging social movement arguing for marginalized lived experience at the heart of research (Bottema-Beutel et al., 2020; Rios et al., 2016), a constructivist investigation of experience and power dynamics appears crucial. Alongside, we recognize the need for positivist evaluation of interventions; the limited extant studies indicate an immature evidence base to underpin practice and policy. Controlled trials must be broadened from the individual to the organizational level of analysis. Minded that qualitiative and quantitative research are complementary, not

conflicted, we propose Critical Realism (Houston, 2014) as an appropriate epistemology for a developing research agenda. Critical Realism facilitates inductive, hypothetic-deductive and abductive reasoning, required to iteratively blend theory and method (Van Maanen et al., 2007) for the development of a nascent research field in a Pragmatic Paradigm (Simpson, 2018). Our proposed ecological framework is outlined in Figure 2, deploying multiple levels of analysis (Bronfenbrenner, 1979) in which we focus on two intersecting points for intervention and analysis: the micro/meso and the meso/macro. This is congruent with Critical Realist research and incorporates the ecological approach that has been more thoroughly explored in general disability employment (Szymanski et al., 2012).

****Note to Editor, insert Figure 2 about here*****

We now briefly explore the issues within each level of analysis before outlining a research and practice agenda in more detail in the next section. The micro level refers to the neurodivergent employee, their individual work performance, and the current perceived need to attain levels of literacy, sedentary concentration and/or social communication norms akin to their neurotypical co-workers in order to retain their employment. Individual level effects will be additionally influenced by intersectionality, such as marginalization resulting from gender, gender identity, ethnicity and race, sexual orientation, age and socio-economic status (Crenshaw, 1991; Cucina et al., 2013; Greenhaus et al., 1990; Ozbilgin et al., 2011; Szymanski et al., 2012; Young et al., 2020). Critical Realism facilitates evaluative studies regarding individual level accommodations as described above, as well as exploring the influences on career inclusion caused by the power dynamics; for example, self-efficacy and career awareness (Leather et al., 2011; Nalavany et al., 2017; Test et al., 2009).

The meso level refers to the immediate context of the neurodivergent employee, including design of their job, workstation and environment, but also the communication

norms of their team and organization. The meso level is influenced heavily by the socio-historical context of said norms including the prioritization of literacy and fine motor control as the major form of communication, and sedentary, hyper-social education and work (Doyle, 2020). We also note current occupational constructions drawn from the macro-historical level of analysis which create meso-level norms. For example office work, which made sense when staff needed access to paper files and ledgers in the 19th and 20th centuries, but makes less sense now that our work is stored electronically and remotely. Such norms have created exclusion and segregation; for example, the illiterate dyslexic who should be avoided or the autistic technologist who might be desirable but only in a limited role. Thus, alongside a 'Realist' evaluation of direct support effectiveness for employers such as toolkits and inclusion best practice guidance, a 'Critical' challenge of common / absent narratives and role models in business is encouraged.

The macro level of analysis influences neurodiversity inclusion through the use of active labor market policies such as those described in the introduction (e.g. Access to Work, Jobs in Jeopardy) and the extent to which employers are incentivized to address disability inclusion in hiring and talent management (Murfitt et al., 2018; Saleh & Bruyère, 2018). As mentioned in the introduction, such policies are lacking in longitudinal evaluation, which is an urgent concern considering the persistent disability employment gap more broadly. Yet such policies also exist in a macro-historical context of wider technological advancement that facilitates new possibilities for inclusion. Contemporary expectations of normalization and homogeneity at work, inherited from the industrial revolution as above, are in flux as we adapt to ubiquitous technology, cloud access to records and indeed even the type of work available (ONCE, 2019; WEF, 2020), impacting the policies and institutions just as they affect businesses. For neurominorities who have struggled with tasks typically framed as necessary for 'good' performance, including literacy and handwriting, hyper-socialization

and sedentary work, such changes require critical appraisal as they offer potential for increased inclusion across the lifespan. For instance, writing tasks are already becoming more fully supported through adaptive software, which allow more accurate dictation and transcription; these changes will increasingly be incorporated into education and national training design. We see opportunity here for the next generation of neurominority workers, who could be significantly less disabled if policies can catch up with technological trends. For example, incentivising acceleration of digitization and automation of literacy production in education and public sector workplaces could have a ripple effect to meso-level workplace norms more generally.

The next section focuses on specific research activities required to mature the neurodiversity field of practice, building on the Critical Realist epistemology framework to evaluate and challenge both supply and demand approaches.

Discussion: Mapping a new field of research and practice

The research agenda. Given the current dearth of evidence as evidenced through our empty review, our attention must turn to the focus for a new research agenda. One particularly urgent concern is the need for longitudinal evaluation and process analysis of adjustments that are currently routinely deployed at the micro level, such as coaching and assistive technology (Doyle, 2019). We need to understand how accommodations 'work' as interventions for a number of target outcomes, such as secure employment, improved career advancement, added value for employers through enhanced work performance, but ultimately evidenced by a reduced disability employment gap. Generalist disability research has produced some cost benefit analysis of supply side adjustments as well as how to implement productive demand side interventions, such as networking, best practice sharing, reporting on disability inclusion data and influencing the will of businesses in acting inclusively (Saleh &

RUNNING HEAD: Diamond in the rough?

Bruyère, 2018). The neurodiversity movement needs replicate, in order to evidence the business case argument that inclusion equals talent and may improve morale and productivity (ILO, 2010).

Alone, intervention evaluation of which activities deployed in practice 'work' will only focus on change at the micro level, with meso and macro 'success' markers as an aggregate of individual improvement and achievement. Yet, globally, current legislation requires the employer to make accommodations / adjustments to infrastructure; it does not require the individual employee to change (social model). Without multi-level, critical analysis we risk appropriating medical research agendas that ignore the social model identity of that minority (Huijg, 2020; Riddick, 2001; Shakespeare & Watson, 1997). Such limited perspective may not only fail to recognize individual strength and capabilities, but also resonate poorly with an increasingly vocal stakeholder movement who ascribe to the 'nothing about us without us' (Charlton, 1998) principle (Bottema-Beutel et al., 2020). We argue that we can learn from principles adapted from analogous fields such as race and gender inclusion, which focus on identifying unconscious biases in hiring, managing and promoting marginalized workers (Roberson, 2018). Outcomes such as pay disparity and representation at senior levels are considered markers of success, not the effectiveness of programs to improve the performance of individuals who happen to be black, trans or female. Race and gender interventions are thus less medicalized, without the 'diagnosis' and 'treatment' lens favored in supply side interventions for neurominorities, though we acknowledge that the social 'norms' of the white male are still implicitly applied through widespread mentoring arrangements (Dashper, 2019; Kandola, 2018). To summarize, operating from the social model signposts that, like wider equality diversity and inclusion initiatives, it is businesses that need to change, not individuals. There is a clear need for neurodiversity research which

incorporates a macro-economic, socio-legal perspective and identifies areas within the employee life cycle where policy change would lead to greater inclusion.

