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How Cultural Origins Influence Cognitive Performance: A Pilot Study

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1. INTRODUCTION

Only 11% of the world population is currently represented in literature (Thalmayer et al., 2021). In 2008, Arnett documented that in psychology literature 73% of first authors and samples were Americans. In 2021, the percentage has decreased to 64%, however only 4% of first authors are not from the United States, English speaking countries or Europe (Thalmayer et al., 2021). This underrepresentation of the world population constitutes a limit and a lack in researchers' knowledge with many consequences in psychology and other disciplines. This study is particularly interested in repercussions on clinical neuropsychological practice as there is limited evidence regarding possible cognitive outcomes determined by cultural belonging. For instance, Europe is undergoing vast migratory flows. Eurostat (2020)[1] reported that on 1 January 2020, 23 million individuals in Europe are from non-EU developing countries (around 5.1% of total population). In addition, 13.5 million individuals live in an EU member state different from the own and in Italy there are 5.0 million non-national individuals. Canevelli and colleagues (2019) estimated nearly 476 500 dementia cases (around 6.5% of overall cases of dementia in Europe) among European immigrant population over 65-years in 2019. It follows that these people seek help for their cognitive disturbances in the actual country of residence. Thus, clinical neuropsychology is facing considerable challenges and clinicians come up against culturally, linguistically and educational differences (Franzen et al., 2021a). Currently, several instruments are available for the assessment, however neuropsychologists' training and the development of new cross-cultural tests are two compelling necessities (Franzen et al., 2021a). Furthermore, Fujii (2018) pointed out that importance should be attributed not only to the tests but also to the contextual factors which influence neuropsychological assessment. ECLECTIC framework was proposed (E: education and literacy; C: culture and acculturation; L: language; E: economics; C: communication; T: testing situation: comfort and motivation; I: intelligence conceptualization; C: context of immigration) to pinpoint potential biases in the assessment.

The aim of this work is to study the influence of culture and acculturation on the cognitive performance in participants fluently speaking Italian. The word *acculturation* refers to

[1] Source: Eurostat "https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Migration_and_migrant_population_statistics"

the interaction between cultural systems which influence one another, leading to modifications in behaviour and attitudes (Berry, 2003). Other works have explored this aspect (e.g., Al-Jawahiri & Nielsen, 2021). However, in this study it was decided to develop a new acculturation questionnaire which presents some similarities with the Short Acculturation Scale for Hispanics (SASH; Marin et al., 1987), but through the use of a double scoring it aims to assess to different dimensions such as Interculturality and Closeness to Italian Culture (see paragraph 3.1). Moreover, comparison of performance was carried out not only among Italian population living in Italy and a culturally diverse sample, but also among Italians living abroad.

In the following chapter a brief theoretical background is given to understand how culture is strictly related to cognitive performance and consequently with a good and accurate neuropsychological assessment. In this regard, a definition of culture is given and Cultural Neuroscience, a new emerging research discipline, is presented so as to highlight relevant aspects which help understand how culture is ultimately in relation with cognitive performance. In doing so, the relationships between culture and genes, and between culture and brain are explored. Successively the study is presented, and lastly new perspectives are outlined.

2. CULTURAL NEUROSCIENCE

Cultural neuroscience is "an emerging research discipline that investigates cultural variation in psychological, neural, and genomic processes as a means of articulating the bidirectional relationship of these processes and their emergent properties" (Chiao, 2009, p. 289). Two different relations are studied: the first is the relation between cultural traits, neurobiology, and behaviour: how does the first dimension influence the following? The second to be considered is the relation between neurobiological mechanisms and the emergence and transmission of cultural traits (Chiao, 2009). Cultural neuroscience is the discipline which is intended to analyse the above mentioned bidirectional relationships. In particular, a central interest of cultural neuroscience is to investigate how culture is involved in shaping specialized neural mechanisms. Indeed, it is a novel empirical approach which takes advantage form cultural psychology, neuroscience and neurogenetics research which are integrated to answer cultural neuroscience questions. In other words, this discipline aims at studying how cultural contexts shape psychological and biological processes (Kim & Sasaki, 2014).

Cultural neuroscience is close to social neuroscience as they both try to understand how cultural transmission is mediated by neurobiological mechanisms. In order to do so, the study of imitative learning is fundamental. However, cultural neuroscience has its peculiarities which distinguish it from other disciplines, as it focuses explicitly on the study of the mechanisms by which cultural traits influence and determine mental and neural events. Moreover, cultural neuroscience also points out how culture could influence neurobiological and psychological processes over time, influencing even perception and cognition (Chiao, 2009; Chiao et al., 2010).

Cultural neuroscience, as above mentioned, has its roots in cultural psychology, human neuroscience and neurogenetics. To better understand this new research field, the relevant aspects of these three disciplines, which establish the basis for cultural neuroscience research, are briefly analysed.

First, Hofstede (2001) defines five aspects in cultural psychology which characterise culture: *individualism-collectivism*, *uncertainty avoidance*, *power distance*, *long/short term orientation* and *masculinity/femininity*. However, other cultural constructs appear to be of great relevance, such as *holistic-analytic cognition* and *socio-economic status* (Chiao, 2009; Chiao et al., 2013; Chiao & Immordino-Yang, 2013). Moreover, cross-cultural psychology to prevent the out-dated nation-culture correspondence has

developed behavioural methods that aim to detect cultural influence on behaviour (Chiao et al. 2010; see paragraph 2.2 for a complete discussion on behavioural methods in cultural psychology). These notions serve as core knowledge to deepen our understanding of how culture influences brain functioning.

Second, human neuroscience takes advantage of several tools which help mapping neural structures and activity in function of mental processes. Functional magnetic resonance imaging (fMRI), positron emission tomography (PET), transcranial magnetic stimulation (TMS), magnetoencephalography (MEG), event-related potentials (ERP), and brain lesion studies are tools for directly and indirectly measuring brain activity. These techniques differ one from the other mainly for spatial and temporal resolution. For this reason, it is fundamental to know these tools and the questions they can answer (Chiao, 2009). Another problem to consider when comparing neural mechanisms from diverse population is the template[2] to which brains are normalized. This template is based on Caucasian individuals, and this may constitute a problem during data analysis (Chiao et al., 2010).

Third, neurogenetics offers a closer view on neural endophenotypes and brain regions which are susceptible to culture and gene coevolutionary forces. Studies in population genetics show significant variations in allelic frequencies as a function of population structure. Cultural variation in allelic frequencies is the result of many evolutionary factors such as natural selection, genetic drift, mutations and gene flow (Tishkoff & Kidd, 2004 as cited in Chiao et al., 2013). In particular, it has been highlighted how two genes such as the serotonin transporter polymorphism (5-HTTLPR) and the dopamine D4 receptor polymorphism (DRD4) may have a central role in cultural neuroscience research (Chiao, 2009; see paragraph 2.3 for a further discussion on neurogenetics).

There are several reasons to broaden our knowledge in cultural neuropsychology. In this section we are going to illustrate some of them. First, we are going to give an insight on why it is important to study cultural influence on the brain, successively how this research could have a broader impact on other fields of basic and applied research.

[2] Brain templates are digital specifical anatomical normalized representations of the brain which depict anatomical details. Brain templates are usually constructed using MRI data from one or a few brains in which anatomical structures are identified. (Roland & Zilles, 1994; Yang et al., 2020)

There is much evidence on the influence of culture on psychological processes and behaviour (Matsumoto & Juang, 2016), for this reason it is necessary to study how culture influences neural mechanisms and, consequently, behaviour. Another element to take in consideration is the cultural variation in neural mechanisms which may be present even in the absence of behavioural and psychological differences. Cognitive processes underlying the behaviour could be different across cultures (Kim & Sasaki, 2014). For example, there is evidence regarding number processing in Chinese and English speakers, probably due to language and different cultural styles in education and learning strategies (Tang et al., 2006). For instance, attention related tasks in East Asians and European Americans (Hedden et al., 2008) and categorization tasks related to semantic judgment strategies (Gutchess et al., 2010). Lastly, a comprehensive understanding of human mind is not possible if there is no incorporation of multiple levels of analysis such as neural mechanisms, genetic factors, and culture influence (Chiao, 2009).

As previously mentioned, there may also be benefits on a larger scale as cultural neuropsychology could gather social and biological sciences (Chiao, 2009). There are also consequences on social aspects as cultural neuroscience may enhance the debate on interethnic ideologies (e.g., colorblindness and pluralism) explaining how cultural identity interacts with brain and behaviour (Chiao, 2009). Finally, cultural neuroscience could have an impact on understanding the discrepancies in mental health disorders prevalence around the world (Chiao, 2009).

2.1 CULTURE

This paragraph is intended to give a definition of *culture,* which is the one we will refer to in this study. In 1871, in his classic work "Primitive Culture", Tylor defined culture as "that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society" (Tylor, 2010, p. 1). In the past decades, anthropologists moved forward this definition in the direction of a more complex and dynamic comprehension of culture. A simplistic understanding of culture could lead to erroneous and inaccurate progress in knowledge.

In accordance with the previous definition, culture is socially transmitted, shared by a group of people and it influences human actions, but what makes it so complex is its multiple dual characterizations. In particular, we consider three pairs of complementary attributes that are in contrast one to the other. First, culture is both abstract (socially characterized and transmitted), and concrete (made of a group of people). Culture is also made of meanings and practices (behaviours and interactions). Lastly, culture is public as it has within group validity and it is passed down over generations, but it also has a private dimension as every person undergoes unique experiences (Dominguez Duque et al., 2010). Moreover, Dominguez Duque and colleagues (2010) identified two aspects which help to understand the dynamism of culture. On one hand, culture is defined as a thing which is coherent and stable. On the other hand, culture is a process in continuous evolution, it undergoes constant negotiation, and its meanings are endlessly revised. "Cultural stability is therefore dynamic" (p. 139).

Given this articulated definition, it is critical to understand if culture in its complexity has an influence on shaping human brain. In this regard, it is worth mentioning the emerging viewpoint of embodied cognition which states that, first, there is a dynamical bidirectional body-mind relationship. Second, body and mind are viewed as two entities in continuous relationship, exchanging information and influencing one the other. A third component to take in account is the surrounding world in which bodies move and act. For this reason, it is possible to talk about situated, contextual and distributed cognition. In particular, it is useful to mention the fourth claim Willson (2002) discussed in her analysis of embodied cognition. This claim states that environment is one of the components of the cognitive system: the activity of the mind is distributed among brain and environment (this definition leads to theoretical issues we will not mention here as they are not relevant for this research, for a complete discussion see Wilson, 2002).

