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Introduction

Introduction to the special issue on cross-cultural neuropsychology

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Over the last few decades, cross-cultural neuropsychology, with its origins in anthropology and linguistics, has developed from a niche area of interest to a considerable field of study within neuropsychology. Cross-cultural neuropsychology "analyzes the influence of cultural variables on cognition from a neurological perspective" (Ardila, 2020, p. 64), examining how and why cultural and linguistic factors influence neuropsychological test results. It also involves the study of differences in brain organization across different cultures and how brain pathology manifests in different cultures.

Some of the earliest seeds of cross-cultural neuropsychology were sown by the early 20th-century concepts put forth by Vygotsky, in addition to the work of Luria, who both proposed that "mind is the product of the material conditions of culture" (Nell, 1999, p. 45). Over a half-century later, Alfredo Ardila laid the foundations for much of the contemporary work being done today. He wrote extensively on the cultural values underlying neuropsychological testing and the applicability of specific test procedures, elements, and strategies developed in Western Europe and North America to populations in other regions of the world.

Initial studies of cross-cultural neuropsychology mainly focused on capturing how the global diversity in languages, cultures, education, and other considerations impacts performance on neuropsychological tests – a line of research still fruitful today. These studies launched a plethora of new hypotheses about possible underlying mechanisms to explain performance differences on cognitive tests, as well as spurring the development of new testing paradigms, cross-cultural neuropsychological measures, and guidelines aimed at providing the field with the right tools and inspiration to improve assessment in cross-cultural settings.

The first comprehensive handbooks on cross-cultural neuropsychology were published at the turn of the century (e.g., Fletcher-Jansen et al., 2000). The number of publications since then slowly increased over the next 20 years. However, a surge of research in this domain has recently occurred. A search of the literature to date shows that only 41 publications explicitly mention "cross-cultural neuropsychology" in their title or as a keyword. Still, fully half of these publications have appeared within the last three years.

This special issue contributes nine state-of-the-art studies to the literature on cross-cultural neuropsychology. The papers in this volume focus on three overall themes: (1) the development of novel tests and testing paradigms to facilitate cross-cultural neuropsychological assessment; (2) linguistic considerations and adaptations for existing neuropsychological assessment procedures; and (3) cross-cultural self-report and informant report measures.

Development of novel cross-cultural measures and testing paradigms

Nielsen et al., developed and validated a brief naming test, the Copenhagen Cross-Linguistic Naming Test (C-CLNT), for use with culturally, linguistically, and educationally diverse older adults in Europe. The C-CLNT was based on a set of standardized color drawings and selected by considering name agreement and frequency across five European and two non-European languages. The C-CLNT displayed acceptable scale reliability and good construct validity, with moderate to strong correlations with traditional language tests. Diagnostic accuracy for dementia was good and significantly better than that of the Boston Naming Test but was poor for mild cognitive impairment. A different approach to circumventing language barriers is used by Ampofo et al. In an elegant study, the authors demonstrated that the use of semantically meaningless consonant-vowel-consonant trigrams, such as VAB, could be used as stimuli in a memory test with minimal changes to accommodate for language differences between American and Italian participants. Such trigrams may be a promising aid in conducting cross-linguistic memory studies (at least, for studies with a Latin/Roman alphabet or similar phonology of words).

Linguistic considerations and adaptations for existing neuropsychological procedures

McHenry et al., evaluated the psychometric properties of the culturally adapted NIH Toolbox African Languages for use with Swahili and Dholuo-speaking children in western Kenya. Most tests showed acceptable psychometric properties for use within these specific language groups. However, issues related to shape identification and trading speed for accuracy limited the utility of the Dimensional Change Card Sort for many participants, with approximately 25% of children unable to match based on shape. While this test battery showed promise for use with these populations, further research is needed to establish these measures' clinical utility and acceptability across culturally diverse populations.

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Salonen et al., showed that the use of Swedish WPPSI-IV normative data for assessing young children belonging to the Swedish-speaking minority in Finland (Finland-Swedes) resulted in, on average, 1/3 SD higher than the Scandinavian norms, a difference which was statistically significant with medium-sized effects. In contrast, Staios et al., showed that the use of majority English language normative data resulted in significantly underestimating performances across a range of neuropsychological measures within a sample of healthy, older, educationally disadvantaged Greek Australian immigrants, including the WAIS-IV, verbal and visual memory tests, language and naming, and executive functions. However, the newly developed representative Greek Australian normative data were shown to be superior in comparison to existing English language norms and was also capable of sensitively and explicitly distinguishing between the healthy controls and those with dementia.

Porsselvi et al., adapted the Oxford Cognitive Screen for use with Tamil speakers and demonstrated the importance of considering language and education in test design/adaptation. The authors ultimately decided to incorporate both aspects of formal, "high variety" Tamil, as spoken in educational settings, and "low variety" Tamil, informal Tamil, spoken by many in everyday life but not used in writing.