We look to generalist disability inclusion research again for further insight on macro-economic research directions. Herein, it remains unclear whether demand side intervention policies such as tax breaks, quota targets and penalties stimulate systemic change (Salah and Bruyere 2018) although there is a moral (and legal) imperative for starting at the system level. Current organizational practice in neurodiversity inclusion, however, tends more towards the 'carrot' than the 'stick'. Key stakeholders in business may not respond positively to mandated quotas and this could set the movement back, rather than drive acceptance. Building on piloted affirmative action programs such as Autism at Work initiatives, employers may instead prefer to be guided by clear policy suggestions on how to progress from token inclusion to systemic inclusion. Research activities will again need to replicate this sort of analysis to support the development of policy through evaluation of neurodiversity specific endeavours currently in vogue such as affirmative action.

To summarize, mainstream psychology and management research have failed to heed the call for research to support the needs of a significant minority (Beauregard et al., 2018; Ozbilgin et al., 2011) and interventions remain focused at the individual level. We argue that this is short-sighted and propose a series of research questions, presented in Table 5, using the 'Context, Intervention. Mechanism, Outcome' (CIMO) framework as a guiding structure in Realist research (Denyer et al., 2008). Our critical lens acknowledges the ontological duality of medical and social models in neurodiversity and enables both inductive and deductive research, in iterations and cycles rather than a beginning and an end. The Critical Realist paradigm epistemologically frames the need for research to simultaneously consider 'what works' with appropriate challenge to the dominant paradigm of what is 'not working.'

RUNNING HEAD: Diamond in the rough?

****Note to Editor, insert Table 5 about here*****

Practice Implications: The neurodiversity paradigm is yet to make an evidence-informed impact on organizational practice. To advance practice whilst awaiting the development of specific research, we propose applying 'Universal Design'; a set of principles about justice, flexibility and simplicity, currently aimed at increasing accessibility of buildings and technology (The Center for Universal Design, 1997) to Human Resource (HR) processes. Our overarching premise is to ensure inclusive practice throughout the employment lifecycle to pre-empt (rather than remediate) exclusion and bias embedding activities. Examples might include replacing unnecessary interview requirements for jobs that hinge on data analytics (where work sample testing would be more appropriate, and tap into the typically autistic talent of accuracy, for example) or considering the overuse of cognitive testing, including without assistive technology compatibility, where specialist thinkers are required to demonstrate generalist abilities for specialist roles. Both these activities could improve the predictive validity of recruitment and benefit a wider population. In short, HR could adapt to maximize the talent potential of this untapped minority, without compromising the integrity of recruitment and organizational performance. Table 6 indicates how Universal Design principles could be applied across six core areas of HR: job design, hiring, onboarding, training and development, performance management and well-being support. We recommend the review, critique and further development of these ideas in industrial/organizational psychology and human resource management research.

** Insert Table 6 about here

Additionally to Universal Design, other bodies of work may offer guidance to practitioners. Those with a minority diagnosis are unlikely to disclose to employers (Madaus et al., 2002; Santuzzi et al., 2014), for (warranted) fear of prejudice and stigma (Colella et al.,

1998). Employment inclusion practitioners could learn from more mature research bodies investigating minority prejudice such as mental health, race, gender or sexual orientation to develop protocols for increasing equity (Kessler et al., 2009; Roberson, 2018). Practitioners should, however, simultaneously balance the legal obligations for disability support and potential medical treatment that might be in operation at the micro level. In practice, relevant interventions need to include but go beyond seeking qualified, professional support for individual employees to ensure that relevant activities do not remain merely compliance-focused. More fundamentally, there is a need for practitioners to intervene when delivering standard HR protocols around job design, hiring, contracting, training, management performance and wellbeing, to consider the impact of the neurotypical norm (as per Table 6). For example, does a role really require influencing skills and teamwork if the focus is on highly accurate output produced alone? Should a role require full time attendance to a busy, crowded office space which has an additional cognitive burden for those with attention deficits, given the ubiquity of remote access technology? HR, applied psychologists, occupational health and vocational rehabilitation practitioners can deliver systemic change by updating their practice to incorporate neurodiversity themes, consulting with lived experience voices to ensure participation and challenging 'neuronormativity' (Huijg, 2020).

Lived experience voices are essential for empowering participation; we recommend that organizations should facilitate neurodiversity champions to speak to the full variety of neurominority experiences and appreciate the different, and often conflicting, narratives of the people for whom they speak (Baron-Cohen, 2019; Doyle, 2021). However, we note that in-house champions should not be expected to provide professional service voluntarily alongside their paid roles. Accommodation and inclusion policy initiatives should still be advised by occupational professionals with expertise in disability (Spargo-Mabbs et al., 2020). There are harsh legal penalties for failing in practice, both for individuals who may

lose their job and employers who could be sued. As neurodiversity inclusion currently sits at the intersection between disability accommodation and diversity inclusion, practitioners must walk a tight rope between the medical and social models to improve occupational access and success. Current advice is therefore to target all levels of analysis in weighing up appropriate interventions, combining participation from those affected with professional recommendations and services. Practitioners are encouraged to seek evaluation opportunities and to work with academic partners on longitudinal studies to build the evidence base in this area, as per the activities in Tables 5 and 6. In Table 7, we pose a series of reflective questions for practitioners to consider when beginning to adopt neurodiversity inclusive protocols and projects.