A relevant notion, originating from embodied cognition, is the embodied embedded cognition (EEC) which, similarly, considers the interaction between environment and the body as components which shape cognition and behaviour. Once more, brain is seen as a component among equally relevant others (van Dijk et al., 2008).

In turn, cultural differences have a strong relation with environmental differences and culture represents a way to adapt to a specific context (Geertz, 2000 as cited in Ardila, 2005). Consequently, it is possible to consider culture as derived and part of the environment.

These notions have a key role for anthropologists as human cultural knowledge and enactments, central in culture, acquire an equally relevant role as the brain and the body. For this reason, it is necessary to add complexity and examine carefully the dynamic and interactive definition of culture in order to avoid oversimplification in research and to have a better understanding of the culture-individual interaction (Seligman et al., 2016).

In light of the definition of culture and of the above mentioned theories, it results that cultural systems shape and are shaped by behaviour in a dynamic and interactive bidirectional relationship.

2.2 METHODS FOR CULTURAL INVESTIGATION

Usually, in research, culture is associated to nationality, ethnicity, or race, but this leads to erroneous overgeneralisations. Individual variability is not taken in consideration and this implies, inaccurately, that people belonging to the same geographical or ethnic group have similar cultural backgrounds. As previously discussed, culture has a dynamic characterisation. In contrast, a generalising approach assumes that culture is predominantly fixed and independent from the context. It also excludes the influences that different cultures could exert on the same individual (Chiao et al. 2010; Seligman et al., 2015).

Another problem related to generalisation is that usually cultural groups are divided on the basis of broad geographic categories: East-Asians and Euro-Americans, ignoring both internal diversity (it is determined by ethnicity, identity and experiences) and populations not represented by these two groups (e.g., Middle East, Latinos, Africans). This East-West dichotomy has highly simplified the differences within and between groups (Seligman et al., 2015). For example, a lot of interest has been captured by the differences in self-construal. However, it is of great importance to think of how results could change if research focused on self-construal in other cultures such as African and Middle Eastern contexts (Oyserman & Lee, 2008). Specifically, an *ecocentric* sense of self has been documented among indigenous people. It corresponds to a close interaction and relation with nature and the land (Kirmayer et al., 2009). It would be interesting to study this construct in comparison to the well-known individualistic and collectivistic style, and consequently analyse if there are differences in psychological or cognitive processes.

To overcome this generalisation, cultural psychology has developed different behavioural methods for investigating and measuring cultural values: behavioural surveys, open-ended interviews, cultural priming and situational sampling (Chiao, 2009; Chiao et al 2010).

Behavioural surveys are questionnaires which are intended to assess culture as a set of cultural values, practices, and beliefs of a certain population (Chiao, 2009; Chiao et al., 2010; Seligman et al., 2015). It is of great importance to point out the critical and valuable aspects of this method. For example, self-construal may influence how people fill in the questionnaires. Seeing that it is going to be discussed in the following paragraphs, self-construal has an influence on a wide variety of processes at a behavioural level, included cognition. In relation to behavioural surveys, it has been found that self-construal is related to response biases. Individualists show an extremity bias (they tend to

answer using the endpoints of Likert scales) while collectivists show moderacy bias (they tend to answer using the midpoint of Likert scales) (Chen & Stevenson, 1995). Moreover, it is inevitable to notice the contradiction with definition of culture provided in paragraph 2.1. These questionnaires ignore the dynamicity of culture and reduce culture to a collection of values and mental traits. Nevertheless, this method, if compared with nationality grouping, allows to have a wider representation of individuals and it may also measure intergroup variability (Chiao et al., 2010; Seligman et al., 2015).

Ethnography or *open-ended* interviews are another valuable instrument to examine and investigate values, cultural practices and beliefs (Gelfand et al., 2012 as cited in Chiao et al., 2013). This method could be very useful because it helps having a deeper understanding of the behaviour of the participant, but it also is time consuming, lacks in generalizability and validity.

Cultural priming is a technique which takes advantage of cultural implicit theories in order to manipulate cultural value systems and analyse how behaviour is shaped in mono and multicultural individuals (Hong, Morris, Chiu, & Benet-Martínez, 2000). Cultural knowledge could be primed directly or indirectly. Oyserman and Lee (2008), analysing distinct priming tasks, found differences in effect size depending on the task. This highlights how cognition and social processes could be influenced differently by priming methods. This technique reflects cultural dynamicity creating a specific context in which the individual is asked to act based on contextually emphasised meanings (Seligman et al., 2015).

Finally, *situational sampling* is a technique which is capable of identifying cultural variation in behaviour. This is possible thanks to its two phases. First, participants from different cultures are asked to provide examples of a given fact, then these examples are used as stimuli to analyse cultural variations (Kitayama et al., 1997; Chiao et al., 2010). This helps to create stimuli which are tailored for different cultural systems, allowing the researchers to study psychological and neural processes of interest (Chiao et al., 2010).

2.3 CULTURE – GENE

Biological and psychological processes are influenced by cultural contexts and genetics. For this reason, it is important to examine the relation among culture, gene, and brain. In particular, it is interesting to understand if there is a reciprocal influence which shapes these elements.

It is clear that natural selection acts through an adaptive mechanism on genes, but it also acts on cultural traits which in turn are involved in a bidirectional relation with genes (Chiao & Blizinsky, 2010). However, according to Feldman & Laland (1996), human evolution itself has been characterized by two components: genetics and culture which operate on psychological and behavioural outcomes via neural structures and responses (Kim & Sasaki, 2014). It follows that these two components cannot be studied separately one from the other.

In this paragraph, particular relevance is given to the culture-gene relation. Specifically, gene culture coevolutionary theory (Feldman & Laland, 1996), or dual inheritance theory (Boyd & Richerson, 1985), explores the transmission of genetic and cultural traits among generations and populations, with a macrolevel focus on how genetics and culture interact. This theory does not focus on the individual level, indeed, it focuses on gene distribution within cultural groups and how that diversity results in practice (Kim & Sasaki, 2014; Sasaki, 2013). According to this theory, we have to take into consideration that every organism has an adaptive mechanism which responds to environmental changes through phenotype variations, although it has to be clear that cultural and genetic inheritance systems are different. It follows that both genetic and cultural variation are adaptive processes, in particular cultural selection could affect and be affected by genetic selection. Specifically, genotypes have an influence on how people interpret and interact with the environment, affecting cultural transmission. At the same time culture shapes the genetic component through its environmental pressure (Kim & Sasaki, 2014). Another important factor to be taken in account is the difference between cultural and environmental variation in phenotypes. The difference resides in the heritability of the variation: cultural variation is passed down and refined over generations (vertical transmission) and populations (horizontal and oblique transmission), while environmental variation and phenotype flexibility are proper of the individual who does not hand down the acquired functions and abilities (Boyd & Richerson, 1985). An example of culture-gene coevolution comes from lactose tolerance: cultural tradition of dairy farming may have influenced lactose absorption genes selection. Beja-Pereira and

colleagues (2003) examined European countries and their history of dairy farming, finding a correlation between neolithic cattle farming sites and present-day lactose tolerance suggesting that cultural milk consumption propensity has led to culture gene coevolution of milk protein genes and human lactose genes.

Less studied is the culture-gene coevolution of human behaviour. As it was previously stated, cultural traits are adaptive and have a central role in defining and influencing also social and psychological characterization, under which genetic selection operates. In this regard Chiao and Blizinsky (2010) studied the association between self-construal cultural values (collectivism and individualism), allelic frequency of the serotonin transporter polymorphism and the prevalence of mood disorders and anxiety across nations. The serotonin transporter gene comprises two alleles: short (S) and long (L) which result in differential serotoninergic neurotransmission expression and function (Hariri & Holmes, 2006). The results of the study confirmed Chiao and Blizinsky (2010) hypothesis: a positive correlation between collectivism and increased prevalence of the S allele was confirmed. Moreover, historical variability in pathogen prevalence predicts the variability of self-construal linking regions with high pathogen prevalence to genetic selection of S allele. Lastly, nations with prevalence of S allele of the serotonin transporter gene show a negative association with mood disorder and anxiety, probably due to the prevalence of cultural collectivism. However, there is no study addressing the neural processes underlying such behaviour and how such processes are shaped by culture and gene interaction (Chiao & Immordino-Yang, 2013).

As it was discussed above, culture and environment do not correspond completely. The gene-culture interaction model highlights other two differences between culture and environment. First, as discussed in paragraph 2.1, culture is a form of the environment, and for this reason it is usually operationalised as a group of people who share experiences and meanings, while environment, as in the dual inheritance theory, is conceptualized as a variation that could cause distress or advantages for the individuals. Second, discrepancies observed between different groups are related to contextual adaptation as cultural habits are functional within the group and specific circumstances (Kim & Sasaki, 2014). This culture gene interaction model is intended to analyse psychological diversity as the product of genetic and cultural interaction (Sasaki, 2013): specific genotypes influence psychological and behavioural predisposition, while culture could shape how these predispositions are enacted (Kim & Sasaki, 2014; see Sasaki, 2013 for a complete

discussion). A critical study which emphasises the role of culture and gene interaction on cognitive tendencies focuses on the detection of changes in facial expression related to a serotonin system polymorphism. In this cross-cultural study it was found that Japanese with s/s genotype of the serotonin transporter polymorphism are quicker and more sensitive in detecting the changes in facial expressions, compared to Japanese with s/l or l/l genotypes. This difference has not been found either in Americans, or in Asian Americans confirming the hypothesis of a culture-gene interaction. People with s/s genotype show greater perceptual efficiency only when the change in facial expression is culturally relevant. This result reflects the cultural importance and attention to social approval and disapproval in Japanese society (Ishii et al., 2014).