Finally, Crisan et al., administered a neuropsychological battery to native speakers of Romanian and Arabic (who have linguistically and orthographically dissimilar languages). Animal fluency and the Emotion Word Fluency Test (Abeare et al., 2017) were administered in English and in their native language in a counterbalanced fashion to assess the effects of limited English proficiency. They compared the performance of these two groups with a Canadian sample of native English speakers tested only in English to investigate the effect of limited English proficiency on neuropsychological performance. Measures with high verbal mediation were predictably associated with lower performance in participants with limited English proficiency. In contrast, tests with minimal verbal mediation tended to be more resistant to the effects of limited English proficiency. However, this pattern showed unexpected differences between the two limited English proficiency groups. For example, on the Delis-Kaplan Executive Function System version of the Stroop test (Delis et al., 2001), which tends to be less verbally mediated, the Romanian sample continued to improve across trials, while the Arabic group declined. In contrast, on the highly verbally mediated Animal fluency task, the Romanian participants improved their performance when tested in their native language, while the Arabic sample showed the opposite pattern, performing better when tested in English. This performance disparity was unexpected and suggests that simply evaluating an individual in their native language is sometimes not effective in minimizing the impact of language proficiency on neuropsychological test performance. It may occasionally produce inadvertent effects, resulting in unexpected or distorted cognitive results. In addition to these thought-provoking findings regarding the impact of language proficiency on neurocognitive performance, the authors identified several measures that appear to be resistant to limited English proficiency.

Impact of culture on self- and informant report of neuropsychiatric symptoms

Two studies examined measures relying on the patient's and caregiver's perception of symptoms. Nguyen et al., studied how the commonly used Neuropsychiatric Inventory can be adapted to Vietnamese and subsequently be used to assess neuropsychiatric symptoms after traumatic brain injury. Their findings add to a growing literature, mainly from the United States, Europe, and Asia (Lai, 2014; Cummings, 2020), indicating that some neuropsychiatric abnormalities after brain injury likely have a sizeable biological component and are potentially less culturally determined. The study by Statucka et al., addresses a topic that has received little attention in the international cross-cultural literature so far: the assessment of subjective complaints and functional impairment in diverse populations. The authors found that immigration status in their sample had a limited effect on reporting cognitive change and the degree to which such change limited daily functioning, suggesting that such measures may be more robust than cognitive tests in these populations. Future studies may examine this topic in more detail by evaluating different instruments and conducting differential item functioning analysis. For example, in a study of eight European countries by Dubbelman et al. (2020), differential item functioning was identified for items such as using a washing machine, making appointments, or playing card or board games, indicating that (subtle) cultural bias may be present in these instruments.

Challenges for cross-cultural neuropsychology

Although the studies included in this special issue provide some next steps and inspiration for future research, conducting studies in cross-cultural neuropsychology is challenging due to the many factors that must be considered. For example, differences between diverse groups may easily be attributed to cultural factors, while differences in language or education actually drive these effects. For example, Manly et al., (2002) demonstrated that expected differences between different ethnoracial groups were attenuated if the reading level, a proxy of quality of education, was taken into consideration. Therefore, researchers must measure many aspects of diversity to identify how cultural groups differ on tests. These factors, outlined in the ECLECTIC framework (Fujii, 2018), include education quantity and quality, literacy, acculturation, language proficiency, bilingualism, comfort with the testing situation, and test wiseness. Even for a "simple" translation of an existing test, many linguistic factors should ideally be considered, such as word frequency, age of acquisition, familiarity, word length, phonemic complexity, imageability, and many other factors (for an informative overview, see, e.g., Ivanova & Hallowell, 2013). The study by Crisan et al., in this issue, provides an additional perspective on the issue of the effects of language proficiency on neuropsychological performance.

Another challenge to research in cross-cultural neuropsychology is that there are numerous ecological, sociological, and economic factors related to culture that could affect early life experiences and can profoundly influence the development and differentiation of cognitive functions and neural structures (Chua et al., 2005; Goh & Park, 2005). The relative impact of each of these factors on cognitive or neural systems may be challenging to disentangle. Research in this domain should consider the differential effects of factors such as socialization, environmental and ecological demands and supports, education (including curriculum and learning environment), language (e.g., mono- versus multilingualism, proficiency in the language tested), value systems, family constellation, and theory of mind (e.g., Sabbagh et al., 2006).