** Insert Table 7 about here

Conclusion

In this paper we have systematically described the dearth of consistent and ecologically-valid research regarding neurodiversity at work. This, we argue, is a risk for individuals, employers, policy makers and applied disability inclusion practice. The neurodiversity phenomenon is no longer new, and we thus present it as an exciting opportunity for multi-disciplinary researchers to explore the implications for both individual career interventions and organizational design. We have outlined an epistemological starting point for the field of research to begin answering the pressing question of 'what works'. The practical concerns we have outlined contribute to a wider need to reflect on the broader influence of disability inclusion legislation which, despite decades of operation in developed countries, has yet to make a substantive impact on disability employment (Scope, 2018; WHO, 2011). We indicate a need to build further than the consideration of 'what works', to 'what can we make work', by incorporating appropriate structural flexibility to facilitate

positive work, life and societal outcomes for the many neurodiverse 'diamonds in the rough'. We conclude with a clear message for five shifts in thinking, as depicted in Figure 3.

** Insert Figure 3 about here

We advocate for starting with a move from the medical to social perspective, then embracing context-sensitive and inclusive research and interrogating policy and practice based on legal compliance. Learning from other, more mature fields is a necessary step to enable organizations to move towards inclusive design without repeating mistakes or reinventing the wheel. We hope we have inspired researchers and practitioners alike to critically reflect on the gaps in our understanding and begin building neurodiversity into studies and projects. We will know this is working when we see neurominorities represented in all forms of employment, adding critical diversity of thought and experience to the design, delivery and support of human endeavors. Inclusive work practices benefit everyone.

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Figure 1

Summary of review extraction from the three searches

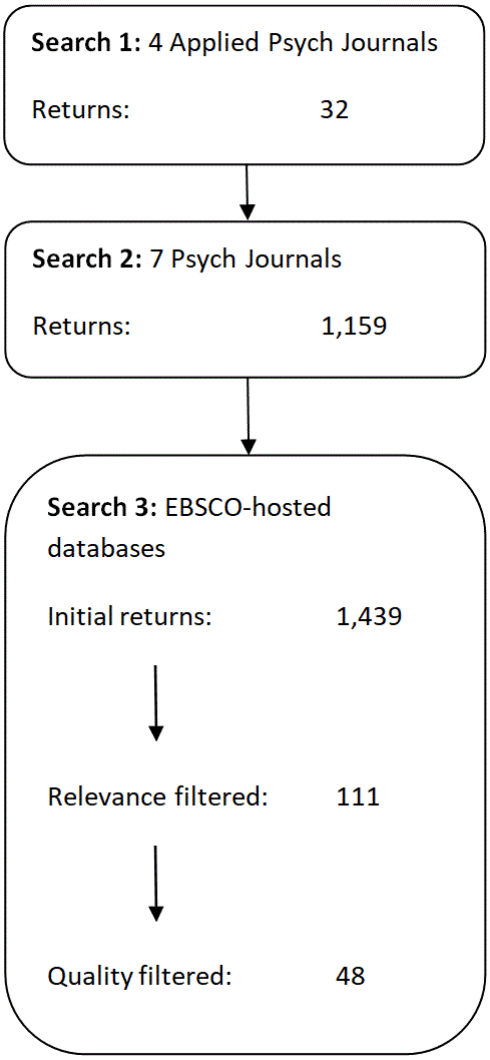

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Figure 2

A socio-legal framework for organizational psychology research into neurodiversity