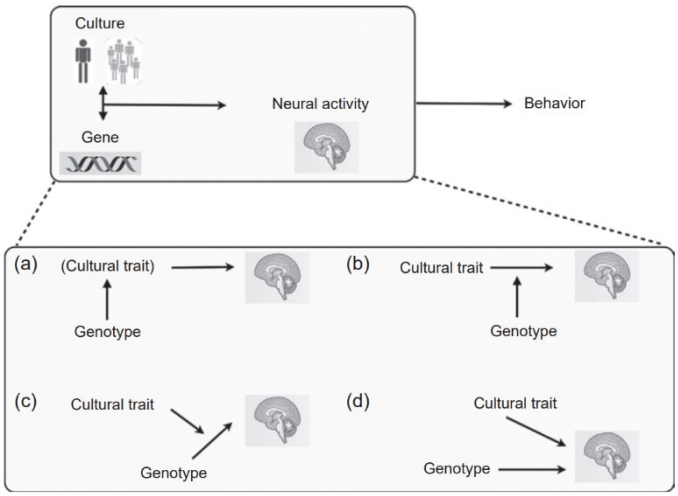

Figure 1.1 Illustration of the variations in the culture-by-gene pathway. (a) Genotypes may enhance the expression of a cultural trait on neural activity; (b) A particular genotype may alter the culture-to-neural activity pathway; (c) A particular cultural trait may alter the gene-to-neural activity pathway. (d) Both genotype and cultural traits may simultaneously, but independently, contribute to neural activity (from Chiao, 2011).

Thus far, most of the studies have explored the relation between culture and genes, and culture and brain (see paragraph 2.3), but there is a lack in literature on the neural activation related to gene culture interaction, even though it is assumed that gene-culture interaction takes place in the brain (see Figure 1.1). A study by Lou and colleagues (2020) is interested in shedding light on the manner with which culture interacts with genes to shape human brain activity. They tested the hypothesis that resting-state brain network properties mediate the relationship between oxytocin receptor gene (OXTR) and interdependence in Chinese population. Consequently, they have found brain imaging evidence which confirms the hypothesis of brain involvement in mediating the relationship between genes and culture.

To this regard, it is fundamental to carry on research in this field in order to have a better comprehension of culture-gene interaction in brain function, even when there is no difference in behaviour.

2.4 CULTURE – BRAIN

As above mentioned, mind exists within a body which is embedded in a physical and social environment. This dynamic relation acts both as a constraint and an enhancement for the brain, especially, but not exclusively, during development when neural representations are constructed in the mind (Westermann et al., 2007). These representations are then internalized to be used to facilitate the interaction with the physical and social world. Ambady and Bharucha (2009) referred to the brain as a *cultural sponge* or the *organ of culture* in reference to the bidirectional relationship between cultural practices and brain adaptation. Moreover, a fundamental role is given to the implicit learning ability which allows for the wiring of neural circuits. Thus, to study how brain functional organization is shaped by sociocultural experience neuroscience techniques are used. In this section, studies investigating cultural influence on functional and behavioural changes are presented.

First, the influence of self-construal style on visual perception is investigated. Evidence from both behavioural and neural level are considered. People belonging to collectivistic cultures (e.g., Asian cultures) are more susceptible to contextual information and are characterised by a holistic cognitive style. On the other hand, individuals from individualistic cultures (American and European cultures) seem to be more capable of ignoring contextual information, consistently with an analytic cognitive style (Nisbett & Miyamoto, 2005; for review, see Chiao 2009). Based upon these findings, the framed-line test was used to demonstrate cross-cultural variation in a non-social domain. People from collectivistic cultures, such as Japanese, showed greater ability in incorporating contextual information in a task requiring the judging of a focal object, if compared to Americans. Caucasians had a better performance when the contextual information had to be ignored. Moreover, additional findings come from people living in a country different from their own where there is a different self-construal style. Consistently, a hosting country effect was found in Americans in Japan and Japanese in America whose performance resembled respectively the one of Japanese and Americans living in their own country (Kitayama et al., 2003). In this regard Hedden et colleagues (2008) investigate the differences in visual perception in Asians and Caucasians both at a behavioural and neural level. The fMRI (functional magnetic resonance imaging) study revealed that the difference in performance between groups is mediated by the activation of fronto-parietal regions associated with high level attentional control. Specifically, a

greater activation was found in response to the task requiring incongruent cultural values. This reflects the need for a greater degree of attentional control during the culturally incongruent task. These results highlight how cultural influence is exerted on high level cognitive tasks, not on early-stage perceptual processing (Hedden et al., 2008). What it is not considered yet is if cultural priming methods could temporarily change the performance between groups. Lin and colleagues (2008) verified if a temporarily accessible information could change neural responses in a perceptual task. Electrophysiological activity was recorded while participants were exposed to a global/local stimulus. Prior to the exposure, participants were also primed with individualistic or collectivistic self-construal styles. It was found that priming caused a temporary shift in self-construal style dynamically altering neural responses during the visual perception task (see also Han & Humphreys, 2016). One last aspect not investigated in the previous studies is if cultural experiences play a role during lifespan. An fMRI study compared young adults and elderly from both East Asia and Western countries. A visual processing task was designed and evidence of a cultural bias in object processing was found. Elderly East Asians showed less adaptation response in the lateral occipital regions if compared with elderly Westerners, whereas this difference was not found between young adult participants. Age alone does not explain the functional engagement of cortical areas, also cultural experience has its role in modifying neural networks over the years (Goh et al., 2007).

Another cognitive domain explored is cognitive style which likewise influences how information is encoded. East Asians tend to have a holistic thinking style and are more likely to encode contextual information, whereas Westerners tend to have an analytic style and are more likely to encode focal information (Nisbett et al., 2001). A cross-cultural fMRI study by Grön and colleagues (2003) investigated neural networks of Germans and Chinese in a non-verbal episodic memory task with repeated learning of abstract geometric patterns. Albeit the alike behavioural performance in Chinese and Germans, a distinct pattern of neural activation was found. This could be interpreted as a variation in processing routine due to cultural influence. Specifically, Chinese showed greater activation of the dorsal stream (greater activity of bilateral frontal and parietal cortex) correspondent to the *where system* for visuo-spatial learning. Conversely, Caucasians showed greater activation of the ventral stream (*what system*, consisting of fusiform gyrus and hippocampal complex) during object identification. During the ongoing trials, neural

activation changed and a shift in processing strategies was observed. Both groups tended to integrate respectively object coding and visuo-spatial processing. This study proved that irrespective of behavioural performance, culture influences neural processes during an episodic memory task.

Many other studies explored cultural influence on several cognitive domains. For example, Chiu (1972) examined cross-cultural differences in categorisation in Chinese and American children revealing a relational-contextual style in Chinese and an inferential-categorical style in American children. Similar results were found by Norenzayan and colleagues (2002) in a study conducted on university students. Other studies examined cultural influence on emotion demonstrating cultural specificity in emotion recognition (Elfenbein & Ambady, 2002) and the effect of cultural acculturation on cross-cultural emotion recognition accuracy. Prado and colleagues (2014) found that Chinese living in Australia who adhere to Australian culture were more accurate in recognizing emotions on Caucasian faces than Chinese living in China.

This evidence makes clear how important the study of cultural influence is, as it could result in variations in neural and psychological processes. These variations conversely may affect health and well-being of the individual. Cognitive neuroscience gives scientists the opportunity for a deeper exploration of the nature of human diversity.

2.5 CULTURAL NEUROPSYCHOLOGY

Got this far, it results evident that culture can shape and has a relevant influence on cognition. Furthermore, Europe has undergone continuous changes due to the migratory flows and this has led through the years to a substantially diverse European, but not only, population. It follows that neuropsychologist are asked to assess culturally and linguistically diverse people which are not represented in the current assessment norms (Franzen et al., 2021a). These circumstances lay the foundation for new challenges in neuropsychology, one of these is the interpretation of neuropsychological test scores when administered to culturally diverse populations. Ultimately, the goal of cross-cultural neuropsychology is the development and validation of tests which are equivalent across cultures (Fernández & Abe, 2018).

In this section biases in cultural neuropsychology will be presented and successively solutions and a new test generation will be discussed in order to give a wide representation of the progresses in cultural neuropsychology assessment.

Three types of bias have been identified: construct bias, method bias and item bias (van de Vijver & Tanzer, 2004). *Construct bias* occurs when the construct measured is not identical and there is partial overlap across cultures (van de Vijver & Tanzer, 2004). Specifically, there is construct underrepresentation when the test used to measure a construct fails to capture distinctive aspects of the construct itself. While there is construct irrelevance when non-related processes for the construct of interest are assessed (Pedraza & Mungas, 2008). Even though many constructs seem universal, their expression varies across cultures and they can not be taken for granted (e.g. intelligence, colour perception; see Fernández & Abe, 2018).

Method bias refers to methodological issues and it consists of three different biases: sample bias, instrument bias and administration bias. The first refers to the incomparability of samples on aspects other than the target variable (e.g. educational and sociocultural background; see Fernández & Abe, 2018). Instrument bias reflects the issues in understanding and completing the task on the basis of the familiarity with the material (e.g. Trial making test uses Latin alphabet; see Fernández & Abe, 2018) while the administration bias includes all the issues related to the form of administration (e.g. language and any form of communications which could lead to misunderstanding). This form of bias is frequent when the patient does not speak fluently the language and does not have an adequate proficiency level (see Fernández & Abe, 2018).

Last, *item bias* or differential item functioning reflects the different meanings attributed to the items across cultures (Pedraza & Mungas, 2008). This kind of bias could be attributed to poor translation of the test or metaphoric use of language (van de Vijver & Tanzer, 2004). It could be associated also to the inapplicability of the item to different cultures (Boer, Hanke & He, 2018). A clear example is the Famous Face Recognition and Naming Test (Rizzo et al., 2002) which includes many famous faces familiar to Italian population, but not to other people from different nationalities. It follows that merely translating tests developed and validated on a specific population is not a valuable option as it would lead to several mistakes in the assessment. van de Vijver and Tanzer (2004) suggest three different methods to reduce the above mentioned bias. To avoid construct bias, they propose a *decentering method* which consists in the exclusion of culturally bound words and concepts. Second, they propose an extensive training of the administrator and the development of a detailed protocol to avoid method bias. Last, psychometric methods could be used to detect and avoid item bias.

Another important factor to take in consideration is the language spoken by the patient. Bilinguals have lower scores in vocabulary tasks (Bialystok et al., 2010), picture naming (Gollan et al., 2007), and semantic fluency (Portocarrero et al., 2007). On the other hand, bilinguals have higher scores, if compared to monolinguals, in executive functioning and episodic memory (Bialystok et al., 2008).