Finally, culture is constantly changing. With such changes, the familiarity with and relevance of testing procedures and test stimuli

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can also change over time. As a result, the structure of neuropsychological assessment procedures and stimuli may not be applicable, familiar, or even behaviorally appropriate across all cultures (Ardila, 2018) or even over time. Basic strategies used by examinees on various tasks have also been shown to differ across cultures (Wang, 2021). Future studies must assess the impact of examinees' strategy use (e.g., methods for imposing meaning on stimuli), the applicability of neuropsychological test stimuli, and the structure and design of cognitive tests across cultures on cognitive performance. The effects of cultural differences on the perceived interpersonal dynamics inherent in the assessment procedure must also be considered. Across the spectrum of cultural differences, it is also essential to keep in mind that the meaning and relevance of cognitive constructs varies across cultures (e.g., memory (Wang, 2021), executive functioning (Cho et al., 2023)). For example, Western concepts of memory emphasize processes such as recall and recognition, while Buddhist ideas of memory focus on aspects such as apperception, perception, insight, and mindfulness (Cassaniti, 2018, Deshpande, 1996, Wang, 2021).

Recommendations for research in cross-cultural neuropsychology

We are currently at the point of being able to formulate and propose testable theoretical models that account for cultural influences on the growth and deterioration of cognitive abilities across the lifespan. We must go beyond simple descriptions of cultural characteristics and differences at the phenotypic level. We have the capacity to explain what accounts for them from an ontological perspective and should consider these issues in the future design of novel neuropsychological instruments and assessment approaches.

Future studies of cross-cultural neuropsychology should implement and systematically report demographic variables and consensually adopted, clear, and specific standards in their research articles. O'Bryant et al. (2004) noted that information on race, ethnicity, native language and acculturation are often not reported in research articles, which likely limits progress in cross-cultural neuropsychology. Medina et al. (2021) provided a recent update on these trends, and while reporting of these variables in research papers is slowly improving, greater systematic reporting of these variables is needed. They present specific recommendations by Rad et al. (2018) as a possible path forward. All researchers (even those outside cross-cultural neuropsychology) should strongly consider implementing these recommendations to enhance the transparency and representation of research in the field as a whole.

At the most basic level, direct translation of instruments from one language to another should be avoided. For example, the original Auditory Verbal Learning Test (Rey, 1958) used two-syllable words for all test stimuli (Woodard, 2006). Taylor's (1959) primarily direct translation of Rey's list of French words into English resulted in a loss of the bisyllabic list structure and changes in word frequency of the items across the two languages. If translation is used, researchers should systematically report and clarify the procedure used to translate the material, the background and training of the translators, and other relevant factors. In clinical studies, standards for using interpreters should also be implemented. For example, researchers should clarify how interpreters were trained and prepared to assist with the evaluation.

We would also advocate for developing and using cross-cultural neuropsychological evaluation procedures rather than race-based norms (Franzen et al., 2022). The examinee is much more than a number corresponding to a score on a test. To again borrow from Luria and Vygotsky, the score represents a phenotype. We must seek to identify the ontological constructs underlying cognitive performance. Advanced psychometric procedures are also available to establish neuropsychological measures' measurement equivalence and diagnostic validity (Pedraza & Mungas, 2008). For example, Item Response Theory techniques can be used for test construction and identifying differential item functioning that may contribute to item bias on cognitive tests. In addition, Bayesian methods have much more to offer over their frequentist counterparts for the development of normative data and interpretation of the performance of an individual relative to a normative group (Crawford & Garthwaite, 2007; Huygelier et al., 2022). Bayesian approaches can also be used to differentiate the impact of cultural traits associated with previous generations and in adjacent populations (transmitted culture) and ecological factors (evoked culture) on cognitive performance (Hyafil & Baumard, 2022).

Finally, much existing cross-cultural research is fraught with methodological concerns, including the use of small sample sizes, which are typically underpowered for detecting meaningful outcomes, and convenience samples rather than random sampling to obtain groups representative of the cultures they purport to reflect. Even if random selection cannot be fully accomplished, comparing critical sample characteristics to known or expected population characteristics is possible to characterize the sample's representativeness. Finally, the use of Bayesian techniques, as mentioned earlier, can be used to establish and interpret normative data more accurately. Other advanced methodological innovations that could clarify factors related to the growth or decline in neuropsychological functions over the lifespan are also readily available. For example, longitudinal modeling of developmental trajectories using latent growth curve modeling, latent change score modeling, or linear mixed effects modeling can be used to characterize the rate and extent of development or decline of cognitive abilities and cultural factors that might be related to such change.

In summary, the papers in this Special Issue present cutting-edge, novel approaches and methodologies for studying important issues in cross-cultural neuropsychology. As noted earlier, exploring the impact of culture is challenging, given varying definitions of culture, the changing nature of culture, and the numerous culturally-related factors that can influence cognitive and neural development. Notwithstanding these challenges, research on cross-cultural neuropsychology has enjoyed unprecedented growth within just the last few years. We hope that this Special Issue will provide a solid contribution to the knowledge base in this field and will stimulate much more innovative research to provide new insights into the effects of culture on neuropsychological functioning

Competing interests. The authors declare no conflicts of interest.

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