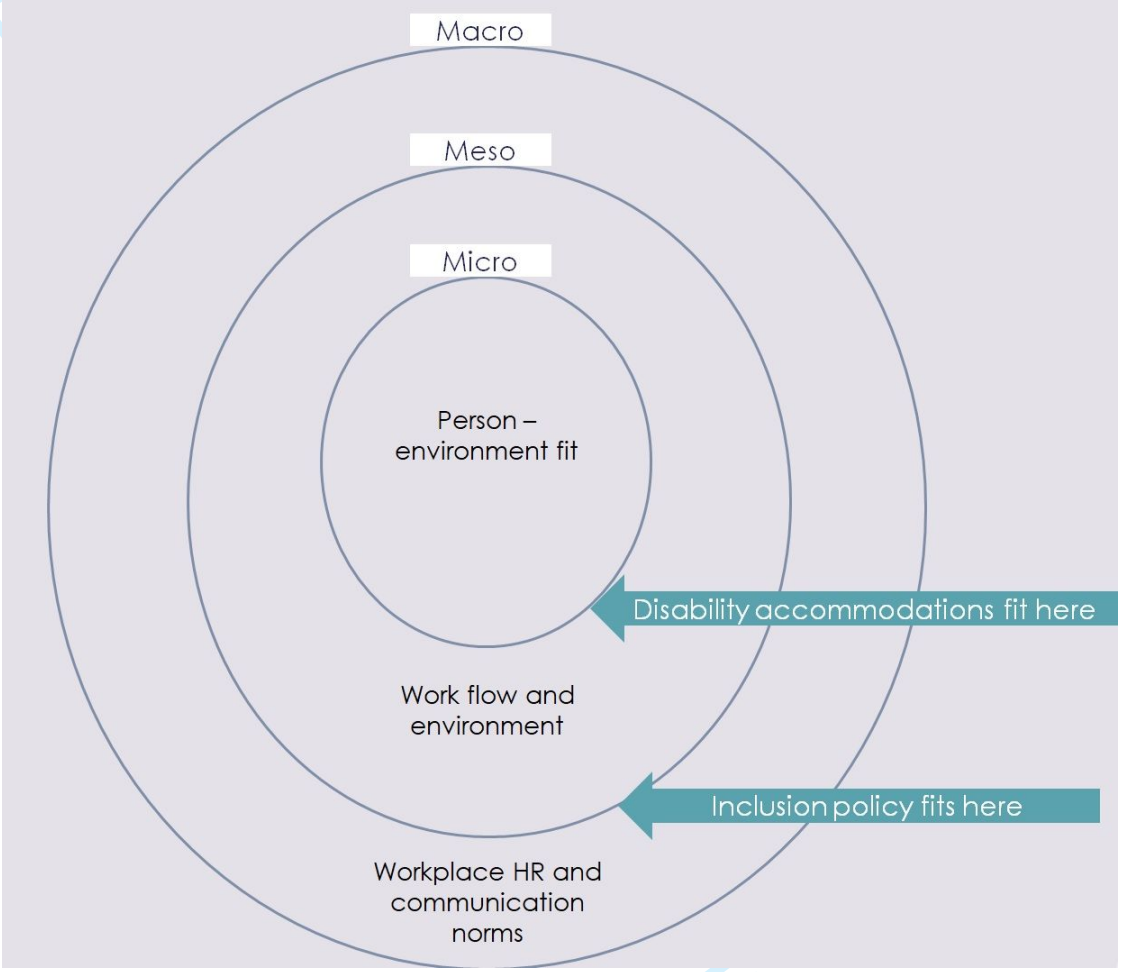

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Figure 3

Five essential shifts for neurodiversity research and practice

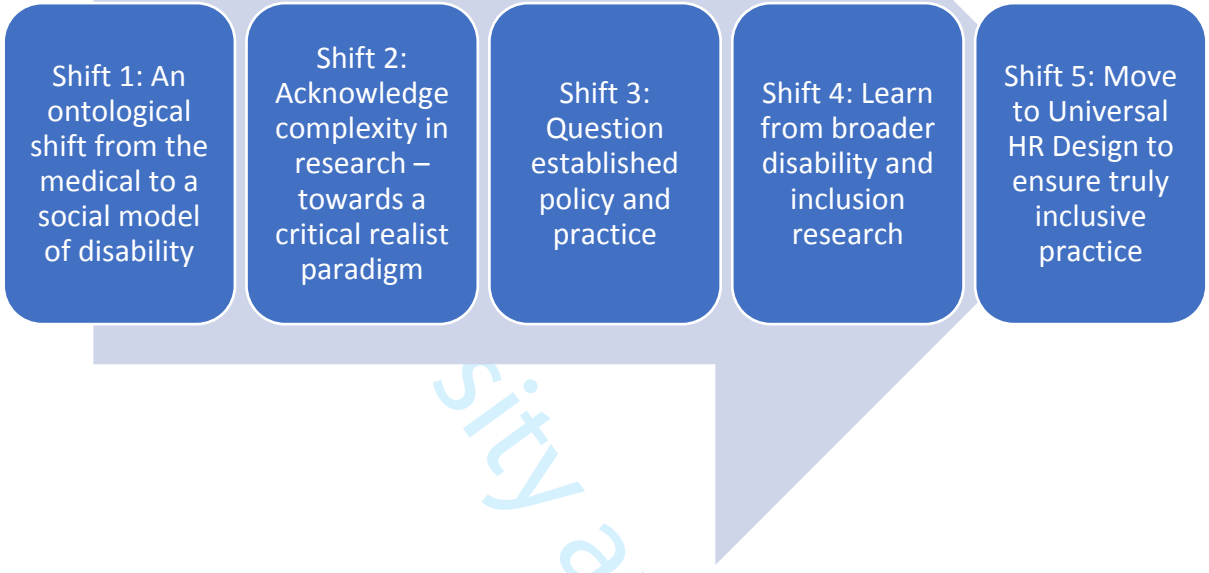

Table 1

Search terms

Conditions	**Variations of terms in search**
Clinical Conditions: ADHD, Autism, TS	ADHD, ADD, Attention Deficit Disorder, Attention Deficit Hyperactivity Disorder, Attention Dysregulation
	Autism, Autistic Spectrum Condition, Autistic Spectrum Disorder, ASD, Asperger's
	Tourette Syndrome, Tourettes, Tic Disorder
Applied Conditions	Dyslex*, Dysprax*, Developmental Coordination Disorder, DCD, Reading Disabilit*, Learning Disabilit*, Specific Learning Disabilt*
Mental Health (for comparison only)	Mental Health, Depression, Anxiety
Work related terms (for the third search only)	Occupation*, Employ*, Unemploy*, Work, Career, Job, Vocation*

Table 2

Number of papers citing neurodiverse conditions in Applied Psychology research

	Journal of Applied Psychology	Personnel Psychology	Industrial and Organizational Psychology	Journal of Occupational and Organizational Psychology
"Neurodiversity" as a term	0	0	0	0
Autism	1	1	7	2
ADHD	1	0	1	1
Dyslexia	1	0	13	2
DCD (Dyspraxia)	0	0	0	0
Tourette Syndrome (TS)	0	1	1	0
Mental Health			110	413

Table 3

Coverage of neurodiverse conditions in UK-based, multi-disciplinary psychological publications

Condition	Hits	pre-1995	1995-2005	2005+	Estimated population prevalence of condition	Proportion of neurodiversity (if mental health included)	Proportion of research
Dyslexia	448	278	79	91	10%	29%	9%
Autism	496	173	80	243	1.5%	4%	10%
DCD	95	46	11	38	2%	6%	2%
ADHD	110	3	17	90	4%	12%	2%
TS	10	3	3	4	1%	3%	0%
Mental Health	4040				16%	46%	78%

Table 4

Disciplinary location of international published research concerning the occupational experience of people with neurodiverse conditions

Journnal Type	Neuroscience	Psychology	Ppsychiatry	Child Development	Condition Specific	Occ Health/ Therapy/ Voc Rehab	Disability	Social Work	Other	Career/Employment/work /management
n	1	5	3	4	9	11	4	1	5	5
%	2%	8%	5%	6%	15%	18%	6%	2%	8%	8%

Table 5

CIMO structure research into occupational neurodiversity (Denyer et al., 2008)

	Micro	Meso	Macro
Context **What do we know about individual, organization and societal influences on neurodiversity inclusion?**	How do intersectional aspects of individual experience such as gender, ethnicity, sexual orientation, age, socio-economic status affect neurominorities? Can support at key contextual transitions improve outcomes, such as education to work, unemployment to work, career progression points?	Do environments which provide a closer 'person-environment fit' of neurodiverse need / talents lead to lower rates of occupational exclusion? What is the role of naturally-occurring supports such as schedule flexibility and minimal environmental distractions? What happens when job tasks relate to skills uncompromised by neurominority such as autistic special interests or ADHD creativity (Meilleur et al., 2015; White & Shah, 2006)?	Are we seeing tokenistic examples of deliberate inclusion only (~~Higginbottom, 2017~~Bernick, 2019; ; Philipson, 2014) or the start of a cultural shift? To what extent are communication norms in education and training design keeping pace with technological and cultural shifts in the world of work?