Furthermore, various solutions intended to improve cross-cultural assessment are presented. Nell (2000) advocates the development of *behavioural neuropsychological approach* which would be useful in developing countries with fragile health system and with patients with low education and who barely speak the language of the clinician (Fernández & Abe, 2018). This approach does not rely on testing batteries, rather it promotes a qualitative approach based on the analysis of four domains (arousal, personality, thinking and physical functioning) (Nell, 2000). It is evident that this method as many weak points. Two of them are the need for high trained clinicians and the subjectivity of the measure (Fernández & Abe, 2018).

A second solution consists in adapting the current tests to different counties and cultures (Ardila, 2005). An example is the Montreal Cognitive Assessment (MoCA) which has been translated and adapted to 36 languages even though not all have been validated (O'Driscoll & Shaikhc, 2017). However, the development of normative data for different cultural groups is an endless task due to the number of different cultures and languages in the world (Fernández & Abe, 2018).

One last promising solution is the development of a new generation of neuropsychological tests with appropriate norms across different cultural groups as they rely on more universal abilities (Ardila, 2005). The advantage of this method is the avoidance of adaptation, thus particular attention should be given to psychometric robustness and cultural fairness (Fernández & Abe, 2018). For example, it is fundamental to consider literacy, education, migration history, acculturation and other cultural factors when developing these cross-culturally applicable tests (Franzen et al., 2021a; see Franzen et al., 2020). The European Consortium on Cross-Cultural Neuropsychology (ECCroN, Franzen et al., 2021a) outlines some critical points essential to the development of these test. As previously mentioned, the test should assess the same cognitive ability across cultures (construct validity) and it should also be psychometrically sound. Stimuli have to be widely applicable (e.g., avoid Latin alphabet) and the environment in which they are presented has to be comfortable for a wide variety of patients. This characteristic is fundamental to promote the best performance possible. It follows that the use of elements and strategies of everyday life relevant across cultures is crucial. One last advice is to follow the adaptation and translation procedures outlined by the International Test Commission (2017). Several culture-free neuropsychological tests have already been developed in Europe. Among screening tests, it is possible to find the Rowland Universal Dementia Assessment Scale (RUDAS, Nielsen et al., 2013) and the Multicultural Cognitive Examination (MCE, Nielsen et al., 2019). Another instrument is the European Cross-Cultural Neuropsychology battery (CNTB, Nielsen et al., 2018) while there are also other tests which are specific for assessing memory, language and executive functions (see Franzen et al., 2021a). One last element to consider is the involvement of an interpreter during the neuropsychological assessment which could help reduce some cultural and linguistic effects (Franzen et al., 2021a).

Although much work has already been done in cross-cultural neuropsychology testing, awareness should be raised among neuropsychologists and collaboration across countries should be increased to develop and increase the number of validated instruments for cross-cultural cognitive assessment (Franzen, 2021b).

3. THE STUDY

3.1 AIM OF THE STUDY

The current society is undergoing big changes and migratory flows are a worldwide discussed phenomenon. This phenomenon has many aspects, but this study is particularly interested in the interaction of people from different cultures. According to Ardila (2005) it is not possible to collect normative data for every single culture. For this reason, the purpose of this investigation is to understand if interculturality and affinity with a certain culture could have an influence on cognitive performance assessed with an Italian screening test. In order to study this relation, the *Interculturality vs. Italian Culture questionnaire* (IICq) has been developed. This questionnaire aims to assess two dimensions of acculturation of individuals. As discussed in chapter 1, the term acculturation refers to the continuous interaction of two or more autonomous cultural systems which leads to behavioural and attitudinal changes consequent to the interaction (Berry, 2003; Al-Jawahiri & Nielsen, 2021). In this study two aspects are considered: *interculturality* (INT) and *closeness to Italian culture* (CIC). The first term refers to a "dynamic view of cultural identity where individuals belonging to different social groups […] interact and influence each other leading to new and complex self-understandings" (Yogeeswaran et al., 2021). Based on this definition, it follows that the degree of interculturality of a person in this study is defined as the amount of culturally diverse experiences a person has had, Italian culture excluded (e.g. a person who has had engaging interactions with other cultures, understands and adheres to its norms). The more experiences a person has, the most intercultural the person is. The closeness to Italian culture is defined, in this research, in terms of understanding and adherence to Italian culture. In this case, the degree of closeness to Italian culture of a person is defined as the amount of different interactions the person has had with Italian culture.

Assumptions were made prior to current investigation. As discussed above (see paragraph 2.1), if culture is situated and contextual (e.g. lifestyle, place of living) and given the aim of this study, participants should be recruited on the basis of culture of origin and place of living. For this reason, three groups of participants were selected: Italians living in Italy, people with non-Italian cultural origins living in Italy and Italians living abroad. Specifically, people living in Italy and embracing Italian culture are supposed to have higher scores in the closeness to Italian culture index (assessed with IICq) than Italians living abroad or people with non-Italian cultural origins living in Italy. However, a

difference in the closeness to Italian culture index could be seen among the three groups. Consequently, participants with non-Italian cultural origins living in Italy and Italians abroad are supposed to have higher scores in the INT index (assessed with IICq), if compared to Italians living in Italy.

As seen in the previous chapter, many factors (e.g. familiarity with a task, self-construal style, cognitive style, test administration) may influence cognitive performance in a culturally-biased test (see paragraph 2.5). Thus, as in this study cognitive performance is assessed with an Italian test, developed and validated on the Italian population, it is assumed that people with a high closeness to Italian culture index are more familiar to the cognitive tasks presented.

The first hypothesis is that scores in the closeness to Italian culture index (CIC) are positively associated with scores in cognitive performance in an Italian screening battery, controlled by age and cognitive reserve. The higher the CIC index, the best the cognitive performance. The second hypothesis foresees that scores in the INT index, controlled by age and cognitive reserve, may be negatively associated with cognitive performance in the tele-GEMS screening test. Notably, the expectation is that the higher the INT, the lower the cognitive performance in a non culture-free test.

3.2 PARTICIPANTS

A sample of 101 participants (63 women and 38 men; aged between 22 and 82 years, M=45.1, SD=17.1) was recruited: 49 Italian participants with Italian cultural origins living in Italy (ITA-ITA; 30 women and 19 men; aged between 22 and 82 years, M=52.4, SD=18.9), 31 participants with foreign cultural origins living in Italy (FOR-ITA; 25 women and 6 men; aged between 23 and 73 years, M=39.5, SD=13.6), 21 participants with Italian cultural origins living abroad (ITA-ABR; 8 women and 13 men; aged between 24 and 54 years, M=36.2, SD=7.51) (see Table 1). The inclusion criteria included healthy participant who were over 18 years old, fluent in Italian language and without diagnosis of neurological disease or in treatment for psychiatric disease.

Culture of Origin (assessed with IICq)	Counts	% of Total
Albanian	2	2.0 %
American	2	2.0 %
Argentinian	1	1.0 %
Brazilian	1	1.0 %
Colombian	2	2.0 %
Cuban	1	1.0 %
Dominican	4	4.0 %
French	1	1.0 %
English	1	1.0 %
Italian	70	69.3 %
Italian + Anglo-Jamaican	1	1.0 %
Italian German	1	1.0 %
Latin American	1	1.0 %
Moroccan	1	1.0 %
Moldavian	3	3.0 %
Polish	1	1.0 %
Romanian	1	1.0 %
Russian	3	3.0 %
Serbian	3	3.0 %
Ukrainian	1	1.0 %

Table 1 The table shows the frequencies (on the left hand-side) and the percentage (on the right hand-side) of Cultural Origins. Cultural origin was assessed via IICq.

3.3 MATERIALS

Three instruments were used: Interculturality vs. Italian Culture questionnaire (IICq) to assess the two dimensions of acculturation, tele-Global Examination of Mental State (tele-GEMS – Mondini et al., in preparation) as a measure of cognitive performance and Cognitive Reserve Index questionnaire (CRIq – Nucci et al., 2012) as it is necessary for the correction of tele-GEMS scores and it is also a reliable predictor of cognitive functioning.

Interculturality vs. Italian Culture questionnaire

IICq is a semi-structured interview developed ad-hoc for this study. Its purpose is to examine participants' interculturality and closeness to Italian culture. IICq is composed of 15 broad questions which are constituted by sub-questions intended to go in depth in specific aspects of interest. The questionnaire is fast to administer (about 15 minutes), but a brief training of the examiner is needed before administration. The 15 broad questions are designed to examine several aspects of intercultural experiences: culture of origin, languages spoken depending on the context and adherence to other cultures. Another factor considered was the amount of time spent interacting with other cultures, explicitly friendship, education, work and leisure time are examined.

The questionnaire has a double independent scoring which intends to capture both *interculturality* and *closeness to Italian culture* of the participants through the use of two different indexes (see Table 2). Every item has the same weight on the final scoring as this is an explorative study and there is no evidence regarding one item to be more relevant than the others. Specifically, every item has been normalized to the maximum score obtainable for that item and then transformed in hundredths multiplying the score for 100. The global IICq score per index is given in hundredths and was obtained through the sum of each score per item and divided for the number of items. The two indexes have different scorings which are distributed on a continuum from "very far from Italian culture" (0) to "very close to Italian culture" (100) and from "not intercultural" (0) to "strongly intercultural" (100). It follows that the indexes are two different measures in reciprocal interaction one to the other but the scoring in one index does not influence the scoring in the other.