		Do environments that systematically provide (for example assistive technology and/or coaching) lead to lower rates of occupational exclusion?	
Intervention **What interventions exist and what do we know about how they are deployed and their effectiveness?**	What is the provision of coaching, mentoring, career support, assistive technology, schedule and environmental flexibilities and more, research to map individual experience of adjustments and their prevalence?-	What employer-led adjustment activities currently exist to accommodate neurominority in the workplace, e.g. supervisor training and HR protocols? How prevalent are they in different countries and sectors? How are adjustments determined, recommended and communicated to employers and employees?	What labor market policy interventions exist and what do we know about their effect on neurominorities – e.g. the full inclusion of neurominority in disability policy, specific policy targeting neurominorities?
Mechanisms	What is the psychology of adjustment activities for neurominorities, do	How can we investigate -the impact of inclusion using theories and frameworks such	How has the narrative on neurodiversity

How might interventions "work?"	they operate on cognitive, emotional, behavioral or social capital mediators?	as Leader-Member Exchange, In group / Out group, motivation and engagement, psychological contract, organizational justice-?	influenced the perceptions of policy makers and employers regarding the recruitment and potential of people with neurominority diagnoses? To what extent are neurominority disablements technologically determined?
Outcome	To what extent do individual adjustment activities provide improvements in longitudinal occupational outcomes for neurodiverse employees, such as higher rates of employment, promotion and representation at senior levels of	What is the cost-benefit of providing adjustments to employers? Which outcomes have value, e.g. direct productivity improvement via talent, indirect via increased workforce engagement, representation, turnover, absence?	How can we assess the wider societal benefits of neurodiversity inclusion such as improvements in the employment gap, recidivism, increased representation in senior roles and

	organizations? What quality of life benefits are there when inclusion is manifest?	Do inclusive contexts and successful interventions actually lead to the retention and expression of 'talent?	positions of influence?

Table 56

Neurodiversity Universal Design for HR

Universal Design Principle	Designing: Avoiding structural exclusion by focusing on performance output, not input	Hiring: Ensuring all candidates can perform at their best during the process	Contracting: Terms and conditions of employment to increase access	Training: inclusion in standard	Performance Review: Optimizing success with inclusive delivery	Wellbeing: adapting standard wellbeing services to support NM needs
Equitable Use	Job design to avoid social constructs in 'essential' criteria, such as "team skills" for jobs where performance will be independent.	Use of work sample tests to measure performance in the actual role, rather than social expectation loaded interviews or proxy measures such as timed intelligence tests.	Provision for: (1) remote working (2) flexible hours (3) general reduction in commuting obligations as standard in all employment contracts where feasible.	Ensuring access to standard training through best practice in preparation and delivery for all in-house provision, details as below.	Provision of personal performance training as standard company offer, e.g. time management, planning, prioritizing and other performance issues common to NM, but also relevant to a wide range of employees and newly promoted.	Ensuring a variety of wellbeing (WB) initiatives, including physical health as equal to mental health. Build access to WB supports into standard onboarding and reviewing protocols so that it is standard.
Flexibility in Use	Craft roles for specialists as well as generalists, for example permitting senior roles without supervision responsibilities.	Offer a menu of adjustments as standard, which signals that organizational intentions are welcoming of	Providing flexible options for standard systems such as frequency of supervision and feedback, which may need to be increased	Adjustable pace in learning program, allow additional time for preparation and any post-training testing.	Permit mentors in performance reviews, provide feedback written in advance to allow reflection. Appraisal scoring to avoid penalizing where	Ensure wellbeing provision incorporates specialists, as standard advice may not be appropriate for some NMs who have

		difference. Invite candidates to contact recruiters if they would require time extensions, or location flexibility, for example.	during onboarding for some neurominorities.		employees excel in specialist areas but are average in others.	additional cognitive and medical needs.
Simple and Intuitive Use	Over time roles develop 'creep' and become overlaid with sometimes inconsistent responsibilities. Regular review of performance output variables and tram structures helps to ensure that jobs are designed simply and intuitively in line with the business goals.	Clear instructions on how to complete application and what to prepare for assessment using simple bullet points or numbered steps.	Well laid out terms and conditions, signposting to relevant policies and procedures, covering note, use Flesch Kincaid score to assess language accessibility.	Consistency of formatting and training scheduling to avoid confusion or absence.	Standard format for assessing and reporting performance that is consistent and clearly communicated in advance.	Well-advertised provision with referral routes clearly presented in simple step-by-step format.
Perceptible Information	Role descriptions to be accessible in format, e.g. multi-sensory, adjustable text size / background color, printable, editable. Language to be behavioral and output driven, avoiding nuance and interpretation such an 'influencing skills'.	Application process in accessible formats, e.g. multi-sensory, adjustable text size / background color, printable, editable.	Understanding the additional needs for psychological contract – what seems obvious may need to be explicit to avoid misunderstandings. Multi-sensory options for ensuring policy compliance, e.g. safeguarding videos. Written contract in accessible format.	Materials to include accessible written pack and opportunity for discussion, reflection and action before completion of training.	Feedback to be factual and not interpretative, guidance and training provided to supervisors about reporting performance feedback clearly with examples.	Transparency on purpose of wellbeing initiative, ensure that it is perceived as optional help rather than mandated acquiescence – many NM people have had negative experiences with mental health practice.
Tolerance for Error	Ensure that safety, risk and client-facing deliverables have	Allowing candidates to review and edit application information	Standard contract process to include review verbally as well	Set a tone in training for the permission of "silly questions" and	Allow for appeal or negotiation where performance ratings	Create feedback loops for employees to submit their

	second checks built into the role design to reduce the need for 100% accuracy.	before online submission. Encouraging applicants to pause or take breaks in interviews if required. Giving clear instructions on directions and log-in details, as many NMs have significant impairments in way finding. Do not penalize this specifically.	as written, give opportunity to ask questions.	create an environment of positive regard. Permit multiple attempts at knowledge tests and allow practice tests.	resulted from misunderstanding.	experiences, both negative and positive, to ensure employee voice is captured and acted upon.
Low Physical Effort	Understand the additional burden on commuting and busy workspaces for NMs, for some this causes physical pain and extreme fatigue, leading to poor performance. Design with minimal sensory load and travel requirements in mind.	Provision of assistive technology or materials in formats compatible with AT. Consider timing of interviews and offer flexibility around location and need to commute in rush hour.	Create as much time as possible for reviewing and competing the contracting process to avoid slow processing speed anxiety.	Use of AT and regular comfort breaks.	Breaks provided to accommodate sensory overwhelm and aid slow processing.	Proximity of support to reduce travel, ensuring wellbeing services also meet multi-sensory design and AT compatible standards.
Space and Size for Approach	Similarly to the above, seek specialist input into the design of workspaces and where possible allow flexibility or compromise (shifts) in attendance on busy work sites.	Match the environment to the job performance so that you can assess in context, with the caveat that there should be a quiet environment for preparation and recruitment tasks as there is likely to be	Defined location of work station, provision of dual monitors, sit stand desks, and acoustic barriers as standard options in contracts.	Flexibility around onsite versus remote delivery, group size and familiarity.	Performance reviews to be conducted in friendly location and quiet, calm environment, with sufficient notice of who will be present.	Flexibility of access remote via app, video, phone or face to face. Avoid reliance on single delivery method.

	additional anxiety for NMs.

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Table 6

CIMO structure research into occupational neurodiversity

	Micro	Meso	Macro
Context **What do we know about individual, organization and societal influences on neurodiversity inclusion?**	How do intersectional aspects of individual experience such as gender, ethnicity, sexual orientation, age, socio-economic status affect neurominorities? Can support at key contextual transitions improve outcomes, such as education to work, unemployment to work, career progression points?	Do environments which provide a closer 'person-environment fit' of neurodiverse need / talents lead to lower rates of occupational exclusion? For example, when there are naturally occurring supports such as schedule flexibility and minimal environmental distractions, or when job tasks relate to skills uncompromised by neurominority such as autistic special interests or ADHD creativity (Meilleur et al., 2015; White & Shah, 2006)? Do environments that systematically provide (for example assistive technology and/or coaching) lead to lower rates of occupational exclusion?	Are we seeing tokenistic examples of deliberate inclusion only (Higginbottom, 2017; Philipson, 2014) or the start of a cultural shift? To what extent are communication norms in education and training design keeping pace with technological and cultural shifts in the world of work?
Intervention **What interventions exist and what do we know**	Investigating the provision of coaching, mentoring, career support, assistive technology, schedule	What employer-led adjustment activities currently exist to accommodate neurominority in the workplace, e.g. supervisor	What labor market policy interventions exist and what do we know about their effect on

about how they are deployed and their effectiveness?	and environmental flexibilities and more, research to map individual experience of adjustments and their prevalence.	training and HR protocols? How prevalent are they in different countries and sectors? How are adjustments determined, recommended and communicated to employers and employees?	neurominorities – e.g. the full inclusion of neurominority in disability policy, specific policy targeting neurominorities?
Mechanisms **How might interventions "work?"**	What is the psychology of adjustment activities for neurominorities, do they operate on cognitive, emotional, behavioral or social capital mediators?	Exploring the impact of inclusion using theories and frameworks such as Leader-Member Exchange, In group / Out group, motivation and engagement, psychological contract, organizational justice and more.	How has the emerging narrative on neurodiversity influenced the perceptions of policy makers and employers regarding the recruitment and potential of people with neurominority diagnoses? To what extent are neurominority disablements technologically determined?
Outcome	To what extent do individual adjustment activities provide improvements in longitudinal occupational outcomes for neurodiverse employees, such as higher rates of employment, promotion and representation at senior levels of	What is the cost-benefit of providing adjustments to employers? Which outcomes have value, e.g. direct productivity improvement via talent, indirect via increased workforce engagement, representation, turnover, absence?	Assessing the wider societal benefits of neurodiversity inclusion such as improvements in the employment gap, recidivism, increased representation in senior roles and positions of influence.

	~~organizations? What quality of life benefits are there when inclusion is manifest?~~	~~Do inclusive contexts and successful interventions actually lead to the retention and expression of 'talent?~~

Table 7

Practice Implications for Working with Neurodiversity

Topic	**Reflective Question – the evidence base**	**Reflective Question – organizational practice**
Best practice for neurominority inclusion	What can be learned from research and practice on other populations such as gender inclusion? What are the implications for intersectionality, e.g. exploring where NM issues are exacerbated by gender or racial bias.	Does the organizsation have relevant policies for other minorities in place? How informed are these by evidence? Do these 'work'? If not, what can be learned?
Legal obligation	Is there 'best evidence' for ensuring best practice beyond legal compliance?	Do all relevant practitioners in the organizsation understand the obligations? Which efforts are there to go beyond legal compliance and actively support?
HR practice	What is the evidence on alternative hiring mechanisms e.g. instead of unstructured interviews?	Have relevant practices been reviewed in line with the guidance in Table 5? Has the neurominority perspective been considered in HR protocols?
Expertise to inform advice and guidance	Who provides respected and evidence-based sources of knowledge?	Who has relevant expertise in-house? It not, where and how could expertise be commissioned? Are advisors appropriately trained, certified and supervissed to support vulnerable adults?

Table 1

Search terms

Conditions	**Variations of terms in search**
Clinical Conditions: ADHD, Autism, TS	ADHD, ADD, Attention Deficit Disorder, Attention Deficit Hyperactivity Disorder, Attention Dysregulation
	Autism, Autistic Spectrum Condition, Autistic Spectrum Disorder, ASD, Asperger's
	Tourette Syndrome, Tourettes, Tic Disorder
Applied Conditions	Dyslex*, Dysprax*, Developmental Coordination Disorder, DCD, Reading Disabilit*, Learning Disabilit*, Specific Learning Disabilt*
Mental Health (for comparison only)	Mental Health, Depression, Anxiety
Work related terms (for the third search only)	Occupation*, Employ*, Unemploy*, Work, Career, Job, Vocation*

Table 2

Number of papers citing neurodiverse conditions in Applied Psychology research

	Journal of Applied Psychology	Personnel Psychology	Industrial and Organizational Psychology	Journal of Occupational and Organizational Psychology
"Neurodiversity" as a term	0	0	0	0
Autism	1	1	7	2
ADHD	1	0	1	1
Dyslexia	1	0	13	2
DCD (Dyspraxia)	0	0	0	0
Tourette Syndrome (TS)	0	1	1	0
Mental Health			110	413

Table 3

Coverage of neurodiverse conditions in UK-based, multi-disciplinary psychological publications