IICq scores		
ITEM	INTERCULTURALITY (INT)	CLOSENESS TO ITALIAN CULTURE (CIC)
1	0 = Italian 1 = non-Italian	0 = non-Italian 1 = Italian
2a	$\left(1 - \frac{years\ of\ permanence\ in\ Italy}{age}\right) \cdot 100$	$\frac{years\ of\ permanence\ in\ Italy}{age} \cdot 100$
3	0 = both Italian 1 = one from different culture 2 = both from different cultures (both from the same) 3 = both from different cultures (one different from the other)	0 = both from different cultures 1 = one from different culture 2 = both Italian
4	0 = Italian culture only 1 = if from different culture, culture of origin only 1 = Italian culture + culture of origin 2 = Italian culture + foreign culture 2 = foreign culture only 3 = culture of origin + foreign culture 3 = all	0 = culture of origin + foreign culture 0 = if from different culture, culture of origin only 0 = foreign culture only 1 = Italian culture + foreign culture 1 = Italian culture + culture of origin 1 = all 2 = Italian culture only
6a	0 = Italy only 1 = Italy + culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) 2 = foreign culture only 2 = Italy + foreign culture 3 = culture of origin (if not Italian origin) + foreign culture	0 = foreign culture only 0 = culture of origin (if not Italian origin) + foreign culture 0 = culture of origin (if not Italian origin) 1 = Italy + foreign culture 1 = Italy + culture of origin (if not Italian origin) 2 = Italy only
6b	0 = 0 years 1 = 1 – 5 years 2 = 6 – 10 years 3 = 11 – 13 years 4 = > 13 years	
6c	0 = 0 years 1 = 1 – 5 years 2 = 6 – 10 years 3 = 11 – 13 years 4 = > 13 years	
6d		0 = 0 years 1 = 1 – 5 years 2 = 6 – 10 years 3 = 11 – 13 years 4 = > 13 years
7a	0 = n/a 0 = Italian 0.5 = Italian + culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) only 1.5 = foreign only 1.5 = Italian + foreign 2 = culture of origin (if not Italian origin) + foreign	0 = n/a 0 = culture of origin (if not Italian origin) + foreign 0 = culture of origin (if not Italian origin) 0 = foreign 0,5 = Italian + culture of origin (if not Italian origin) 0,5 = Italian + foreign 0,5 = Italian + culture of origin (if not Italian origin) + foreign

	2 = Italian + culture of origin (if not Italian origin) + foreign	1 = Italian
7b	0 = n/a 0 = Italian 0.5 = Italian + culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) only 1.5 = foreign only 1.5 = Italian + foreign 2 = culture of origin (if not Italian origin) + foreign 2 = Italian + culture of origin (if not Italian origin) + foreign	0 = n/a 0 = culture of origin (if not Italian origin) + foreign 0 = culture of origin (if not Italian origin) 0 = foreign 0,5 = Italian + culture of origin (if not Italian origin) 0,5 = Italian + foreign 0,5 = Italian + culture of origin (if not Italian origin) + foreign 1 = Italian
7c	0 = n/a 0 = Italian 0.5 = Italian + culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) only 1.5 = foreign only 1.5 = Italian + foreign 2 = culture of origin (if not Italian origin) + foreign 2 = Italian + culture of origin (if not Italian origin) + foreign	0 = n/a 0 = culture of origin (if not Italian origin) + foreign 0 = culture of origin (if not Italian origin) 0 = foreign 0,5 = Italian + culture of origin (if not Italian origin) 0,5 = Italian + foreign 0,5 = Italian + culture of origin (if not Italian origin) + foreign 1 = Italian
7d	0 = n/a 0 = Italian 0.5 = Italian + culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) only 1.5 = foreign only 1.5 = Italian + foreign 2 = culture of origin (if not Italian origin) + foreign 2 = Italian + culture of origin (if not Italian origin) + foreign	0 = n/a 0 = culture of origin (if not Italian origin) + foreign 0 = culture of origin (if not Italian origin) 0 = foreign 0,5 = Italian + culture of origin (if not Italian origin) 0,5 = Italian + foreign 0,5 = Italian + culture of origin (if not Italian origin) + foreign 1 = Italian
8a	0 = yes 1 = no	0 = no 1 = yes
8b	0 = yes 1 = no	0 = no 1 = yes
8c	0 = yes 1 = no	0 = no 1 = yes
9a	0 = 0 countries 1 = 1 country 2 = 2 countries 3 = 3 countries 4 = > 3 countries	0 = > 1 country 1 = 0 countries
9b	$\frac{years\ abroad}{age} \cdot 100$	
9d.1	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin)	

	1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	
9d.2	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	
9d.3	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	
9d.4.1	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	
9d.4.2	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	
10	0 = Italian 1 = culture of origin (if not Italian origin) 1 = other	0 = culture of origin (if not Italian origin) 0 = other 1 = Italian

11a	0 = no 1 = yes	
11b		0 = no 1 = yes
11c	0 = no 1 = yes	
12	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	0 = n/a 0 = culture of origin (if not Italian origin) 0 = other 1 = Italian only
13	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	0 = n/a 0 = culture of origin (if not Italian origin) 0 = other 1 = Italian only
14	0 = n/a 0 = Italian only 1 = culture of origin (if not Italian origin) 1 = culture of origin (if not Italian origin) + Italian 2 = foreign 2 = foreign + Italian 3 = foreign + culture of origin (if not Italian origin) 3 = Italian + foreign + culture of origin (if not Italian origin)	0 = n/a 0 = culture of origin (if not Italian origin) 0 = other 1 = Italian only
15	0 = 1 language 1 = 2 languages 2 = 3 languages 3 = 4 languages 4 = > 4 languages	0 = other 1 = only Italian

Table 2. Attribution of scores to every single item of the IICq. The IICq has a double scoring intended to measure both Interculturality and Closeness to Italian Culture. The INT index is composed of 15 questions made up of 28 items while the Closeness to Italian Culture index is composed of 15 questions made up of 20 items. Each item has its own scoring, but every item has the same weight on the final scoring.

tele-Global Examination of Mental State

Tele-GEMS (Montemurro et al., in preparation) is the telephonic version of GEMS (Mondini et al., in preparation), an instrument for cognitive screening. This instrument is composed of 10 tests which examine different domains of cognition: orientation in time and space, short-term and long-term memory, working memory, spatial representation, naming, comprehension, auditory attention, verbal fluency and metaphor comprehension. The duration is about 10 minutes and it is administered remotely.

Cognitive Reserve Index questionnaire

The Cognitive Reserve Index questionnaire (CRIq) is a semi-structured interview (Nucci et al., 2012) which measures the amount of Cognitive Reserve (CR) acquired during a person's lifetime. In a single index, the CRIq conveys the three primary sources of CR: education, working activity, and leisure time activities. The CRIq assigns a score to each item based on the frequency and the number of years of practice. The CRIq is a tool freely available on the web at the link https://www.cognitivereserveindex.org/NewEdition/index.html. Once finished the compiling, it gives the final score automatically (i.e., CRI) and the three subscores: CRI-Education, CRI-WorkingActivity, and CRI-LeisureTime. The duration is about 20 minutes.

3.4 PROCEDURE

Participants have been recruited via phone call and via a call for participants shared on social networks. A phone call appointment was agreed upon, and a reminder was sent to every participant the day before the evaluation. Assessments were conducted during the day in a time between 8am and 4pm, time zone of the participant. The day of the evaluation, before data collection, participants were informed about the aim of the study and checked for auditory abilities. In order to favour concentration and the best performance possible, participants were asked to be in a silent place with no watch, calendar and possibility of distraction (e.g. people in the room, other phone calls, repetitive messages' ringtone). Successively the participants were asked to sign the informed consent form. If they did not have the possibility to sign it, the consent was taken orally and recorded.

The procedure started with the administration of CRIq, followed by tele-GEMS. Before the administration of tele-GEMS participants were asked again not to look at their watch or at the calendar if present in the room. They were also asked to avoid the use of any kind of advice which could have helped them in the completion of the screening battery. Finally, IICq was administered. The procedure lasted around 40 minutes per participant.

3.5 DATA ANALYSIS AND RESULTS

The Jamovi version 2.2.5.0 (The Jamovi project, 2021) was used to analyse the data. Jamovi is a free and open statistics package easy to use. It provides a spreadsheet editor and a range of statistical analyses.

IICq analysis

First, the distribution of scores for CIC (IICq) and INT among groups was checked. The main descriptive statistics of IICq CIC Index are reported in Table 3. The scores are distributed like a normal distribution for the FOR-ITA and ITA-ABR groups (Shapiro-$Wilk_{FOR\text{-}ITA}$ p = .223; Shapiro-$Wilk_{ITA\text{-}ABR}$ p = .295) while for the ITA-ITA group scores are distributed like a non-normal distribution (Shapiro-Wilk p = .003).

The ITA-ITA group has a platykurtic pattern (Kurtosis = -0.755) and it is asymmetrical to the left (Skewness = -0.755) while FOR-ITA and ITA-ABR groups have a leptokurtic pattern ($Kurtosis_{FOR\text{-}ITA}$ = .095, $Kurtosis_{ITA\text{-}ABR}$ = 1.15) and are respectively asymmetrical to the left and the right ($Skewness_{FOR\text{-}ITA}$ = -0.131; $Skewness_{ITA\text{-}ABR}$ = .877). In Figure 1 it is possible to see a graph about the trend of the data.

Descriptives

	GROUP	CIC
Mean	ITA-ITA	89.4
	FOR-ITA	51.2
	ITA-ABR	55.2
Median	ITA-ITA	91.3
	FOR-ITA	49.9
	ITA-ABR	54.3
Mode	ITA-ITA	96.3
	FOR-ITA	21.9
	ITA-ABR	48.1
Standard deviation	ITA-ITA	8.02
	FOR-ITA	11.4
	ITA-ABR	4.63
Range	ITA-ITA	69.9 - 100
	FOR-ITA	21.9 - 71.2
	ITA-ABR	48.1 - 67.1

Table 3. Descriptive statistics of the IICq Closeness to Italian Culture index (CIC) for the ITA-ITA, FOR-ITA and ITA-ABR groups. Mean, Median, Mode, Standard Deviation and Range are

reported. The three groups reported in the table are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR).