Condition	Hits	pre-1995	1995-2005	2005+	Estimated population prevalence of condition	Proportion of neurodiversity (if mental health included)	Proportion of research
Dyslexia	448	278	79	91	10%	29%	9%
Autism	496	173	80	243	1.5%	4%	10%
DCD	95	46	11	38	2%	6%	2%
ADHD	110	3	17	90	4%	12%	2%
TS	10	3	3	4	1%	3%	0%
Mental Health	4040				16%	46%	78%

Table 4

Disciplinary location of international published research concerning the occupational experience of people with neurodiverse conditions

Journal Type	Neuroscience	Psychology	Psychiatry	Child Development	Condition Specific	Occ Health/ Therapy/ Voc Rehab	Disability	Social Work	Other	Career/Employment/work /management
n	1	5	3	4	9	11	4	1	5	5
%	2%	8%	5%	6%	15%	18%	6%	2%	8%	8%

Table 5

CIMO structure research into occupational neurodiversity (Denyer et al., 2008)

	Micro	Meso	Macro
Context **What do we know about individual, organization and societal influences on neurodiversity inclusion?**	How do intersectional aspects of individual experience such as gender, ethnicity, sexual orientation, age, socio-economic status affect neurominorities? Can support at key contextual transitions improve outcomes, such as education to work, unemployment to work, career progression points?	Do environments which provide a closer 'person-environment fit' of neurodiverse need / talents lead to lower rates of occupational exclusion? What is the role of naturally-occurring supports such as schedule flexibility and minimal environmental distractions? What happens when job tasks relate to skills uncompromised by neurominority such as autistic special interests or ADHD creativity (Meilleur et al., 2015; White & Shah, 2006)?	Are we seeing tokenistic examples of deliberate inclusion only (Bernick, 2019; Philipson, 2014) or the start of a cultural shift? To what extent are communication norms in education and training design keeping pace with technological and cultural shifts in the world of work?

		Do environments that systematically provide (for example assistive technology and/or coaching) lead to lower rates of occupational exclusion?	
Intervention **What interventions exist and what do we know about how they are deployed and their effectiveness?**	What is the provision of coaching, mentoring, career support, assistive technology, schedule and environmental flexibilities and more, research to map individual experience of adjustments and their prevalence?	What employer-led adjustment activities currently exist to accommodate neurominority in the workplace, e.g. supervisor training and HR protocols? How prevalent are they in different countries and sectors? How are adjustments determined, recommended and communicated to employers and employees?	What labor market policy interventions exist and what do we know about their effect on neurominorities – e.g. the full inclusion of neurominority in disability policy, specific policy targeting neurominorities?
Mechanisms	What is the psychology of adjustment activities for neurominorities, do	How can we investigate the impact of inclusion using theories and frameworks such	How has the narrative on neurodiversity

How might interventions "work?"	they operate on cognitive, emotional, behavioral or social capital mediators?	as Leader-Member Exchange, In group / Out group, motivation and engagement, psychological contract, organizational justice?	influenced the perceptions of policy makers and employers regarding the recruitment and potential of people with neurominority diagnoses? To what extent are neurominority disablements technologically determined?
Outcome	To what extent do individual adjustment activities provide improvements in longitudinal occupational outcomes for neurodiverse employees, such as higher rates of employment, promotion and representation at senior levels of	What is the cost-benefit of providing adjustments to employers? Which outcomes have value, e.g. direct productivity improvement via talent, indirect via increased workforce engagement, representation, turnover, absence?	How can we assess the wider societal benefits of neurodiversity inclusion such as improvements in the employment gap, recidivism, increased representation in senior roles and

	organizations? What quality of life benefits are there when inclusion is manifest?	Do inclusive contexts and successful interventions actually lead to the retention and expression of 'talent?	positions of influence?

Table 6

Neurodiversity Universal Design for HR

Universal Design Principle	Designing: Avoiding structural exclusion by focusing on performance output, not input	Hiring: Ensuring all candidates can perform at their best during the process	Contracting: Terms and conditions of employment to increase access	Training: inclusion in standard	Performance Review: Optimizing success with inclusive delivery	Wellbeing: adapting standard wellbeing services to support NM needs
Equitable Use	Job design to avoid social constructs in 'essential' criteria, such as "team skills" for jobs where performance will be independent.	Use of work sample tests to measure performance in the actual role, rather than social expectation loaded interviews or proxy measures such as timed intelligence tests.	Provision for: (1) remote working (2) flexible hours (3) general reduction in commuting obligations as standard in all employment contracts where feasible.	Ensuring access to standard training through best practice in preparation and delivery for all in-house provision, details as below.	Provision of personal performance training as standard company offer, e.g. time management, planning, prioritizing and other performance issues common to NM, but also relevant to a wide range of employees and newly promoted.	Ensuring a variety of wellbeing (WB) initiatives, including physical health as equal to mental health. Build access to WB supports into standard onboarding and reviewing protocols so that it is standard.
Flexibility in Use	Craft roles for specialists as well as generalists, for example permitting senior roles without supervision responsibilities.	Offer a menu of adjustments as standard, which signals that organizational intentions are welcoming of	Providing flexible options for standard systems such as frequency of supervision and feedback, which may need to be increased	Adjustable pace in learning program, allow additional time for preparation and any post-training testing.	Permit mentors in performance reviews, provide feedback written in advance to allow reflection. Appraisal scoring to avoid penalizing where	Ensure wellbeing provision incorporates specialists, as standard advice may not be appropriate for some NMs who have