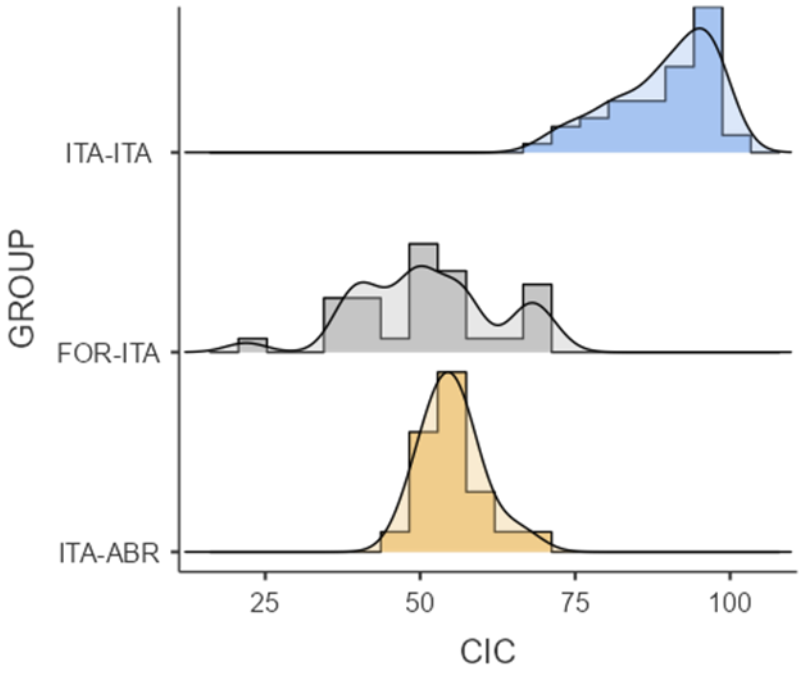

Figure 1. Distribution of IICq Closeness to Italian Culture index (CIC) per group. The three groups represented in the figure are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR).

The main descriptive statistics of IICq INT Index are reported in Table 4. The scores are distributed following a Gaussian distribution for the ITA-ABR group (Shapiro-Wilk p = .506) while for the ITA-ITA group and the FOR-ITA group, scores are distributed like a non-Gaussian distribution (respectively Shapiro-Wilk$_{\text{ITA-ITA}}$ p = <.001, Shapiro-Wilk$_{\text{FOR-ITA}}$ p = .007). ITA-ABR group has a platykurtic pattern (Kurtosis = -0.760), while ITA-ITA and FOR-ITA groups have a leptokurtic pattern (respectively Kurtosis$_{\text{ITA-ITA}}$ = .942, Kurtosis$_{\text{FOR-ITA}}$ = 3.52) and they are all asymmetrical to the right (Skewness$_{\text{ITA-ITA}}$ = 1.25; Skewness$_{\text{FOR-ITA}}$ = 1.40; Skewness$_{\text{ITA-ABR}}$ = .388). In Figure 2 it is possible to see a graph about the trend of the data.

Descriptives

	GROUP	INT
Mean	ITA-ITA	5.91
	FOR-ITA	33.7
	ITA-ABR	29.1
Median	ITA-ITA	3.57
	FOR-ITA	31.2
	ITA-ABR	28.7
Mode	ITA-ITA	2.38
	FOR-ITA	14.3
	ITA-ABR	21.4
Standard deviation	ITA-ITA	5.59
	FOR-ITA	11.7
	ITA-ABR	5.00
Range	ITA-ITA	0.00 – 23.1
	FOR-ITA	14.3 – 73.7
	ITA-ABR	21.4 – 38.8

Table 4. Descriptive statistics of the IICq interculturality index (INT) for the ITA-ITA, FOR-ITA and ITA-ABR groups. Mean, Median, Mode, Standard Deviation, and Range are reported. The three groups reported in the table are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR).

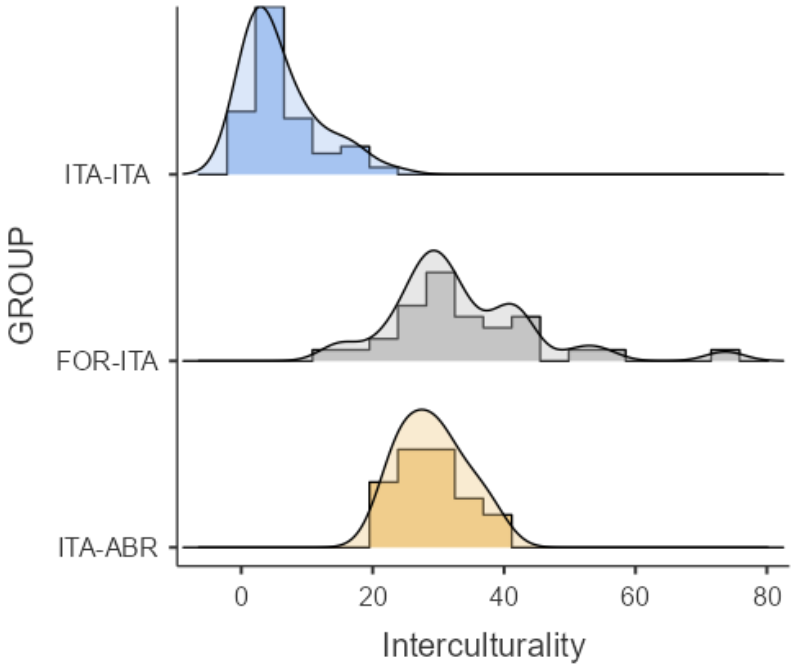

Figure 2. Distribution of IICq interculturality index (INT) per group. The three groups represented in the figure are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR).

Qualitatively, looking at the distribution of the CIC index data, it is possible to say that the questionnaire has a good power as in the CIC index both FOR-ITA and ITA-ABR groups have a lower scoring for CIC ($M_{FOR\text{-}ITA}$ = 51.2, $Mdn_{FOR\text{-}ITA}$ = 49.9; $M_{ITA\text{-}ABR}$ = 55.2, $Mdn_{ITA\text{-}ABR}$ = 54.3), if compared to the ITA-ITA group ($M_{ITA\text{-}ITA}$ = 89.4, $Mdn_{ITA\text{-}ITA}$ = 91.3). Moreover, ITA-ABR group scores are slightly higher than FOR-ITA group.
The CIC index consisted of 20 items of which two have been removed as they have no variance (IT_8c, IT_11b). The standardized Cronbach's alpha for the 18 remaining items was 0.865 which confirms a good internal consistency. Considering the variation in thousandths of Cronbach's α due to specific items dropping, no item was removed from the questionnaire. This could be explained as a random variation due to the variability of the sample.

Qualitatively, looking at the distribution of the INT index data, it is possible to say that the questionnaire has a good power as in the INT index both the FOR-ITA and ITA-ABR groups have higher INT ($M_{FOR\text{-}ITA}$ = 33,7, $Mdn_{FOR\text{-}ITA}$ = 31.2; $M_{ITA\text{-}ABR}$ = 29.1, $Mdn_{ITA\text{-}ABR}$ = 28.7) if compared to the ITA-ITA group ($M_{ITA\text{-}ITA}$ = 5.91, $Mdn_{ITA\text{-}ITA}$ = 3.57).

The INT index consisted of 28 items of which one has been removed as it has no variance (INT_8c). The standardized Cronbach's alpha for the 27 remaining items was 0.898 which confirms a good internal consistency. Considering the variation in thousandths of Cronbach's α due to specific items dropping, no item was removed from the questionnaire. This could be explained as a random variation due to the variability of the sample.
As a result, according to the standardized Cronbach's alpha for the two indexes (α_{CIC} = 0.865, α_{INT} = 0.898) it is possible to assume that IICq is a reliable instrument to assess the variables of interest for this research.

Cognitive performance analysis

Second, the distribution of scores for tele-GEMS among groups was checked. The main descriptive statistics of tele-GEMS are reported in Table 5. The scores are distributed like a normal distribution for both the FOR-ITA and ITA-ABR groups (Shapiro-Wilk$_{FOR-ITA}$ p = .091, Shapiro-Wilk$_{ITA-ABR}$ p = .083) while for the ITA-ITA group scores are distributed like a non-normal distribution (Shapiro-Wilk p = <.001). The ITA-ITA group and the ITA-ABR group have a leptokurtic pattern (respectively, Kurtosis$_{ITA-ITA}$ = 6.85, Kurtosis$_{ITA-ABR}$ = .907), while the FOR-ITA group has a platykurtic pattern (Kurtosis = -0.921) and they are all asymmetrical to the left (Skewness$_{ITA-ITA}$ = -2.26; Skewness$_{FOR-ITA}$ = -0.456; Skewness$_{ITA-ABR}$ = -0.652). In Figure 3 it is possible to see a graph about the trend of the data.

Descriptives

	GROUP	Tele-GEMS total
Mean	ITA-ITA	86.8
	FOR-ITA	81.1
	ITA-ABR	91.6
Median	ITA-ITA	90.2
	FOR-ITA	83.8
	ITA-ABR	91.0
Mode	ITA-ITA	83.5
	FOR-ITA	59.0
	ITA-ABR	99.5
Standard deviation	ITA-ITA	11.7
	FOR-ITA	11.0
	ITA-ABR	5.91

Descriptives

	GROUP	Tele-GEMS total
Range	ITA-ITA	37.3 - 100
	FOR-ITA	59.0 – 96.7
	ITA-ABR	76.7 - 100

Table 5. Descriptive statistics of tele-GEMS per group. Mean, Median, Mode, Standard Deviation and Range of tele-GEMS are reported for each group. The three groups reported in the table are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR).

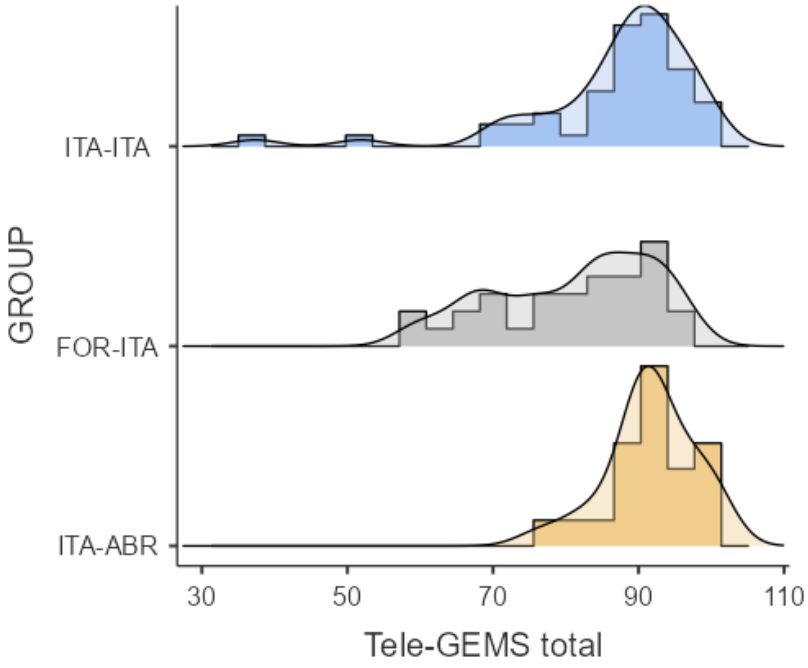

Figure 3. Distribution of the tele-GEMS scoring per group. The three groups represented in the figure are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR).

Furthermore, difference in cognitive performance at the tele-GEMS (dependent variable) between groups was examined. A linear regression model was used and age and cognitive reserve have been included as covariates due to their not negligible relevance (see Table 6). Cognitive reserve is used instead of education as they are highly correlated (Nucci, et al., 2012).

Tele-GEMS total	
Age	β = - 0.562***
CRI total	β = 0.408***
Group: FOR-ITA – ITA-ITA	β = - 0.932***
Group: ITA-ABR – ITA-ITA	β = - 0.133
Group: FOR-ITA – ITA-ABR	β = - 0.799***
R^2 = 0.345***	

Table 6. Predictor values (β) of Linear Regression Model tele-GEMS total. Age, CRI total and group belonging are the covariates. Intercept was omitted as it has no relevance for the study. INT and CIC indexes have not been included in the model due to their multicollinearity with the group membership. *p* for ITA-ABR – ITA-ITA is >.05.

Note. ****p*<.001

As reported in Table 10, age, cognitive reserve and membership to one of the groups are all significant predictors and predict about 35% of the variability of cognitive performance (R^2 = 0.345, $p < .001$) with a greater weight of the membership to the FOR-ITA group ($\beta_{\text{FOR-ITA – ITA-ITA}}$ = -0.932, $p < .001$; $\beta_{\text{FOR-ITA – ITA-ABR}}$ = -0.799, $p < .001$). Age has a negative relation with the weighted tele-GEMS scoring (β = -0.562, $p < .001$), when age increases, cognitive performance decreases. To the contrary, cognitive reserve has a positive relation with the weighted tele-GEMS scoring (β = .408, $p < .001$) hence as the cognitive reserve increases, the cognitive performance increases too. It is important to take in consideration also the non-significant difference in cognitive performance between the ITA-ABR group and the ITA-ITA group (β = -0.133, $p = .568$). Finally, it is possible to conclude that there is a significant difference in the tele-GEMS score between FOR-ITA group and ITA-ITA group.

In this Linear Regression Model, it is not taken in account the analysis comparing the membership to FOR-ITA group and ITA-ABR group. Qualitatively it seems reasonable to assume that belonging to one of the two groups leads to a different cognitive performance. Specifically, belonging to the ITA-ABR group is related to a higher cognitive performance in tele-GEMS ($M_{\text{FOR-ITA}}$ = 81.1, $SD_{\text{FOR-ITA}}$ = 11.0, $M_{\text{ITA-ABR}}$ = 91.6, $SD_{\text{ITA-ABR}}$ = 5.91; see Table 9).

Successively, tele-GEMS performance (dependent variable) was analysed in order to verify the influence of CIC and INT indexes on cognitive performance. Once more, non-negligible factors as age and cognitive reserve have been included as covariates. In the

following tables (see Table 7, Table 8, Table 9, Table 10), it is possible to see the values of the predictors within the model and the part of variance explained by the use of these two factors. Either CIC and INT indexes are included in the Linear Regression Model.

Tele-GEMS total	
Age	β = -0.621***
CRI total	β = 0.470***
CIC	β = 0.397***
R^2 = 0.319***	

Table 7. Predictor values (β) of Linear Regression Model of tele-GEMS total. Age, CRI total and CIC index are the covariates. Intercept was omitted as it has no relevance for the study.

Note. ***p<.001

Tele-GEMS total					
ITA-ITA (df = 45)		FOR-ITA (df = 27)		ITA-ABR (df = 17)	
Age	β = - 0.683***	Age	β = - 0.373	Age	β = - 0.020
CRI total	β = 0.368**	CRI total	β = 0.637*	CRI total	β = - 0.343
CIC	β = 0.247*	CIC	β = 0.199	CIC	β = - 0.305
R^2 = 0.487***		R^2 = 0.056		R^2 = 0.116	

Table 8. Predictor values (β) of Linear Regression Model of tele-GEMS total per group. Age, CRI total and CIC index are the covariates. Intercept was omitted as it has no relevance for the study.

Note. *p<.05, **p<.01, ***p<.001

Tele-GEMS total	
Age	β = -0.613***
CRI total	β = 0.488***
INT	β = -0.331***
R^2 = 0.270***	

Table 9. Predictor values (β) of Linear Regression Model of tele-GEMS total. Age, CRI total and INT index are the covariates. Intercept was omitted as it has no relevance for the study.

Note. ***p<.001

Tele-GEMS total					
ITA-ITA (df = 45)		FOR-ITA (df = 27)		ITA-ABR (df = 17)	
Age	β = - 0.615***	Age	β = - 0.449	Age	β = - 0.062
CRI total	β = 0.406***	CRI total	β = 0.636	CRI total	β = - 0.362
INT	β = 0.013	INT	β = - 0.061	INT	β = - 0.253
R^2 = 0.429***		R^2 = 0.025		R^2 = 0.091	

Table 10. Predictor values (β) of Linear Regression Model of tele-GEMS total per group. Age, CRI total and CIC index are the covariates. Intercept was omitted as it has no relevance for the study.

Note. ***p<.001

In the models above it is possible to see how both CIC and INT are significant predictors of cognitive performance (see Table 7 and Table 9) while they are not significant predictors within groups (see Table 8 and Table 10).

In Table 7, it is found that age, CRIq and CIC index predict about 32% of the variability of cognitive performance (R^2 = 0.319, p < .001) with a greater negative weight of age (β = -0.621, p < .001) on cognitive performance. Conversely, both CRIq (β = 0.470, p < .001) and CIC index (β = 0.397, p < .001) have a positive one.

It is interesting to notice that CIC index seems to be a better predictor for cognitive performance than INT index.

In Table 9, it is reported that age, CRIq and INT index predict about 27% of the variability of cognitive performance (R^2 = 0.270, p < .001) where age has a greater negative weight on the cognitive performance (β = -0.613, p < .001) when one increases, the other decreases. Accordingly, also INT index has a negative relationship with cognitive performance (β = -0.331, p = .001) as it was hypothesized. On the contrary CRIq has a positive relationship with cognitive performance (β = 0.488, p < .001).

Other analysis following qualitative observations

Finally, further analysis is conducted following some qualitative observations. The samples of participants are small and heterogeneous for age and cognitive reserve. This makes quantitative analysis inaccurate and not generalizable to the entire population. These analyses are made following the order of the tests in the tele-GEMS screening battery.

In the temporal orientation item “Which season are we in?” all the seven participants belonging to the ITA-ABR group living in China, Japan and Norway, interviewed before

the beginning of winter season, answered wrongly (for a discussion of this result see Chapter 4).

In the naming task people were asked to name "the object which is used to draw perfect circles". In the FOR-ITA group, 13 participants out of 31 (42%) answered wrongly or declared they did not know the name in Italian, additionally 3 participants answered correctly but observed that they did know the name because their children were using compass at school.

Last, in the verbal fluency task, many participants belonging to the FOR-ITA group reported to think of many words in their mother tongue. In particular, a Linear Regression Model has been used to analyse verbal fluency (dependent variable) in function of INT and CIC indexes. Once more, non-negligible factors as age and cognitive reserve have been included as covariates. It has been observed that age, CRIq and INT index predict about 25% of the variability of verbal fluency between subjects ($R^2 = 0.247$, $p < .001$) while age, CRIq and CIC index predict about 29% of the variability of verbal fluency ($R^2 = 0.291$, $p < .001$) (see Figure 4 and Table 11). These results seem to confirm our hypothesis that closeness to Italian culture is a better predictor of cognitive performance in a battery validated on Italian population.

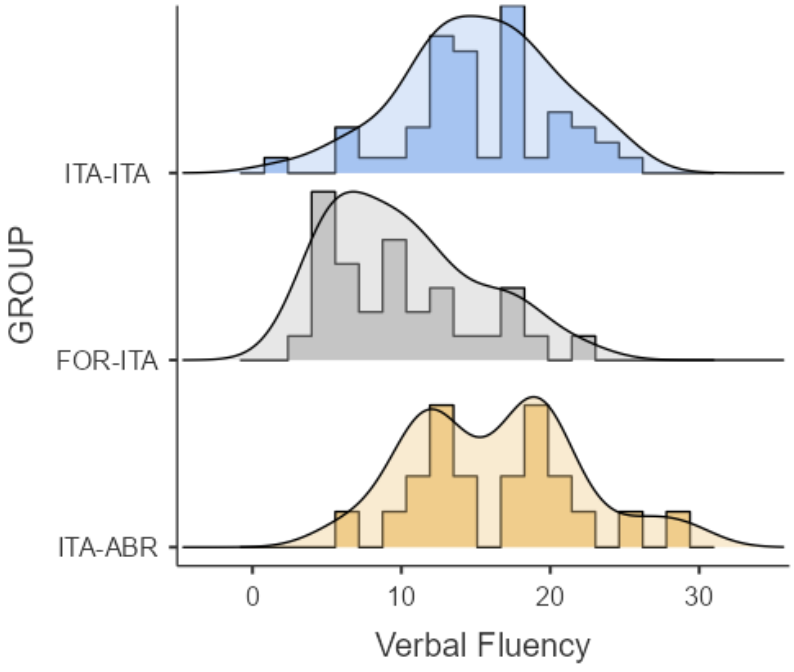

Figure 4. Distribution of the verbal fluency scoring in tele-GEMS per group. The three groups represented in the figure are participants with Italian cultural origins living in Italy (ITA-ITA), participants with foreign cultural origins living in Italy (FOR-ITA) and participants with Italian cultural origins living abroad (ITA-ABR). ITA-ITA group (M = 15.3; SD = 5.07; Mdn = 15);

FOR-ITA group (M = 10.1; SD = 4.96; Mdn = 10); ITA-ABR group (M = 16.3; SD = 6.68; Mdn = 17).

Verbal Fluency			
Model 1		Model 2	
Age	β = - 0.594***	Age	β = - 0.576***
CRI total	β = 0.323**	CRI total	B = 0.282**
INT	β = - 0.476***	CIC	β = 0.506***
R^2 = .247***		R^2 = .291***	

Table 11. Predictor values (β) of Linear Regression Model of Verbal Fluency. Age, CRI total and CIC index are the covariates in Model 1, whereas age, CRI total and INT index are the covariates in Model 2.