		difference. Invite candidates to contact recruiters if they would require time extensions, or location flexibility, for example.	during onboarding for some neurominorities.		employees excel in specialist areas but are average in others.	additional cognitive and medical needs.
Simple and Intuitive Use	Over time roles develop 'creep' and become overlaid with sometimes inconsistent responsibilities. Regular review of performance output variables and tram structures helps to ensure that jobs are designed simply and intuitively in line with the business goals.	Clear instructions on how to complete application and what to prepare for assessment using simple bullet points or numbered steps.	Well laid out terms and conditions, signposting to relevant policies and procedures, covering note, use Flesch Kincaid score to assess language accessibility.	Consistency of formatting and training scheduling to avoid confusion or absence.	Standard format for assessing and reporting performance that is consistent and clearly communicated in advance.	Well-advertised provision with referral routes clearly presented in simple step-by-step format.
Perceptible Information	Role descriptions to be accessible in format, e.g. multi-sensory, adjustable text size / background color, printable, editable. Language to be behavioral and output driven, avoiding nuance and interpretation such an 'influencing skills'.	Application process in accessible formats, e.g. multi-sensory, adjustable text size / background color, printable, editable.	Understanding the additional needs for psychological contract – what seems obvious may need to be explicit to avoid misunderstandings. Multi-sensory options for ensuring policy compliance, e.g. safeguarding videos. Written contract in accessible format.	Materials to include accessible written pack and opportunity for discussion, reflection and action before completion of training.	Feedback to be factual and not interpretative, guidance and training provided to supervisors about reporting performance feedback clearly with examples.	Transparency on purpose of wellbeing initiative, ensure that it is perceived as optional help rather than mandated acquiescence – many NM people have had negative experiences with mental health practice.
Tolerance for Error	Ensure that safety, risk and client-facing deliverables have	Allowing candidates to review and edit application information	Standard contract process to include review verbally as well	Set a tone in training for the permission of "silly questions" and	Allow for appeal or negotiation where performance ratings	Create feedback loops for employees to submit their

	second checks built into the role design to reduce the need for 100% accuracy.	before online submission. Encouraging applicants to pause or take breaks in interviews if required. Giving clear instructions on directions and login details, as many NMs have significant impairments in way finding. Do not penalize this specifically.	as written, give opportunity to ask questions.	create an environment of positive regard. Permit multiple attempts at knowledge tests and allow practice tests.	resulted from misunderstanding.	experiences, both negative and positive, to ensure employee voice is captured and acted upon.
Low Physical Effort	Understand the additional burden on commuting and busy workspaces for NMs, for some this causes physical pain and extreme fatigue, leading to poor performance. Design with minimal sensory load and travel requirements in mind.	Provision of assistive technology or materials in formats compatible with AT. Consider timing of interviews and offer flexibility around location and need to commute in rush hour.	Create as much time as possible for reviewing and competing the contracting process to avoid slow processing speed anxiety.	Use of AT and regular comfort breaks.	Breaks provided to accommodate sensory overwhelm and aid slow processing.	Proximity of support to reduce travel, ensuring wellbeing services also meet multi-sensory design and AT compatible standards.
Space and Size for Approach	Similarly to the above, seek specialist input into the design of workspaces and where possible allow flexibility or compromise (shifts) in attendance on busy work sites.	Match the environment to the job performance so that you can assess in context, with the caveat that there should be a quiet environment for preparation and recruitment tasks as there is likely to be	Defined location of work station, provision of dual monitors, sit stand desks, and acoustic barriers as standard options in contracts.	Flexibility around onsite versus remote delivery, group size and familiarity.	Performance reviews to be conducted in friendly location and quiet, calm environment, with sufficient notice of who will be present.	Flexibility of access remote via app, video, phone or face to face. Avoid reliance on single delivery method.

	additional anxiety for NMs.

Table 7

Practice Implications for Working with Neurodiversity

Topic	**Reflective Question – the evidence base**	**Reflective Question – organizational practice**
Best practice for neurominority inclusion	What can be learned from research and practice on other populations such as gender inclusion? What are the implications for intersectionality, e.g. exploring where NM issues are exacerbated by gender or racial bias.	Does the organization have relevant policies for other minorities in place? How informed are these by evidence? Do these 'work'? If not, what can be learned?
Legal obligation	Is there 'best evidence' for ensuring best practice beyond legal compliance?	Do all relevant practitioners in the organization understand the obligations? Which efforts are there to go beyond legal compliance and actively support?
HR practice	What is the evidence on alternative hiring mechanisms e.g. instead of unstructured interviews?	Have relevant practices been reviewed in line with the guidance in Table 5? Has the neurominority perspective been considered in HR protocols?
Expertise to inform advice and guidance	Who provides respected and evidence-based sources of knowledge?	Who has relevant expertise in-house? It not, where and how could expertise be commissioned? Are advisors appropriately trained, certified and supervised to support vulnerable adults?

RUNNING HEAD: Diamond in the rough?

Appendix 1

Journal Title list for the papers extracted in search three (table 4)

Tourettes	**Procedia Social and Behavioral Sciences**
	Dissertation Abstracts International: Section B: The Sciences and Engineering
	Journal of Neurology, Neurosurgery, & Psychiatry (JNNP)
	Psychiatric rehabilitation journal
Dyslexia	Rehabilitation Psychology
	Journal of Applied Psychology
	Coaching: An International Journal of Theory, Research & Practice
	Journal of learning disabilities
	Diversity & Equality in Health & Care
	Nurse Education in Practice
DCD	British Journal of Therapy & Rehabilitation
	American Journal of Occupational Therapy
	Journal of Adult Development
	Frontiers in Psychology
	Disability and rehabilitation

RUNNING HEAD: Diamond in the rough?

Autism	PLoS ONE
	Pediatrics
	American Journal of Occupational Therapy
	Research on Social Work Practice
	Journal of Autism & Developmental Disorders
	Journal of Vocational Rehabilitation
	Research in developmental disabilities
	Journal of Disability Policy Studies
	Journal of Autism & Developmental Disorders
	Journal of Vocational Rehabilitation
	Journal of Vocational Rehabilitation
	Career Development for Exceptional Individuals
	OT Practice
	Work
	Journal of Vocational Rehabilitation
	Journal of Autism & Developmental Disorders

RUNNING HEAD: Diamond in the rough?

	Journal of Autism and Developmental Disorders
	Journal of Autism and Developmental Disorders
	Research in developmental disabilities
ADHD	Medicated & Unmedicated ADHD Boys at Midlife (35 to 45)
	ADHD in Adults--Comorbidities & Adaptive Impairments
	International Journal of Managing Projects in Business
	Journal of Management Development
	Advances in Mental Health & Intellectual Disabilities
	Journal of Occupational and Environmental Medicine
	Disability and Rehabilitation: Assistive Technology
	Journal of Applied Rehabilitation Counseling
	Journal of Employment Counseling
	Dissertation Abstracts International Section A: Humanities and Social Sciences
	American Journal of Occupational Therapy
	ADHD in adults: A practical guide to evaluation and management.
	European Psychiatry

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