Note. **p<.01, ***p<.001

4. DISCUSSION AND CONCLUSIONS

This study examined the influence of culture on cognitive performance in an Italian screening test. Specifically, a questionnaire was developed ad hoc for the study: *Interculturality vs. Italian Culture questionnaire*. Through this questionnaire two different indexes with independent scoring were measured: interculturality and closeness to Italian culture. The first is measured as the amount of interactions with diverse cultures (Italian excluded), while the second is measured as the amount of interactions with different aspects of Italian culture across lifespan. Cognitive performance was measured with tele-GEMS, a screening test developed in Italy. Three groups of participants fluently speaking Italian were selected based on cultural origin and current place of residence. Cognitive performance was analysed through linear regression models. In the first analysis age, cognitive reserve (CRIq) and belonging to one of the three groups were the main significant predictors. It was found that belonging to one group or another was a significative predictor of cognitive performance. Specifically, there was a significative difference in tele-GEMS scoring when comparing participants from ITA-ITA group with participants from FOR-ITA group, and when comparing participants from ITA-ABR group with participants from FOR-ITA group. In both cases belonging to FOR-ITA group is a negative predictor of cognitive performance in tele-GEMS. No difference was found when comparing performance of participants from ITA-ITA and ITA-ABR groups.

Successively, other regression models were used to study cognitive performance. Closeness to Italian culture index and interculturality index were respectively used as covariates in addition to age and cognitive reserve. As a result, it was found that these covariates are significative predictors between groups but not within. In particular, as expected, CIC index was found to be a positive predictor of cognitive performance in tele-GEMS, while INT index was found to be a negative predictor of cognitive performance in tele-GEMS.

Given the small samples of participants, a qualitative analysis of the results followed. In particular, three tasks were examined. Temporal orientation, naming and verbal fluency. It was noticed that Italians living abroad, especially those living in China, Japan and Norway, when asked to answer the question “Which season are we in?”, reported to be in Winter season even though it was Autumn. Some of them also added to the answer some observations about the cold weather. This could be reconducted to an implicit association weather-season participants had. All the countries in which these people were

living have Autumnal lower temperatures if compared to the ones in Italy. Thus, the above mentioned implicit association could have led the participants to a wrong answer.

The other observations concern language related tasks. First, the naming task is composed of four items, a difference was noticed in the third item: "The object which is used to draw perfect circles". The correct answer is *compass* which is an Italian low frequency word. In turn, 42% of FOR-ITA group participants answered wrongly or did not know the answer while an additional 10% reported to know the word only because their children were currently using the object at school. Thus, the use of low frequency words could be an issue for non-mother-tongue participants. Second, verbal fluency was analysed. Qualitatively a difference in performance was noticed between Italian origin (ITA-ITA and ITA-ABR) and foreign origin participants (FOR-ITA) with a better performance of the formers. A linear regression model followed, and it was found that INT index was a negative predictor of verbal fluency, while CIC index was a positive predictor of verbal fluency. According to the IICq questionnaire, all participants belonging to the FOR-ITA and ITA-ABR groups speak more than one language and have high INT index scores. This seems to be in contrast with current literature which states that bilinguals are better in phonetic fluency than monolinguals probably due to enhanced executive functions (e.g. Friesen et al., 2015; Luo et al., 2010; Marsh et al., 2019). On the other hand, there are also studies which demonstrated that bilinguals are worst in verbal fluency than monolinguals. The late-second-language (L2) fluency could be affected by an incomplete acquisition of the language, but there is also language competition between mother tongue (L1) and L2 during speech production. Evidence has been found on the continuous activation of non-target language even if the task did not require it. Interestingly, L1 affects L2 but also L2 affects L1 on a smaller degree (Bergmann et al., 2015). Why does INT index correlate negatively with verbal fluency? In this regard it is fundamental to split the two groups (ITA-ABR and FOR-ITA groups) as they differ in L1 and L2. Comparing the mean scores, it is possible to see that Italians living abroad (ITA-ABR group) had the best performance, coherently with literature stating that bilinguals are better than monolinguals in verbal fluency because of enhanced executive functions. On the other hand, participants belonging to the FOR-ITA group showed the worst performance. Nevertheless, it has to be noticed that language proficiency was not assessed (for both L1 and L2) and this could be the reason why FOR-ITA group has the worst performance and why high INT seems to be associated with a worst performance. Consistently with literature, the FOR-ITA group's performance could be affected by both

L2 proficiency and competition with L1, while the ITA-ABR group's performance seems not to be affected by these two factors in this study. This could be reconducted to the absence of assessment for L2 proficiency. In the future, it would be of great importance to assess language proficiency in languages spoken to favour a better comprehension of the influence of INT, and it would also be necessary to consider the mother-tongue language in order to verify for the ability to distinguish the sounds of the Latin alphabet.
In conclusion, the findings support the initial hypothesis. CIC index and INT index are respectively a positive and negative predictor for cognitive performance in a Italian screening test. Albeit it is fundamental to highlight the limits of this study. Due to the current pandemic conditions, the study was conducted via phone call and the decision to use a brief telematic screening test was forced. In the future, it would be of great interest to assess participants with an instrument that explores cognitive abilities more in depth. Furthermore, the sample of participants was very small and the three groups were composed of a different number of participants each. These circumstances expose statistical analysis to distortion. For this reason, it was not possible to conduct an analysis for every single cognitive domain.
The results of this study provide additional evidence to the increasing literature on the influence of culture on cognitive performance and it opens to new interesting questions. First it would be of great relevance to strengthen the above proposed questionnaire which could help assessing the requirements necessary to administer a culture-biased test. Moreover, it would be extremely helpful in the neuropsychological practice to develop a questionnaire which could adjusts the scores in cognitive performance in function of closeness to Italian culture and interculturality. This could be a useful instrument especially with both patients of different cultural origins and patients with Italian origins living abroad but speaking Italian fluently. This questionnaire could be a valuable instrument in case of absence of an appropriate culture free test and absence of normative data. Additionally, it is of great interest to understand if interculturality, due to its intrinsic relation with a wide amount of experiences, is associated with a higher cognitive reserve. If so, on one hand it results necessary to understand its influence on cognitive performance depending on the membership to one of the groups identified for this study; on the other hand, it would be expected that higher interculturality is associated to a better cognitive performance in a culture free test, adjusted for age and cognitive reserve. Lastly, a question arises: does interculturality distance from own culture of origin? If so, would a culture-free test be a better instrument for the ITA-ABR group?

Many questions are raised and this underlines how more research is necessary in this field in order to ensure the best possible neuropsychological practice in an extremely dynamic society.

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APPENDIX

"INTERCULTURALITY vs ITALIAN CULTURE QUESTIONNAIRE"

1) Quale è la TUA cultura di origine o della TUA FAMIGLIA?	1)
2) Sei nato/a in Italia? a. Se NO, da quanto tempo sei in Italia?	2) 2a)
3) I tuoi genitori sono entrambi di origine _____ (VEDI RISPOSTA D1) *a. Se NO, chi e quale* *MADRE _____* *PADRE _____*	3) 3a) MADRE PADRE
4) Frequenti persone che hanno: **(possibile segnare più alternative)** ☐ Se origine culturale diversa da italiana, la tua stessa origine culturale? ☐ Cultura italiana? SI ☐ Origini differenti dalla tua e differenti da quella italiana? NO *4.1 Qual è la cultura che frequenti più spesso?*	Origini differenti da propria e Italia: 4.1)
*5) Dove e come hai imparato l'italiano? **(possibile segnare più alternative)*** ☐ *A scuola* ☐ *Al lavoro* ☐ *Altro (specificare)*	Altro:
6) Istruzione a. Dove hai frequentato la scuola/università? b. Se origine culturale diversa da italiana, quanti anni hai frequentato la scuola nella cultura di origine, *fino a che età/grado*? c. Quanti anni hai frequentato la scuola all'estero ad eccezione del tuo paese di origine, *fino a che età/grado*?	6a) 6b) 6c) 6c.1) 6d) 6d.1)

c.1 In che lingua erano le lezioni? d. Quanti anni hai frequentato la scuola in Italia (*da che grado e fino a che grado)?* *d.1 In che lingua sono/erano le lezioni?*	
7) Che lingua parli prevalentemente in Italia: a. Con la tua famiglia di origine (genitori, fratelli, parenti)? b. <u>Se CONVIVENTE</u>, con la/e persona/e con cui abiti (compagno/a, marito/moglie, coinquilini, …) c. Con gli amici? d. Al lavoro?	7a) 7b) 7c) 7d)
8) Ti senti fluente in italiano: a. Scrittura b. Parlato c. Lettura	8a) 8b) 8c)
9) Se ABITI/HAI ABITATO per dei <u>periodi all'ESTERO</u> (>3 mesi), ad eccezione del tuo paese di origine, a. Dove hai abitato? b. Per quanto tempo? (somma di tutti i periodi all'estero) *c. Per quale motivo eri/sei all'estero?* d. In che lingua comunicavi prevalentemente con: d.1 Amici d.2 <u>Se OSPITATO</u>, famiglia ospitante d.3 Le persone che incontravi nella vita di tutti i giorni (Es. cassieri, baristi, persone al parco (eccetto colleghi, amici, famiglia ospitante) d.4 Se per LAVORO, d.4.1 Colleghi d.4.2 Clienti	9a) 9b) 9c) 9d) 9d.1) 9d.2) 9d.3) 9d.4) 9d.4.1) 9d.4.2)

10) Ti percepisci più italiana/o o _____ (VEDI D1)?	10)
11) Segui tradizioni Es. cibo, religione, programmi televisivi, altre tradizioni a. <u>Se origine culturale diversa da italiana</u>, della tua cultura di origine (*se Sì, quali*)? b. Della cultura italiana? c. Di altre culture?	11a) 11b) 11c)
12) Se leggi (libri di narrativa), in quale lingua leggi prevalentemente?	12)
13) Se ascolti musica (con testo), in quale lingua la ascolti prevalentemente?	13)
14) Se vedi film, in quale lingua li guardi prevalentemente?	14)
15) Quali lingue parli fluentemente?	15)